

CITY OF WORCESTER MASSACHUSETTS



PROJECT MANUAL

**WORCESTER TECHNICAL HIGH SCHOOL
TUFTS VET TECH CLINIC RENOVATIONS
1 OFFICER MANNY FAMILIA WAY
BID #8647-F6**

DIVISIONS 0 THROUGH 32

March 11, 2026

Prepared by:



SECTION 00 01 02

PROJECT DIRECTORY

OWNER

City of Worcester
City Hall, 455 Main Street
Worcester, Massachusetts 01608

ARCHITECT

Lamoureux Pagano Associates | Architects
108 Grove Street, Suite 300
Worcester, Massachusetts 01605

CONSULTANTS

STRUCTURAL ENGINEERING

Bolton & DiMartino, Inc.
100 Grove Street #317
Worcester, Massachusetts 01608

**FIRE PROTECTION, MECHANICAL &
PLUMBING ENGINEERING**

Seaman Engineering Corp.
22 West Street, Unit C
Millbury, Massachusetts, 01527

**ELECTRICAL, COMMUNICATIONS &
TECHNOLOGY ENGINEERING**

ART Engineering Corp.
38 Front Street, Floor 3
Worcester, Massachusetts 01608

PROJECT MANUAL AND SPECIFICATIONS

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SECTION 001000
CITY OF WORCESTER
INVITATION TO BID / NOTICE TO CONTRACTORS
BID # 8647-F6

The City of Worcester, the Awarding Authority, invites sealed bids for: **WORCESTER TECHNICAL HIGH SCHOOL TUFTS TECH CLINIC RENOVATIONS**, in accordance with documents prepared by Lamoureux Pagano Associates Architects Inc., 108 Grove Street, Worcester, MA 01605.

WORCESTER TECHNICAL HIGH SCHOOL TUFTS TECH CLINIC RENOVATIONS
1 OFFICER MANNY FAMILIA WAY, WORCESTER, MA 01605

The project scope generally includes:

1. Renovation of an existing 9,100 square foot vocational shop area and the addition to create a new entrance for a new instructional veterinary clinic which is to be available to the public. The work includes the removal and relocation of existing equipment, demolition of interior partitions; modifications to existing fire protection, plumbing, HVAC and electrical systems; the construction of new interior partitions with new floor and ceiling finishes; the construction of a new 465 square foot addition with an exposed steel canopy; and associated site improvement work.
2. The work area is within a fully operational and occupied technical high school. Spaces directly adjacent to the work area will be occupied by staff and students during normal school hours and during after-hours programs. The contractors and all workers shall complete CORI checks through the Owner. All work shall be coordinated with the Owner so that there will be no disruptions to services in the building except during off hours, weekends, and vacation periods.

SEALED GENERAL BIDS for **WORCESTER TECHNICAL HIGH SCHOOL TUFTS TECH CLINIC RENOVATIONS** will be received at the Purchasing Division, 455 Main Street, Worcester, MA 01605 no later than 10:00 a.m., Wednesday April 15, 2026 and will be publicly opened thereafter and read aloud.

General Bids must be accompanied by:

- (1) A fully executed FORM FOR GENERAL BID;
Specification Section **00 40 00**.
- (2) City of Worcester form of Tax Payment Certificate;
Specification Section **00 85 00**.
- (3) **Affidavit of Acknowledgment and Certificate of Compliance** for the City of Worcester Minority/Women Business Enterprise & Worker Utilization. **M/WBEP-Form EOO-101**; Specification Section **00 95 00**.

- (4) **Initial Statement and Certification of Compliance** with the Responsible Employer Ordinance, **Form REO-101 page 2**.
Specification Section **00 95 00**. **This form may or may not be changed prior to Bidding pending Legal review.**
- (5) **Provide Evidence** of Compliance with the Responsible Employer Ordinance (**REO**).
As per Specification Section **00 95 00**.
- (6) **A Certificate of Eligibility** certifying the bidder's qualification in the category of **GENERAL BUILDING CONSTRUCTION** issued by the Division of Capital Asset Management and Maintenance, DCAMM, showing that the Bidder has been approved to bid on projects the size and nature of this project. In order to be eligible to be awarded this contract, a general bidder must be certified in the appropriate category and for the total Project Cost including all alternates elected (if applicable) to be taken by the Owner.
- (7) **A Prime Contractor Update Statement**. It is the Bidder's responsibility to obtain the necessary forms and make application to DCAMM in sufficient time for DCAMM to evaluate the application and issue a Certificate of Eligibility. A sample of the Contractor Update Statement (effective March 30, 2023) is located at the end of Section **00 15 00**.
- (8) Bid deposit for the general bid in the amount of **five (5) percent** of the value of the bid or a bid bond.
- (9) **Foreign Corporation Certificate of Registration** from the Commonwealth of Massachusetts State Secretary (if applicable).
- (10) **CORI Compliance Gender Identity Form**
- (11) **Wage Theft Prevention Certification Form**

SEALED FILED SUB-BIDS for **WORCESTER TECHNICAL HIGH SCHOOL TUFTS TECH CLINIC RENOVATIONS** will be received at the Purchasing Division, 455 Main Street, Worcester, MA 01605 no later than 10:00 a.m., Wednesday, April 1, 2026 and will be publicly opened thereafter and read aloud.

Filed Sub-Bids required are as follows:

- (1) **Section 04 00 01 MASONRY**
- (2) **Section 07 00 02 ROOFING & FLASHING**
- (3) **Section 09 00 05 ACOUSTICAL CEILINGS**
- (4) **Section 09 00 06 RESILIENT FLOORING**
- (5) **Section 09 00 09 PAINTING**
- (6) **Section 21 00 01 FIRE PROTECTION**
- (7) **Section 22 00 00 PLUMBING**
- (8) **Section 23 00 00 HVAC**
- (9) **Section 26 00 01 ELECTRICAL**

SUB-BIDS must be accompanied by:

- (1) A fully executed FORM FOR SUB-BID;
Specification Section **00 50 00**.
- (2) Certification of Payment of Massachusetts State Taxes Form;
Specification Section **00 85 00**.

- (3) **Affidavit of Acknowledgment and Certificate of Compliance** for the City of Worcester Minority/Women Business Enterprise & Worker Utilization. **M/WBEP-Form EOO-101**; Specification Section **00 95 00**.
- (4) **Initial Statement and Certification of Compliance** with the Responsible Employer Ordinance, **Form REO-101 page 2**, Specification Section **00 95 00**.
- (5) **Provide Evidence** of Compliance with the Responsible Employer Ordinance (**REO**). As per Specification Section **00 95 00**.
- (6) **A Certificate of Eligibility** certifying the bidders qualification, in the respective filed sub trade category being bid, issued by the Division of Capital Asset Management and Maintenance, DCAMM, showing that the Bidder has been approved to bid on projects the size and nature of this project. In order to be eligible to be awarded this contract, a bidder must be certified in the appropriate category and for the total Cost of the respective work including all alternates elected (if applicable) to be taken by the Owner.
- (7) **A Sub-Bidder Update Statement**, It is the Bidder's responsibility to obtain the necessary forms and make application to DCAMM in sufficient time for DCAMM to evaluate the application and issue a Certificate of Eligibility. A sample of the Sub-Bidder Update Statement (updated March 2023) is located at the end of Section **00 15 00**.
- (8) Bid deposit for the sub-bid in the amount of **five (5) percent** of the value of the bid, or a bid bond.
- (9) **Foreign Corporation Certificate of Registration** from the Commonwealth of Massachusetts State Secretary (if applicable).
- (10) **CORI Compliance Gender Identity Form**
- (11) **Wage Theft Prevention Certification Form**

PLANS AND SPECIFICATIONS will be available Wednesday, March 11, 2026 at www.worcesterma.gov. It is the responsibility of every bidder who receives this bid to check the website for any addenda.

WAGE RATES - Bids are subject to the provisions of M.G.L., Chapter 149, Section 44A to J inclusive, as amended to date, and such other Federal, State and Municipal laws or regulations.

Attention of bidders is particularly called to the requirements as to conditions of employment to be observed and to the fact that not less than the minimum wage rates set forth in the Contract Documents shall be paid on this project. Minimum wage rates are per M.G.L., Chapter 149, Sections 26 & 27 inclusive.

MINORITY/WOMEN BUSINESS ENTERPRISE PROGRAM - The City of Worcester has established goals for the participation of minorities and women workers, contractors, subcontractors, and suppliers on all City projects. Bids must demonstrate the contractor's ability to utilize minorities and women in all phases of this project. The City of Worcester has established a program to enhance contract opportunities to minority and women-owned businesses through its Minority/Women Business Enterprise Program. This program contains minimum participation goals of ten (10) percent by MBE's and fifteen (15) percent by WBE's calculated as a percentage of the total bid price. Accordingly, all general bidders and filed sub-bidders must execute and submit with their respective bids M/WBEP Form EOO-101, Contractor's and Filed Subcontractor's Certification.

RESPONSIBLE EMPLOYER ORDINANCE - The performance of the work derived from this bid is subject to the City's Responsible Employer Ordinance, Chapter 2, Section 35 of WRO (2008). Accordingly, all general bidders and filed sub-bidders must execute and submit with their respective bids Form REO-101 page 2, Contractor's and Filed Subcontractor's Initial Certification.

NOISE ORDINANCE – All Contractors must adhere to the provision of § 1A(e)(9) of chapter nine of the Revised Ordinances of the city by limiting their on-site, noise producing construction and related work to the hours specified by said ordinance.

PRE-BID CONFERENCE - The pre-bid conference will be held on Wednesday, March 18, 2026 at Worcester Technical High School, 1 Officer Manny Familia Way, Worcester, MA 01605 beginning at 2:00 p.m. with a brief overview and tour of the construction areas. It is recommended that all Bidders attend this meeting.

WORK UNDER SEPARATE CONTRACTS AND BY OWNER – The Owner may do other work during construction with its own forces or by separate contract.

COMMENCEMENT OF WORK AND TIME OF COMPLETION – The selected General Bidder must agree to commence work within five (5) days of the execution of a General Contract and to substantially complete on February 19, 2027 in accordance with the project schedule set forth in the contract documents.

The Awarding Authority reserves the right to waive any informality in, or to reject any or all general bids, if it were in the public interest to do so. In inviting sub-bids in connection with such a contract, the Awarding Authority shall reserve the right to reject any sub-bid on any sub-trade, if it determines that such sub-bid does not represent the sub-bid of a person competent to perform the work as specified, or that less than three (3) such sub-bids were received and that the prices are not reasonable for acceptance without further competition.

The City of Worcester is an equal opportunity/affirmative action employer.

City of Worcester, Massachusetts
Executive Office of the City Manager

END OF SECTION



**CITY OF WORCESTER
INSTRUCTIONS TO BIDDERS
BID # 8647-F6**

SECTION 1 - INTRODUCTION; DEFINITIONS

- 1.0 In accordance with an Advertisement for Bids, a copy of which is bound herewith, the City of Worcester (the "Owner") has invited bids for the Worcester Technical High School Tufts Vet Tech Clinic Renovation. The project scope generally consists of:
- (1) Renovation of an existing 9,100 square foot vocational shop area and the addition to create a new entrance for a new instructional veterinary clinic which is to be available to the public. The work includes the removal and relocation of existing equipment, demolition of interior partitions; modifications to existing fire protection, plumbing, HVAC and electrical systems; the construction of new interior partitions with new floor and ceiling finishes; the construction of a new 465 square foot addition with an exposed steel canopy; and associated site improvement work.
 - (2) The work area is within a fully operational and occupied technical high school. Spaces directly adjacent to the work area will be occupied by staff and students during normal school hours and during after-hours programs. The contractors and all workers shall complete CORI checks through the Owner. All work shall be coordinated with the Owner so that there will be no disruptions to services in the building except during off hours, weekends and vacation periods and other work indicated on the contract documents
- 1.1 These Instructions to bidders (the "Instructions") are intended to assist bidders (which term as used in these Instructions shall include general bidders and sub-bidders if applicable) in the preparation of their bids, to call attention to various legal requirements and to set forth certain conditions upon which bids are submitted and received.
- 1.2 The award of the contract is governed by Chapter 149, Sections 44A-44J of the Massachusetts General Laws. Certain provisions of the foregoing statute and of other applicable statutes are summarized in these Instructions. Whenever these Instructions or any other contract documents set forth or summarize applicable statutory provisions, whether or not the statutes have been specifically referred to, such summaries are for convenience only, do not purport to be complete or correct as summaries of any particular material, and shall in no respect

supersede, expand or limit rights or duties of the Owner or bidders in matters governed by the statute.

1.3 The following definitions shall apply in these Instructions and in the other Contract Documents:

- (1) The term "bidding documents" shall include the Advertisement for Bids, these Instructions, the bid forms, contract forms and other Contract Documents bound herewith, the Drawings, the Specifications, and all Addenda issued prior to receipt of bids.
- (2) The terms "Addenda" and "Addendum" shall mean written documents and/or drawings issued by the Owner prior to execution of the contract, which supplement, modify, correct, explain or interpret the bidding documents.
- (3) All definitions set forth in the Conditions of the Contract or the other Contract Documents as therein defined are applicable to these Instructions and to the other bidding documents.

SECTION 2 - AVAILABILITY OF CONTRACT DOCUMENTS

- 2.1 Plans and specifications are available at www.worcesterma.gov.
- 2.2 The Owner shall prepare and update daily a list of persons who have requested a set of drawings and specifications for the project, which list shall be sent each week to the Central Register published by the Massachusetts Secretary of State.

SECTION 3 - EXAMINATION OF SITE AND CONTRACT DOCUMENTS; PRE-BID CONFERENCE

- 3.1 Before submitting a bid, each bidder must: (a) thoroughly examine the Contract Documents (b) visit the site to fully examine and acquaint himself with local conditions that may in any manner affect cost, progress or performance of the Work, (c) familiarize himself with federal, state and local laws, ordinances, rules and regulations that may in any manner affect cost, progress or performance of the Work, and (d) study and carefully correlate his observations with the requirements of the Contract Documents. Failure of a bidder to visit the site and acquaint himself with the Contract Documents or to attend the pre-bid conference, if any, shall in no way relieve the bidder from any obligation with respect to his bid.
- 3.2 On request, the Owner will provide each bidder access to the site to conduct such reasonable investigations and tests as such bidder deems necessary to prepare his bid.
- 3.3 Each bidder shall promptly notify Jeremy C. Flansburg, MCPPO MAPPO Assistant Purchasing Director, Purchasing Division, 455 Main Street,

Worcester, MA 01605, (508) 799-1220 Flansburgjc@worcesterma.gov of any ambiguity, inconsistency, or error he may discover upon examination of the Contract Documents, the site or other local conditions. The submission of a bid will constitute a representation by the bidder that he has complied with every requirement of this Section 3 and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the work of this contract.

- 3.4 A pre-bid conference will be held at the place and time set forth in the Advertisement for Bids.

SECTION 4 - ADDENDA AND INTERPRETATION OF CONTRACT DOCUMENTS

- 4.1 All questions and requests for clarifications or interpretations of the meaning of the Contract Documents shall be in writing, via email transmission, addressed to Jeremy C. Flansburg MCPPO, MAPPO, Assistant Purchasing Director, Purchasing Division, 455 Main Street, Worcester, MA 01605, (508) 799-1220 FlansburgJC@worcesterma.gov and to be given consideration must be received at least five (5) days prior to the date fixed for opening of bids.
- 4.2 Clarifications or such interpretations and any supplemental instructions or forms, if issued, will be issued in the form of written Addenda and when possible, not later than two (2) days before the date fixed for opening of bids. Addenda will be sent by email to the contact listed on the receipt for drawings and specifications. Each bidder shall be responsible for determining that he has received all Addenda issued, and failure of any bidder to receive any such Addendum shall not relieve such bidder from any obligation under its bid as submitted. Failure to acknowledge receipt of an Addendum on the Bid Form by the Bidder may be cause for rejection of the Bid.
- 4.3 All Addenda so issued shall become part of the Contract Documents.
- 4.4 Oral clarifications or interpretations will be of no legal effect. The Owner will not be responsible for, and no bidder may rely upon or use as the basis of a claim against the Owner or the Architect, any information, explanation or interpretation of the Contract Documents rendered in any fashion except as herein provided.

SECTION 5 - PRE QUALIFICATION BY DIVISION OF CAPITAL ASSET MANAGEMENT AND MAINTENANCE (DCAMM) (CHAPTER 149 PROJECTS)

- 5.1 **GENERAL BIDS** on this contract must be accompanied by a copy of a Certificate of Eligibility issued by the Massachusetts Division of Capital Asset Management and Maintenance (DCAMM) showing that the bidder has the classification and capacity rating to perform the work required. In

order to be eligible to be awarded this contract, a general bidder must be certified by the DCAMM for the total Project Cost, including all alternates elected (if applicable) to be taken by the Owner, and certified in the category of **GENERAL BUILDING CONSTRUCTION**.

- 5.2 Each general bid must also be accompanied by a Contractor Qualifications Statement Update ("Update Statement"). The Owner will furnish copies of the Update Statement form to bidders on request. (Note: A sample copy of the Update Statement is located at the end of this Section.). Any general bid submitted without a currently valid Certificate of Eligibility and Update Statement shall be invalid and will not be accepted by the Owner.
- 5.3 The Owner may at its discretion give the bidder notice of defects or omissions in the bidder's Update Statement and an opportunity to make revisions to this statement. A contractor's bid shall not be rejected if there are mistakes or omissions of form in its Update Statement, provided the contractor promptly corrects those mistakes or omissions upon request by the Owner.
- 5.4 The Owner will consider the information contained in the Update Statement, which it may verify by its own investigation, and material that it may request from the DCAM according to 810 CMR 4.03 (12) in determining whether the low bidder is eligible for contract award pursuant to M.G.L. Chapter 149, Section 44A (2). The Owner's eligibility review of the low bidder will concentrate on the bidder's performance since its last certification by the DCAMM, provided, however, that the Owner may bring information to the DCAMM's attention concerning a contractor's qualifications, if the DCAMM was not aware of that information when it certified the contractor.
- 5.5 The low bidder may not be awarded a contract which, when added to the cost to complete all other currently held contracts, would exceed the contractor's aggregate rating limit.
- (1) The Owner will use the information provided in the Update Statement to compute the amount of work the bidder has underway.
- (2) If the contractor provides the Owner with evidence that its outstanding balance of contracts will be within its aggregate rating limit by the start date of the project for which it is low bidder, the Owner may, at its discretion, make the contract award.
- 5.6 Should the lower bidder be determined not to be eligible, the Owner shall review the next low bidder's eligibility, in accordance with these procedures and the applicable legal requirements until a bidder is determined to be eligible for contract award.

- 5.7 The contract shall not be awarded to any bidder whose submitted background information when investigated and verified by the Owner, raises significant question as to his ability to successfully complete the project in question due to problems with his competence and responsibility.

SECTION 6 - WAGE RATES

- 6.1 Minimum rates of wages for work performed under this contract will be as predetermined by the Commissioner of Labor and Industries of the Commonwealth of Massachusetts in accordance with the provisions of Sections 26 to 27C, inclusive, of Chapter 149 of the Massachusetts General Laws.
- 6.2 Section 27B of said Chapter 149 provides record-keeping requirements for contractors and subcontractors with respect to employees, hours, wages and other matters.
- 6.3 Bidders' attention is called to Section 148 of Chapter 149 of the Massachusetts General Laws, relating to the weekly payment of wages.

SECTION 7 - SALES TAX

- 7.1 Section 6(f) of Chapter 54H of the Massachusetts General Laws exempts from Massachusetts sales tax, building materials and supplies to be used in the project, and bidders shall not include in their bids any amount therefore. The number of the certificate granted by the Commissioner of Revenue for use in obtaining the exemption may be obtained from the City of Worcester.

SECTION 8 - PREPARATION AND SUBMISSION OF BIDS

- 8.1 Each bid shall be submitted upon the bid forms furnished by the Owner, copies of which are bound with the bid documents. The bid forms may be submitted without the balance of the Contract Documents. All blank spaces shall be filled in, in ink or typewritten, in words or figures. The bid prices for each item on the bid forms shall be stated in both words and figures. Where itemized lump sum or unit prices are called for, the bidder shall provide all such prices. In the event of a discrepancy between prices written in words and prices written in figures, the written words shall govern. In the event of a discrepancy between the indicated sum of any column of figures and the correct sum thereof, the correct sum shall govern. The bid shall state the legal name of the bidder and shall be signed in ink by a person or persons legally authorized to bind the bidder to a contract. The name and title of the person or persons signing the bid shall be typed or printed below the signatures.
- 8.2 Each bid and the bid deposit (described below) shall be submitted to the Owner at the place stated in the Advertisement for Bids in a sealed

envelope bearing on the outside the name of the bidder, his address and the title of the project for which the bid is submitted. If forwarded by mail, the sealed bid and the bid deposit shall be enclosed in an envelope with the notation "BID ENCLOSED" on the face and addressed as indicated in the Advertisement for Bids. A Certificate of Eligibility and an Update Statement in accordance with Section 5 shall if applicable, accompany each general bid.

- 8.3 Each sub-bid shall be submitted as specified in Paragraph 8.2 above, and, in addition, the notation "SUB-BID" and the name of the sub-trade for which the sub-bid is submitted shall be placed on the outside of the sealed envelope containing the sub-bid.
- 8.4 The Form for General Bid requires the general bidder to indicate whether performance and payment bonds will be required by the general bidder to be furnished by one or more filed sub-bidders. If the general bidder requests one or more filed sub-bidders to furnish such bonds, the general bidder must pay the premiums for all such bonds requested, and must include the costs of such premiums in his general bid.
- 8.5 Section 39L of Chapter 30 of the Massachusetts General Laws prohibits the Owner from entering into a contract for this work with, and shall not approve as a subcontractor furnishing labor and materials for a part of any such work, a foreign corporation which has not filed with the Owner, a certificate of the State Secretary stating that such corporation has complied with Massachusetts General Laws Chapter 181, Sections 3 and 5. Therefore, every Foreign Corporation, whether submitting a general or sub-bid, must furnish a certified copy of its Certificate of Registration that has been duly filed with the State Secretary's office. Any bid, general or sub, of a foreign corporation submitted without a Certificate may be invalid and may be rejected pursuant to Section 11.

SECTION 9 - RECEIPT OF BIDS

- 9.1 All bidders are cautioned to allow ample time for transmittal of bids. Bidders are solely responsible for delivery to and receipt by the Owner of bids at the place stated in the Advertisement for Bids. Bids received after the specified time or at other than the specified location will not be accepted or recognized and will be returned to the Bidder unopened. The time of receipt will determine the acceptability of mailed bids, regardless of postmark.
- 9.2 Any bid may be withdrawn by the bidder or his duly authorized representative by written notice received by the Owner at the address for receipt of bids specified in the Advertisement for Bids prior to the time scheduled for the opening of such bids or authorized postponement thereof. No bid may be withdrawn for sixty (60) days, Saturdays, Sundays and legal holidays excluded, after the opening of general bids. No telephone or telegraphic bid, change in bid or withdrawal of bid will be

received or recognized. A bid may be amended or modified only by withdrawing the bid and resubmitting another bid prior to the time for the opening of bids.

- 9.3 Bids will be opened and read publicly at the place and time stated in the Advertisement for Bids or the authorized postponement thereof. Bidders or their authorized representatives are invited to be present.

SECTION 10 - BID DEPOSIT

- 10.1 A bid deposit in the form of a bid bond, or cash, or a certified check must accompany each bid, or a treasurer's or cashier's check issued by a responsible bank or trust company, payable to the City of Worcester. A bid bond shall be (a) in form satisfactory to the Owner and substantially conforming to the sample contained in the Contract Documents, (b) with a Surety company qualified to do business (licensed) in the Commonwealth of Massachusetts and satisfactory to the Owner, and conditioned upon the faithful performance by the principal of the agreements contained in the bid. The bid deposit shall be in the amount of five (5) percent of the value of the bid.

SECTION 11 - REJECTION OF BIDS

- 11.1 The Owner reserves the right to reject any or all general bids if it were in the public interest to do so. The Owner reserves the right to reject any sub-bid on any sub-trade, if it determines that such sub-bid does not represent the sub-bid of a person competent to perform the work as specified or that less than three (3) such sub-bids were received and that the prices are not reasonable for acceptance without further competition.
- 11.2 Within two (2) days, Saturdays, Sundays and legal holidays excluded, after opening sub-bids, the Owner will reject every sub-bid which is not accompanied by the required bid deposit or which otherwise does not conform to statutory requirements, or which is on a form not completely filled in, or which is incomplete, conditional or obscure, or which contains any addition not called for; provided, however, that the failure of the Owner to reject such a sub-bid within such period shall not validate such a sub-bid nor preclude the Owner from subsequently rejecting it.
- 11.3 The Owner shall reject every general bid and filed sub-bid which is not accompanied by the required bid deposit, or which otherwise does not conform to the statutory requirements or the bid documents.
- 11.4 The Owner reserves the right to reject any and all general bids which contains erasures, alterations, additions, errors or irregularities of any kind, or which contains proposed prices for any class or item of work which are, in the judgment of the Owner, substantially less or more than the actual cost to complete the work; provided, however, that the Owner

reserves the right to waive any and all informalities as to form. Matters as to substance shall not be waived.

SECTION 12 - AWARD OF CONTRACT

- 12.1 The general contract will be awarded to the lowest responsible and eligible general bidder complying with the conditions and requirements provided in these Instructions, the bid forms and the other bid documents.
- 12.2 Award of the contract will be made within thirty (30) days, Saturdays, Sundays and legal holidays excluded, after (i) the opening of the general bids or (ii) the receipt by the Owner of any approvals necessary from federal or state agencies in connection with the project, whichever is later.
- 12.3 The successful bidder will be notified in writing, by mail or otherwise, that their bid has been accepted and that he has been awarded the contract. The successful bidder shall execute the contract and furnish the required bonds, at the offices of the Owner if requested, within five (5) days, Saturdays, Sundays and legal holidays excluded, after presentation of the contract to him or notice to him that the contract is ready for execution.
- 12.4 If the bidder selected as the general contractor fails to perform his agreement to execute the contract in accordance with the terms of his bid and furnish a performance bond and also a labor and materials payment bond as stated in his bid, the award will be made to the next lowest responsible and eligible general bidder, subject to the provisions of Sections 44A-44J, inclusive, of said Chapter 149 of the Massachusetts General Laws.
- 12.5 After the apparent lowest eligible and responsible general bidder is selected, it shall promptly confer with the Owner on the question of sub-bidders. Upon the Owner's acceptance of the sub-bidders to be utilized, the selected bidder shall promptly present subcontracts to its filed sub-bidders, and in all cases, the presentment of subcontracts must be made a minimum of six days prior to the presentment of the general contract to the general bidder by the Owner. The general bidder shall submit copies of the executed subcontracts to the Owner as a prerequisite to the Owner's presentment of the general contract. As provided in the statutory subcontract form, the validity of the subcontracts is contingent upon execution of the general contract. [Massachusetts General Laws Chapter 149, Section 44F(4)(c)].

SECTION 13 - CERTIFICATES AND DOCUMENTS TO BE FURNISHED PRIOR TO EXECUTION OF THE CONTRACT

- 13.1 If the amount or the estimated amount of this contract is greater than \$100,000, then, pursuant, to Section 39R of Chapter 30 of the Massachusetts General Laws, the Contract Documents require the general contractor to make and keep books, records and accounts

pertaining to the contractor's financial affairs and to file with the Deputy Commissioner of Capital Asset Management & Maintenance and the Owner the statements and certificates described below in Paragraphs 13.2, 13.3 and 13.4.

13.2 Prior to the execution of the contract the general contractor shall file with the Owner:

- (1) A statement of management controls.
- (2) A statement prepared and signed by an independent certified public accountant, stating that he and or she has examined the statement of management on internal accounting controls, and expressing an opinion as to:
 - (a) whether the representations of management are consistent with the result of management's evaluation of the system of internal accounting controls; and
 - (b) whether such representations of management are, in addition, reasonable with respect to transactions and assets in amounts, which would be material when measured in relation to the applicant's financial statements.

13.3 Prior to execution of the contract, and annually during the term of the contract, the general contractor shall file with the Deputy Commissioner of Capital Asset Management & Maintenance a Financial Statement prepared by an independent certified public accountant on the basis of an audit by such accountant. All statements shall be accompanied by an accountant's report.

13.4 Pursuant to Sections 49A of Chapter 62C of the Massachusetts General Laws the contractor must certify that it has complied with all laws of the Commonwealth of Massachusetts relating to taxes. A form of certificate for this purpose is included in the Contract Documents.

13.5 Prior to commencement of work, the contractor must furnish to the Owner certificates evidencing required insurance coverage in accordance with the provisions of the insurance requirements contained in the Supplementary General Conditions of the Contract.

13.6 The affidavit of compliance with certain laws of the Commonwealth relating to corporations, and evidence of corporate authority with respect to execution of the contract documents on behalf of the contractor, on the form contained in the bidding documents, must be furnished by the contractor to the Owner at the time of execution of the contract.

- 13.7 The general contractor as stated in the bid form must furnish a performance bond and a labor and materials payment bond, each in the amount of the contract sum. Such bonds must be on the forms similar to those contained in the bid documents and must be executed and delivered to the Owner at the time of execution of the contract. Each attorney-in-fact who executes such a bond on behalf of the surety must affix thereto a certified and current copy of his power of attorney.
- 13.8 A performance and a labor and materials payment bond furnished by a subcontractor, at the request of a general contractor, shall secure the performance of the sub-contract by the subcontractor; and shall indemnify and hold harmless the general contractor and the surety or sureties under the labor and materials payment bond furnished by the general contractor to the Owner against (1) any and all expense arising out of any and all claims in connection with the performance of said subcontract which would be required to be paid under the labor and materials payment bond furnished by the general contractor to the Owner and (2) attorney's fees in the event that the subcontractor, after the notice, fails to assume the defense and defend such claims.
- 13.9 The subcontract agreement between the general contractor and each filed subcontractor shall be in the form contained in the Contract Documents bound with the instructions, as required by Section 44 F of said Chapter 149 of the Massachusetts General Laws.

SECTION 14 - FILED SUB-BID PROCEDURE

- 14.1 As stated in the Advertisement for Bids, the Owner has requested FILED SUB-BIDS on the following classes of work:
- (1) Section 04 00 01 MASONRY
 - (2) Section 07 00 02 ROOFING & FLASHINGS
 - (3) Section 09 00 05 ACOUSTICAL CEILINGs
 - (4) Section 09 00 06 RESILIENT FLOORING
 - (5) Section 09 00 09 PAINTING
 - (6) Section 21 00 01 FIRE PROTECTION
 - (7) Section 22 00 00 PLUMBING
 - (8) Section 23 00 00 HVAC
 - (9) Section 26 00 01 ELECTRICAL
- 14.2 Every sub-bidder duly filing a sub-bid with the Owner shall be bound thereby to every general bidder not excluded therein from the use thereof; and any variance from such sub-bid communicated to a general bidder shall be of no effect.
- 14.3 Each sub-bidder shall list in the sub-bid form the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the section of the specifications for that sub-trade requires such listings; provided that in the absence of a contrary provision

in the specification, any sub-bidder may, without listing any bid price, list his own name for any such class of work or part thereof and perform that work with persons on his own payroll if such sub-bidder after sub-bid opening, shows to the satisfaction of the Owner that he does customarily perform such class of work or the part thereof with employees on his own payroll who are mechanics or laborers referred to in Section 26 of said Chapter 149, of the Massachusetts General Laws, and is qualified so to do.

- 14.4 **FILED SUB-BIDS** on this contract must be accompanied by a copy of a Certificate of Eligibility issued by the Massachusetts Division of Capital Asset Management & Maintenance (DCAMM) showing that the bidder has the classification and capacity rating to perform the work required. In order to be eligible to be awarded this contract, each filed sub-bidder must be certified by the DCAMM for their total Project Cost, including all alternates elected (if applicable) to be taken by the Owner, and certified in their respective trade category.
- 14.5 Each filed sub-bid must also be accompanied by a Contractor Qualifications Statement Update ("Update Statement"). The Owner will furnish copies of the Update Statement form to bidders on request. (Note: A sample copy of the Update Statement is located at the end of this Section.). Any filed sub-bid submitted without a currently valid Certificate of Eligibility and Update Statement shall be invalid and will not be accepted by the Owner.
- 14.6 Not later than the second day, Saturdays, Sundays and legal holidays excluded, before the day fixed by the Owner for the opening of general bids, the Owner shall mail to every person on record as having taken a set of Drawings and Specifications a list of sub-bidders arranged by sub-trades and listing for each sub-trade the name, address and sub-bid price of every sub-bidder submitting a sub-bid thereon not rejected by the Owner, and the general bidders excluded from using such sub-bid. A person shall not be named by a general bidder as a sub-bidder for a sub-trade on the general bid form unless such person is included for such sub-trade in said list.
- 14.7 All sub-bidders, when finally selected, shall be notified in writing of their selection with forty-eight (48) hours thereafter by the general bidder. The selected general bidder and each of the selected sub-bidders shall promptly execute the subcontract agreements, and fully executed copies of all subcontract agreements shall be delivered to the Owner prior to presentment of the Owner-Contractor Agreement to the selected general bidder for execution. The selected General Bidder shall promptly and without delay, notify the Owner of any selected sub-bidder who fails to execute a sub-contract or furnish the requisite bonds and/or insurance within five (5) days of presentment thereof.

SECTION 15 - MINORITY AND WOMEN BUSINESS ENTERPRISE PROGRAM

- 15.1 The Owner has established goals for the participation of minority and women contractors and subcontractors on all City projects. **In furtherance thereof, the City of Worcester's Supplemental Equal Employment Opportunity Anti-Discrimination And Affirmative Action Program is included in the Bidding Documents, and all bidders shall comply with the requirements set forth therein.** Any bidder who has any questions about the forms and procedures should contact Joshua Kasuba, Contract Compliance Officer, Purchasing Division, Room 201, 455 Main Street, Worcester, MA 01605, Telephone: (508) 799-1220.

SECTION 16 - RESPONSIBLE EMPLOYER ORDINANCE

- 16.1 The performance of the work derived from this bid is subject to the city's Responsible Employer Ordinance, Chapter 2, Section 35 of the Worcester Revised Ordinances (2008). Bidders are hereby instructed to review and familiarize themselves with the requirements thereof. The complete text of the ordinance is contained in the Supplementary General Conditions - Part I.

SAMPLE PRIME CONTRACTOR UPDATE STATEMENT AND SUB-BIDDER UPDATE STATEMENT ON THE FOLLOWING PAGES

END OF SECTION

PRIME UPDATE STATEMENTS ARE NOT PUBLIC RECORDS AND
ARE NOT OPEN TO PUBLIC INSPECTION (M.G.L. C.149, §44D)

TO ALL BIDDERS AND AWARDING AUTHORITIES

A COMPLETED AND SIGNED PRIME CONTRACTOR UPDATE STATEMENT MUST BE SUBMITTED WITH EVERY PRIME BID FOR A CONTRACT PURSUANT TO M.G.L. c.149, §44A AND M.G.L. c. 149A. ANY PRIME BID SUBMITTED WITHOUT AN APPROPRIATE UPDATE STATEMENT IS INVALID AND MUST BE REJECTED.

Caution: This form is to be used for submitting Prime Contract bids. It is not to be used for submitting Filed Sub-Bids or Trade Sub-Bids.

AWARDING AUTHORITIES

If the Awarding Authority determines that the bidder does not demonstrably possess the skill, ability and integrity necessary to perform the work on the project, it must reject the bid.

BIDDER'S AFFIDAVIT

I swear under the pains and penalties of perjury that I am duly authorized by the bidder named below to sign and submit this Prime Contractor Update Statement on behalf of the bidder named below, that I have read this Prime Contractor Update Statement, and that all of the information provided by the bidder in this Prime Contractor Update Statement is true, accurate, and complete as of the bid date.

Bid Date

Print Name of Prime Contractor

Project Number
(or name if no number)

Business Address

Awarding Authority

Telephone Number

SIGNATURE⇒

Bidder's Authorized Representative

INSTRUCTIONS

INSTRUCTIONS TO BIDDERS

- This form must be completed and submitted by all Prime contractors bidding on projects pursuant to M.G.L. c. 149, §44A and M.G.L. c. 149A.
- You must give complete and accurate answers to all questions and provide all of the information requested. **MAKING A MATERIALLY FALSE STATEMENT IN THIS UPDATE STATEMENT IS GROUNDS FOR REJECTING YOUR BID AND FOR DEBARRING YOU FROM ALL PUBLIC CONTRACTING.**
- **This Update Statement must include all requested information that was not previously reported on the Application used for your firm's most recently issued (not extended or amended) Prime Contractor Certificate of Eligibility. The Update Statement must cover the entire period since the date of your Application, NOT since the date of your Certification.**
- You must use this official form of Update Statement. Copies of this form may be obtained from the awarding authority and from the Division of Capital Asset Management and Maintenance Web Site: www.mass.gov/DCAMM.
- If additional space is needed, please copy the appropriate page of this Update Statement and attach it as an additional sheet.
- See the section entitled "Bidding Limits" in the *Instructions to Awarding Authorities* for important information concerning your bidding limits.

INSTRUCTIONS TO AWARDING AUTHORITIES

Determination of Bidder Qualifications

- It is the awarding authority's responsibility to determine who is the lowest eligible and responsible bidder. You must consider all of the information in the low bidder's Update Statement in making this determination. Remember: this information was not available to the Division of Capital Asset Management and Maintenance at the time of certification.
- The bidder's performance on the projects listed in Parts 1 and 2 must be part of your review. Contact the project references.
- **AWARDING AUTHORITIES ARE STRONGLY ENCOURAGED TO REVIEW THE LOW BIDDER'S ENTIRE CERTIFICATION FILE AT THE DIVISION OF**

CAPITAL ASSET MANAGEMENT AND
MAINTENANCE. Telephone (617) 727-9320 for an
appointment.

Bidding Limits

Single Project Limit: The total amount of the bid, including all alternates, may not exceed the bidder's Single Project Limit.

Aggregate Work Limit: The annual value of the work to be performed on the contract for which the bid is submitted, when added to the annual cost to complete the bidder's other currently held contracts, may not exceed the bidder's Aggregate Work Limit. Use the following procedure to determine whether the low bidder is within its Aggregate Work Limit:

<u>Step 1</u>	Review Update Statement Question #2 to make sure that all requested information is provided and that the bidder has accurately calculated and totaled the annualized value of all incomplete work on its currently held contracts (column 9).
<u>Step 2</u>	Determine the annual dollar value of the work to be performed on your project. This is done as follows: (i) If the project is to be completed in less than 12 months, the annual dollar value of the work is equal to the full amount of the bid. (ii) If the project will take more than 12 months to complete, calculate the number of years given to complete the project by dividing the total number of months in the project schedule by 12 (calculate to 3 decimal places), then divide the amount of the bid by the calculated number of years to find the annual dollar value of the work.
<u>Step 3</u>	Add the annualized value of all of the bidder's incomplete contract work (the total of column 9 on page 5) to the annual dollar value of the work to be

performed on your project. **The total may not exceed the bidder's Aggregate Work Limit.**

Correction of Errors and Omissions in Update Statements

Matters of Form: An awarding authority shall not reject a contractor's bid because there are mistakes or omissions of form in the Update Statement submitted with the bid, provided the contractor promptly

corrects those mistakes or omissions upon request of the awarding authority. [810 CMR 8.05(1)].

Correction of Other Defects: An awarding authority may, in its discretion, give a contractor notice of defects, other than mistakes or omissions of form, in the contractor's Update Statement, and an opportunity to correct such defects, provided the correction of such defects is not prejudicial to fair competition. An awarding authority may reject a corrected Update Statement if it contains unfavorable information about the contractor that was omitted from the Update Statement filed with the contractor's bid. [810 CMR 8.05(2)].

PART 1 - COMPLETED PROJECTS

LIST ALL PUBLIC AND PRIVATE *BUILDING* PROJECTS YOUR FIRM HAS COMPLETED SINCE THE DATE OF APPLICATION FOR YOUR MOST RECENTLY ISSUED (NOT EXTENDED OR AMENDED) DCAMM CERTIFICATE OF ELIGIBILITY. YOU MUST REPORT ALL REQUESTED INFORMATION NOT PREVIOUSLY REPORTED ON THAT DCAMM APPLICATION*.

PROJECT TITLE & LOCATION	WORK CATEGORY	CONTRACT PRICE	START DATE	DATE COMPLETED

Attach additional sheets if necessary

* If your firm has been terminated from a project prior to completion of the work or has failed or refused to complete its work under any contract, full details and an explanation must be provided. See Part 3 of this Update Statement.

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH COMPLETED PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE	COMPANY NAME	CONTACT PERSON	TELEPHONE
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above, either through a business or family relationship? ☐ YES ☐ NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship? ☐ YES ☐ NO

If you have answered YES to either question, explain. _____

PART 2 - CURRENTLY HELD CONTRACTS

LIST ALL PUBLIC AND PRIVATE BUILDING AND NON-BUILDING *CONSTRUCTION* PROJECTS YOUR COMPANY HAS UNDER CONTRACT ON THIS DATE REGARDLESS OF WHEN OR WHETHER THE WORK COMMENCED.

1	2	3	4	5	6	7	8	9
PROJECT TITLE & LOCATION	WORK CATEGORY	START AND END DATES	ON SCHEDULE (yes / no)	CONTRACT PRICE	% NOT COMPLETE	\$ VALUE OF WORK NOT COMPLETE (col. 5 X col. 6)	NO. OF YEARS REMAINING (see note below)	ANNUALIZED VALUE OF INCOMPLETE WORK (col. 7 ÷ col. 8) (divided by)

ANNUALIZED VALUE OF ALL INCOMPLETE CONTRACT WORK (Total of Column 9)

\$ _____

- Column 8
- If less than one year is left in the project schedule, write 1.
 - If more than 12 months are left in the project schedule, divide the number of months left in the project schedule by 12 (calculate to three decimal places).

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH CURRENTLY HELD PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE	COMPANY NAME	CONTACT PERSON	TELEPHONE
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		
	OWNER:		
	DESIGNER:		
	GC:		

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above either through a business or family relationship? ☐ YES ☐ NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship? ☐ YES ☐ NO

If you have answered YES to either question, explain. _____

For **Parts 3 and 4**, if you answer YES to any question, please provide on a separate page a complete explanation. You must report all requested information not previously reported on your most recent DCAMM Application for Prime Certificate of Eligibility. Information must supplement all judicial and administrative proceedings involving bidder's firm, which were instituted or concluded (adversely or otherwise) since your firm's Application for your most recently issued (not extended or amended) Certificate of Eligibility. Include all details [project name(s) and location(s), names of all parties involved, relevant dates, etc.].

PART 3 – GENERAL PERFORMANCE

Part 3 of the Update Statement corresponds to Section 5 of the Prime Application. The numbering below refers back to the numbered questions in the application for your reference.

Prime Application Section 5 - General Performance

	YES	NO
5.A. Has your Company been terminated prior to completion of a Contract?	☐	☐
5.B. Has your Company failed or refused to perform or complete any of its Scope of Work under any Contract prior to substantial completion?	☐	☐
5.C. Has your Company and/or any principal, officer, or individual with a Financial Interest in your Company filed for bankruptcy?	☐	☐
5.D. Has a surety for your Company taken over or been asked to complete your Scope of Work under any Contract?	☐	☐
5.E. Has a payment or performance bond been invoked against your Company on any Contract?	☐	☐
5.F. Has any surety for your Company made payment under a payment bond to a vendor or supplier or other party on any Contract?	☐	☐
5.G. Has any subcontractor filed a demand for direct payment on any of your Contracts?	☐	☐
5.H. Has a lawsuit been filed by any of your subcontractors or suppliers to enforce a mechanic's lien in connection with any of your Contracts?	☐	☐
5.I. Has there been a death of any Company employee or other person in connection with (or as the result of) performing your Company's Scope of Work on any of your Contracts?	☐	☐
5.J. Has any Company employee or other person suffered an injury while performing any tasks within the Scope of Work on any of your Contracts resulting in his/her inability to return to work for a period in excess of one year?	☐	☐

PART 4 – LEGAL OR ADMINISTRATIVE PROCEEDINGS; COMPLIANCE WITH LAWS

Part 4 of the Update Statement corresponds to section 6 of the Prime Application. The numbering below refers back to the numbered questions in the application for your reference.

Prime Application Section 6 -Legal or Administrative Proceedings; Compliance with Laws

The term “administrative proceeding” as used in this Prime Contractor Update Statement includes (i) any action taken or proceeding brought by a governmental agency, department or officer to enforce any law, regulation, code, legal, or contractual requirement, except for those brought in state or federal courts, or (ii) any action taken by a governmental agency, department or officer imposing penalties, fines or other sanctions for failure to comply with any such legal or contractual requirement.

The term “anyone with a financial interest in your firm” as used in this Section “I”, shall mean any person and/or entity with a 5% or greater ownership interest in the applicant’s firm.

	YES	NO
6.A. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to the procurement or performance of any of your Contracts?	☐	☐
6.B. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of any state or federal construction procurement laws?	☐	☐
6.C. Have any criminal charges involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to the procurement or performance of any of your Contracts (e.g., fraud, graft, embezzlement, forgery, bribery, falsification or destruction of records or receipt of stolen property)?	☐	☐
6.D. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of state ethics laws (in Massachusetts: M.G.L. Chapter 268A)?	☐	☐

Section 6 - Legal or Administrative Proceedings; Compliance with Laws (continued)

	YES	NO
6.E. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of any state or federal law regulating hours of labor, unemployment compensation, minimum wages, prevailing wages, overtime pay, equal pay, child labor or worker's compensation?	☐	☐
6.F. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of any state or federal law prohibiting discrimination in hiring and/or employment?	☐	☐
6.G. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled for violation of any state or federal law regulating labor relations, including collective bargaining agreements, employee welfare benefit plans, employee pension benefit plans, other ERISA and non-ERISA plans?	☐	☐
6.H. Have any proceedings by a local, state, or federal agency been brought, concluded, or settled relating to decertification, debarment or suspension of your Company and/or any principal or officer or individual with a Financial Interest in your Company from construction contracting?	☐	☐
6.I. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of state or federal environmental laws?	☐	☐
6.J. Has your Company been fined or sanctioned by OSHA and/or any other state or federal agency for violations of any laws or regulations related to occupational health or safety?	☐	☐
6.K. Has your Company ever (i) failed to meet applicable workforce and/or diversity program goals, benchmarks or other requirements, and/or (ii) been sanctioned, fined and/or penalized for non-compliance with workforce policies and/or diversity programs (e.g., for MBEs, WBEs, SDVOBEs and DBEs) and/or failure to maintain and/or submit required reports, such as certified payrolls.	☐	☐
6.L. Other than previously reported in the above questions, have any Judicial Actions or Administrative Proceedings or investigations involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled by any local, state or federal agency relating to the procurement or performance of any construction contract?	☐	☐

PART 5 - SUPERVISORY PERSONNEL

List all supervisory personnel, such as project managers and superintendents, who will be assigned to the project if your firm is awarded the contract. **Attach the resume of each person listed below.**

NAME	TITLE OR FUNCTION

PART 6 - CHANGES IN BUSINESS ORGANIZATION OR FINANCIAL CONDITION

Have there been any changes in your company's business organization (**including changes in ownership, mergers, or asset/stock sales**), financial condition or bonding capacity since the date your current Certificate of Eligibility was issued? ☐ Yes ☐ No

If YES, attach a separate page providing complete details.

PART 7 – LIST OF COMPLETED CONSTRUCTION PROJECTS SUBMITTED TO THE DIVISION OF CAPITAL ASSET MANAGEMENT AND MAINTENANCE.

Attach here a copy of the list of completed construction projects which was submitted with your firm's DCAMM Application for your most recently issued (not extended or amended) DCAMM Certificate of Eligibility. The Attachment must include a complete copy of the entire Projects Table – "Completed Projects" and the final page – "Certification" (Signature Page) containing the signature and date that the Completed Projects list was submitted to the Division of Capital Asset Management and Maintenance.

**SUB-BIDDERS' UPDATE STATEMENTS ARE NOT PUBLIC RECORDS AND
ARE NOT OPEN TO PUBLIC INSPECTION (M.G.L. C.149, §44D)**

Sub-Bidder Update Statement

TO ALL SUB-BIDDERS, TRADE CONTRACTORS AND AWARDING AUTHORITIES

A COMPLETED AND SIGNED SUB-BIDDER UPDATE STATEMENT MUST BE SUBMITTED WITH EVERY FILED SUB-BID PURSUANT TO M.G.L. c.149, §44F AND EVERY TRADE SUB-BID PURSUANT TO M.G.L. c. 149A. ANY FILED SUB-BID OR TRADE SUB-BID SUBMITTED WITHOUT AN APPROPRIATE SUB-BIDDER UPDATE STATEMENT IS INVALID AND MUST BE REJECTED.

Caution: This form is to be used for submitting Filed Sub-Bids and Trade Sub-Bids Only

AWARDING AUTHORITIES

If the Awarding Authority determines that the Sub-Bidder is not competent to perform the work as specified on the project, it should reject the bid.

SUB-BIDDER'S AFFIDAVIT

I swear under the pains and penalties of perjury that I am duly authorized by the bidder named below to sign and submit this Sub-Bidder Update Statement on behalf of the bidder named below, that I have read this Sub-Bidder Update Statement, and that all of the information provided by the bidder in this Sub-Bidder Update Statement is true, accurate, and complete as of the bid date.

Bid Date

Print Name of Sub-Bidder or Trade Contractor

Project Number
(or name if no number)

Business Address

Awarding Authority

Telephone Number

SIGNATURE⇒

Bidder's Authorized Representative

INSTRUCTIONS

INSTRUCTIONS TO SUB-BIDDERS

- This form must be completed and submitted by all Filed Sub-Bidders bidding on projects pursuant to M.G.L. c. 149, §44F and Trade Contractors bidding on projects pursuant to M.G.L. c. 149A.
- You must give complete and accurate answers to all questions and provide all of the information requested. MAKING A MATERIALLY FALSE STATEMENT IN THIS SUB-BIDDER UPDATE STATEMENT IS GROUNDS FOR REJECTING YOUR BID AND FOR DEBARRING YOU FROM ALL PUBLIC CONTRACTING.
- **This Sub-Bidder Update Statement must include all requested information that was not previously reported on the Application used for your company's most recently issued (not extended or amended) Sub-Bidder Certificate of Eligibility. The Sub-Bidder Update Statement must cover the entire period since the date of that Application, NOT since the date of your Certification.**
- You must use this official form of Sub-Bidder Update Statement. Copies of this form may be obtained from the awarding authority or from the DCAMM Web Site:
www.mass.gov/DCAMM/certification.
- If additional space is needed, please copy the appropriate page of this Sub-Bidder Update Statement and attach it as an additional sheet.

INSTRUCTIONS TO AWARDING AUTHORITIES

Determination of Sub-Bidder Qualifications

- It is the awarding authority's responsibility to determine each responsible bidder. You must consider all of the information in the bidder's Sub-Bidder Update Statement in making this determination. Remember: this information was not available to the Division of Capital Asset Management and Maintenance at the time of certification.
- The Sub-Bidder's performance on the projects listed in Parts 1 and 2 must be part of your review. Contact the project references.
- Awarding Authorities are strongly encouraged to review the Sub-Bidder's entire certification file at the Division of Capital Asset Management and Maintenance, telephone (857) 204-1305 or via email at certification.DCamm@mass.gov for an appointment.

Correction of Errors and Omissions in Sub-Bidder Update Statements

Matters of Form: An awarding authority shall not reject a Sub-Bidder's bid because there are mistakes or omissions of form in the Sub-Bidder Update Statement submitted with the bid pursuant to M.G.L. c.149, §44D, provided the Sub-Bidder promptly corrects those mistakes or omissions upon request of the awarding authority. [810 CMR 8.13(1)]

Correction of Other Defects: An awarding authority may, in its discretion, give a Sub-Bidder notice of minor defects and omissions as to form in the Sub-Bidder's Update Statement and provide an opportunity to correct its Sub-Bidder Update Statement. However, the Sub-Bidder shall not be allowed to make corrections to a Sub-Bidder Update Statement if material information about the Sub-Bidder was omitted from the Sub-Bidder Update Statement filed with the Sub-Bidder's bid. The Awarding Authority shall advise DCAMM of any material omissions in a Sub-Bidder's Update Statement. [810 CMR 8.13(2)]

PART 1 - COMPLETED PROJECTS

List All Public And Private Projects Of \$20,000 or more your company has completed since the date of application for your most recently issued (not extended or amended) Sub-Bidder Certificate Of Eligibility*.

PROJECT TITLE & LOCATION	WORK CATEGORY	CONTRACT PRICE	START DATE	DATE COMPLETED

Attach additional sheets if necessary

* If your company has been terminated from a project prior to completion of the work or has failed or refused to complete its work under any contract, full details and an explanation must be provided. See Part 3 of this Sub-Bidder Update Statement.

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH COMPLETED PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE		COMPANY NAME	CONTACT PERSON	TELEPHONE	EMAIL ADDRESS
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above, either through a business or family relationship? ☐ YES ☐ NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship? ☐ YES ☐ NO

If you have answered YES to either question, explain. _____

PART 2 – PROJECTS IN PROGRESS CONTRACTS

List all public and private projects of \$20,000 or more your company has under contract on this date regardless of when or whether the work commenced.

1	2	3	4	5	6	7
PROJECT TITLE & LOCATION	WORK CATEGORY	START AND END DATES (MM/YYYY)	ON SCHEDULE (yes / no)	CONTRACT PRICE	% NOT COMPLETE	\$ VALUE OF WORK NOT COMPLETE (col. 5 X col. 6)

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH INCOMPLETE PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE		COMPANY NAME	CONTACT PERSON	TELEPHONE	EMAIL ADDRESS
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				
	OWNER:				
	DESIGNER				
	GC:				

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above either through a business or family relationship? ☐ YES ☐ NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship? ☐ YES ☐ NO

If you have answered YES to either question, explain. _____

PART 3 - GENERAL PERFORMANCE

For Parts 3 and 4, if you answer YES to any question, please provide on a separate page a complete explanation. Information you provide herein must supplement the application for your most recently issued (not extended or amended) Sub-Bidder Certificate of Eligibility. You must report all requested information not previously reported on that application.

Include all details [project name(s) and location(s), names of all parties involved, relevant dates, etc.].

	YES	NO
5A. Has your Company been terminated prior to completion of a Contract?	☐	☐
5B. Has your Company failed or refused to perform or complete any of its Scope of Work under any Contract prior to substantial completion?	☐	☐
5C. Has your Company and/or any principal, officer, or individual with a Financial Interest in your Company filed for bankruptcy?	☐	☐
5D. Has a surety for your Company taken over or been asked to complete your Scope of Work under any Contract?	☐	☐
5E. Has a payment or performance bond been invoked against your Company on any Contract?	☐	☐
5F. Has any surety for your Company made payment under a payment bond to a vendor or supplier or other party on any Contract?	☐	☐
5G. Has any subcontractor filed a demand for direct payment on any of your Contracts?	☐	☐
5H. Has a lawsuit been filed by any of your subcontractors or suppliers to enforce a mechanic's lien in connection with any of your Contracts?	☐	☐
5I. Has there been a death of any Company employee or other person in connection with (or as the result of) performing your Company's Scope of Work on any of your Contracts?	☐	☐
5J. Has any Company employee or other person suffered an injury while performing any tasks within the Scope of Work on any of your Contracts resulting in his/her inability to return to work for a period in excess of one year?	☐	☐

PART 4 - Legal or Administrative Proceedings; Compliance with Laws

Please answer the following questions. Information must supplement all judicial and administrative proceedings involving bidder's company, which were instituted or concluded (adversely or otherwise) since your company's Application for your most recently issued (not extended or amended) Sub-Bidder Certificate of Eligibility. You must report all requested information not previously reported on that DCAMM Application.

The term "administrative proceeding" as used in this Sub-Bidder Update Statement includes (i) any action taken or proceeding brought by a governmental agency, department or officer to enforce any law, regulation, code, legal, or contractual requirement, except for those brought in state or federal courts, or (ii) any action taken by a governmental agency, department or officer imposing penalties, fines or other sanctions for failure to comply with any such legal or contractual requirement.

The term "anyone with a financial interest in your company" as used in this Section "I", shall mean any person and/or entity with a 5% or greater ownership interest in the applicant's company.

If you answer YES to any question, on a separate page provide a complete explanation of each proceeding or action and any judgment, decision, fine or other sanction or result. Include all details (name of court or administrative agency, title of case or proceeding, case number, date action was commenced, date judgment or decision was entered, fines or penalties imposed, etc.).

	YES	NO
6.A. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to the procurement or performance of any of your Contracts?	☐	☐
6.B. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of any state or federal construction procurement laws?	☐	☐
6.C. Have any criminal charges involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to the procurement or performance of any of your Contracts (e.g., fraud, graft, embezzlement, forgery, bribery, falsification or destruction of records or receipt of stolen property)?	☐	☐
6.D. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of state ethics laws (in Massachusetts: M.G.L. Chapter 268A)?	☐	☐

PART 4 - Legal or Administrative Proceedings; Compliance with Laws (continued)

	YES	NO
6.E. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of any state or federal law regulating hours of labor, unemployment compensation, minimum wages, prevailing wages, overtime pay, equal pay, child labor or worker's compensation?	☐	☐
6.F. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of any state or federal law prohibiting discrimination in hiring and/or employment?	☐	☐
6.G. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled for violation of any state or federal law regulating labor relations, including collective bargaining agreements, employee welfare benefit plans, employee pension benefit plans, other ERISA and non-ERISA plans?	☐	☐
6.H. Have any proceedings by a local, state, or federal agency been brought, concluded, or settled relating to decertification, debarment or suspension of your Company and/or any principal or officer or individual with a Financial Interest in your Company from construction contracting?	☐	☐
6.I. Have any Judicial Actions or Administrative Proceedings involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled relating to a violation of state or federal environmental laws?	☐	☐
6.J. Has your Company been fined or sanctioned by OSHA and/or any other state or federal agency for violations of any laws or regulations related to occupational health or safety?	☐	☐
6.K. Has your Company ever (i) failed to meet applicable workforce and/or diversity program goals, benchmarks or other requirements, and/or (ii) been sanctioned, fined and/or penalized for non-compliance with workforce policies and/or diversity programs (e.g., for MBEs, WBEs, SDVOBEs and DBEs) and/or failure to maintain and/or submit required reports, such as certified payrolls.	☐	☐
6.L. Other than previously reported in the above questions, have any Judicial Actions or Administrative Proceedings or investigations involving your Company and/or a principal or officer or individual with a Financial Interest in your Company been brought, concluded, or settled by any local, state or federal agency relating to the procurement or performance of any construction contract?	☐	☐

PART 5 - SUPERVISORY PERSONNEL

List all supervisory personnel who will be assigned to the project if your company is awarded the contract.

Attach the resume of each person listed below.

NAME	TITLE OR FUNCTION

PART 6 - CHANGES IN BUSINESS ORGANIZATION OR FINANCIAL CONDITION

Have there been any changes in your company's business organization (**including changes in ownership, mergers, or asset/stock sales**), financial condition or bonding capacity since the date your current Certificate of Eligibility was issued? ☐ Yes ☐ No

If YES, attach a separate page providing complete details.

PART 7 – LIST OF COMPLETED CONSTRUCTION PROJECTS SUBMITTED TO THE DIVISION OF CAPITAL ASSET MANAGEMENT AND MAINTENANCE ALONG WITH CERTIFICATION SIGNATURE PAGE.

Attach here a copy of the list of completed construction projects which was submitted with your company's application for your most recently issued (not extended or amended) Sub-Bidder Certificate of Eligibility. The Attachment must include a complete copy of the entire Completed Projects spreadsheet and the final page Certification (Signature) Page of the online application, containing the signature and date the completed projects list was submitted to the Division of Capital Asset Management and Maintenance.



CITY OF WORCESTER

**GENERAL CONDITIONS OF THE
CONTRACT FOR CONSTRUCTION**

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GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

ARTICLE 1 - GENERAL PROVISIONS

1.1 DEFINITIONS

1.1.1 THE CONTRACT DOCUMENTS

- 1.1.1.1 The Contract Documents consist of the Owner-Contractor Agreement, the Conditions of the Contract (General, Supplementary and other Conditions), Performance Bond, Payment Bond, Vote of Corporation, Instructions to Bidders, Bid Proposal, the Drawings, the Specifications, and all Addenda issued prior to and all Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a written interpretation issued by the Architect pursuant to Article 2, or (4) a written order for a minor change in the Work issued by the Architect pursuant to Article 12. The Contract Documents do not include Bidding Documents such as, sample forms, or portions of Addenda relating to any of these, or any other documents, unless specifically enumerated in the Owner-Contractor Agreement. The Drawings of this Contract shall be as listed on the cover sheet of the Drawings, as applicable. The Specifications of this Contract shall be listed on the Index to the Technical Specifications.

In the event of any conflict among the Contract Documents, the Documents shall be construed according to the following priorities: Highest Priority - Modifications, Second Priority- Agreement, Third Priority - Addenda-later date to take precedence, Fourth Priority - Special Requirements, Fifth Priority - Special Conditions, Sixth Priority - Supplementary General Conditions, Seventh Priority - General Conditions, Eighth Priority - Specifications, Ninth Priority - Drawings.

1.2 THE CONTRACT

- 1.2.1 The Contract Documents form the Contract for Construction. This Contract represents the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification as defined in Article 1. These General Conditions, wherever applicable, shall be construed consistent with, and not to the exclusion of any terms of the Owner-Contractor Agreement, provided further however, that the terms of such Agreement shall take precedence, as provided in Article 1. Except for the special agreements in Article 4, nothing contained in the Contract Documents shall be construed to create any contractual relationship of any kind between the Architect and the Contractor. Nothing contained in the Contract Documents shall create any contractual relationship between the Owner or the Architect and any Subcontractor or Sub-subcontractor.

1.3 THE WORK

- 1.3.1 The Work comprises the completed construction required by the Contract Documents and includes all labor necessary to produce such construction, and all materials and equipment incorporated or to be incorporated in such construction.

1.4 THE PROJECT

- 1.4.1 The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part.

1.5 EXECUTION, CORRELATION AND INTENT

- 1.5.1 The Owner and Contractor shall sign the Contract Documents in duplicate.
- 1.5.2 By executing the Contract, the Contractor represents that he has visited the site, familiarized himself with the local conditions under which the Work is to be performed, and correlated his observations with the requirements of the Contract Documents.
- 1.5.3 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work. The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all. Work not covered in the Contract Documents will not be required unless it is consistent therewith and is reasonably inferable therefrom as being necessary to produce the intended results. Words and abbreviations, which have well-known technical or trade meanings are used in the Contract Documents in accordance with such, recognized meanings. All work mentioned or indicated in the Contract Documents shall be performed by the Contractor as part of this Contract unless it is specifically indicated in the Contract Documents that such work is to be done by others. Should the drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work and/or materials unless otherwise directed by written addendum to the Contract.
- 1.5.4 The organization of the Specifications into divisions, sections and articles, and the arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. The Contractor and all Subcontractors shall refer to all of the Drawings, including those showing primarily the work of the mechanical, electrical and other specialized trades, and to all of the Sections of the Specifications, and shall perform all work reasonably inferable therefrom as being necessary to produce the indicated results.
- 1.5.5 All indications or notations which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the Contract Documents.
- 1.5.6 Where codes, standards, requirements and publications of public and private bodies are referred to in the Specifications, references shall be understood to be to the latest revision prior to the date of receiving bids, except where otherwise indicated.

- 1.5.7 Where no explicit quality or standards for materials or workmanship are established for work, such work is to be of good quality for the intended use and consistent with the quality of the surrounding work and of the construction of the Project generally.
- 1.5.8 All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the manufacturer's written or printed directions and instructions unless otherwise indicated in the Contract Documents.
- 1.5.9 The Mechanical and Electrical Drawings are diagrammatic only, and are not intended to show the exact physical locations or configurations of work. Such work shall be installed to clear all obstructions, permit proper clearances for the work of other trades, and present an orderly appearance where exposed. Exact locations of fixtures and outlets shall be obtained from the Architect as provided in Article 4 before the work is roughed in; work installed without such information from the Architect shall be relocated at the Contractor's expense.
- 1.5.10 Except for work governed by M.G.L. c.149 §44F, the Owner and Architect assume no liability arising out of jurisdictional issues raised or claims advanced by trade organizations or other interested parties based on the arrangement or manner of subdivision of the content of the Plans and Specifications. The Contractor shall make all necessary arrangements to reconcile any such jurisdictional conflicts without delay, damage, or cost to the Owner, unless otherwise agreed to by the parties hereto.

1.6 OWNERSHIP AND USE OF DOCUMENTS

- 1.6.1 All Drawings and Specifications furnished by the Architect, and all copies thereof and the copyright therein, are the property of the Architect or the Owner. They are to be used only with respect to this Project and are not to be used on any other project. With the exception of one contract set for each party to the Contract, such documents are to be returned or suitably accounted for to the Architect on request at the completion of the Work. Submission or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Owner's common law copyright or other reserved rights.

ARTICLE 2 - ARCHITECT

2.1 DEFINITION

- 2.1.1 The Architect is the person lawfully licensed to practice Architecture, or an entity lawfully practicing architecture identified as such in the Owner-Contractor Agreement, and is referred to throughout the Contract Documents as if singular in number and masculine in gender. The term Architect means the Architect or his Authorized Representative.

2.2 ADMINISTRATION OF THE CONTRACT

- 2.2.1 The Architect will provide administration of the Contract as herein described and pursuant to the terms of the Design Services Agreement between the Architect and the Owner.

- 2.2.2 The Architect will be the Owner's representative during construction and until final payment is due. The Architect will advise and consult with the Owner. The Owner's instructions to the Contractor shall be forwarded through the Architect. The Architect will have the authority to act on behalf of the Owner only to the extent provided in the Contract Documents and the Design Services Agreement between the two, unless otherwise modified by written instrument in accordance with Article 2.
- 2.2.3 The Architect will visit the site at intervals appropriate to the stage of construction to familiarize himself generally with the progress and quality of the Work and to determine in general if the Work is proceeding in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. On the basis of his on-site observations as an Architect, he will keep the Owner informed of the progress of the Work, and will endeavor to guard the Owner against defects and deficiencies in the Work of the Contractor.
- 2.2.4 The Architect will not be responsible for, and will not have control or charge of, construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, and he will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Architect will not be responsible for or have control or charge over the acts or omissions of the Contractor, Subcontractors, or any of their agents or employees, or any other persons performing any of the Work.
- 2.2.5 The Architect shall at all times have access to the Work wherever it is in preparation and progress. The Contractor shall provide facilities for such access so the Architect may perform his functions under the Contract Documents.
- 2.2.6 Based on the Architect's observations and an evaluation of the Contractor's Applications for Payment, the Architect will determine the amounts owing to the Contractor and will issue Certificates for Payment in such amounts, as provided in Article 9.
- 2.2.7 The Architect will be the interpreter of the requirements of the Contract Documents and the judge of the performance there under by both the Owner and Contractor.
- 2.2.8 The Architect will render interpretations necessary for the proper execution or progress of the Work, with reasonable promptness and in accordance with M.G.L. Chapter 30, Section 39P, or any lesser time limit agreed upon. Either party to the Contract may make written request to the Architect for such interpretations.
- 2.2.9 Claims, disputes and other matters in question between the Contractor and the Owner relating to the execution of progress of the Work or the interpretation of the Contract Documents shall be referred initially to the Architect for decision, which he will render in writing within a reasonable time.
- 2.2.10 All interpretations and decisions of the Architect shall be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. In his capacity as interpreter and judge, he will endeavor to secure faithful performance by both the Owner and the Contractor, will not show partiality to either, and

will not be liable for the result of any interpretation or decision rendered in good faith, and in the absence of negligence, in such capacity.

- 2.2.11 The Architect's decisions in matters relating to artistic effect will be final if consistent with the intent of the Contract Documents.
- 2.2.12 The Architect will have authority to reject Work, which does not conform to the Contract Documents. Whenever, in his opinion, he considers it necessary or advisable for the implementation of the intent of the Contract Documents, he will have authority to require special inspection or testing of the Work in accordance with Article 7, whether or not such Work be then fabricated, installed or completed. However, neither the Architect's authority to act under this Article 2 nor any decision made by him in good faith either to exercise or not to exercise such authority, shall give rise to any duty or responsibility of the Architect to the Contractor, any Subcontractor, any of their agents or employees, or any other person performing any of the Work.
- 2.2.13 The Architect will review and approve or take other appropriate action upon Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for conformance with the design concept of the Work and with the information given in the Contract Documents. Such action shall be taken with reasonable promptness so as to cause no delay. The Architect's approval of a special item shall not indicate approval of an assembly of which the item is a component.
- 2.2.14 The Architect will prepare Change Orders in accordance with Article 12, and will have authority to order minor changes in the Work as provided in Article 12.
- 2.2.15 The Architect will conduct inspections to determine the dates of Substantial Completion and final completion, will receive and forward to the Owner for the Owner's review written warranties and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate of Payment upon compliance with the requirements of Article 9.
- 2.2.16 In case of the termination of the employment of the Architect, the Owner shall appoint an Architect against whom the Contractor makes no reasonable objection whose status under the Contract Documents shall be that of former Architect.

ARTICLE 3 - OWNER

3.1 DEFINITION

- 3.1.1 The term Owner means the City of Worcester, acting by and through its city manager and such representatives as the city manager shall assign to the Project.

3.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

- 3.2.1 The Owner shall, at the request of the Contractor, at the time of execution of the Owner-Contractor Agreement, furnish to the Contractor reasonable evidence that he has made financial arrangements to fulfill his obligations under the Contract. Unless such reasonable evidence is furnished, the Contractor is not required to execute the Owner-Contractor Agreement or to commence the Work.

- 3.2.2 The Owner shall furnish existing surveys, if any, describing the physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site.
- 3.2.3 Except as provided in Article 4, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for the construction, use or occupancy of permanent structures or for permanent changes in existing facilities.
- 3.2.4 The Owner shall furnish information or services under the Owner's control with reasonable promptness after receipt from the Contractor of a written request for such information or services.
- 3.2.5 Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, all copies of available bid documents, Drawings, and Specifications. The Contractor may at any time order additional sets at the Contractor's expense.
- 3.2.6 The Owner shall forward all instructions to the Contractor through the Architect.
- 3.2.7 The foregoing are in addition to other duties and responsibilities of the Owner enumerated herein and especially those in respect to Work by Owner or by Separate Contractors, Payments and Completion, and Insurance in Articles 6, 9 and 11 respectively.

3.3 OWNER'S RIGHT TO STOP THE WORK

- 3.3.1 If the Contractor fails to correct defective Work as required by Article 13 or persistently fails to carry out the Work in accordance with the Contract Documents, the Owner, by a written order signed personally or by an agent specifically so empowered by the Owner in writing, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the Owner to stop the Work shall not give rise to any duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Article 6.

3.4 OWNER'S RIGHT TO CARRY OUT THE WORK

- 3.4.1 3.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within ten (10) days after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to any other remedy he may have, make good such deficiencies. In such case an appropriate Change Order shall be issued deducting from the payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and the amount charged to the Contractor are both subject to prior notice being given to the Architect by the Owner. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.

ARTICLE 4 - CONTRACTOR

4.1 DEFINITION

- 4.1.1 The Contractor is the person or entity identified as such in the Owner-Contractor Agreement and is referred to throughout the Contract Documents as if singular in number and masculine in gender. The term Contractor means the Contractor or his Authorized Representative.

4.2 REVIEW OF CONTRACT DOCUMENTS

- 4.2.1 Before starting the Work, and at frequent intervals during the progress thereof, the Contractor shall carefully study and compare the Agreement, Conditions of the Contract, Drawings, Specifications, Addenda and other Contract Documents and shall at once report to the Architect any error, inconsistency or omission he may discover. Any necessary change shall be ordered as provided in Article 12 and other provisions of the Contract Documents. If the Contractor proceeds with the Work without such notice to the Architect, having discovered such errors, inconsistencies or omissions, or if by reasonably study of the Contract Documents he could have discovered such, the Contractor shall bear all costs arising there from.
- 4.2.2 The Contractor shall give the Architect timely notice of any additional design drawings, specifications, or instructions required to define the Work in greater detail, or to permit the proper progress of the Work.
- 4.2.3 The Contractor shall not proceed with any Work not clearly and consistently defined in detail in the Contract Documents, but shall request additional drawings or instructions from the Architect as provided in Article 4. If the Contractor proceeds with such Work without obtaining further drawings or instructions, he shall correct Work incorrectly done at his own expense.
- 4.2.4 The Contractor may submit Requests For Information (RFI) to the Architect to help facilitate the Contractor's performance of the Contract. Prior to submitting each RFI, the Contractor shall first carefully study and compare the Contract Documents, field conditions, other Owner provided information, Contractor and Subcontractor prepared Coordination Drawings and prior Project correspondence and documentation to determine that the information to be requested is not reasonably obtainable from such sources after such careful study and comparison.
- 4.2.5 Each RFI shall be submitted by the Contractor to the Architect for determination. Each RFI shall be in writing, on such form and with such accompanying information as the Architect may require for such purpose. Each RFI shall identify a single item or topic and the specific sources which were reviewed by the Contractor in its efforts to determine the information requested, and a statement that the information being requested could not be determined from such sources.
- 4.2.6 The Contractor shall submit each RFI sufficiently in advance of the date by which such information is required in order to allow the Architect sufficient time, in the Architect's professional judgment, to permit adequate review and response and to permit Contractor compliance with the latest Construction Schedule.

- 4.2.7 The Contractor shall reimburse the Owner amounts charged to the Owner by the Architect for responding to excessive or unnecessary RFI's where such information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner provided information, Contractor prepared Coordination Drawings, or project correspondence or documentation.

4.3 SUPERVISION AND CONSTRUCTION PROCEDURES

- 4.3.1 The Contractor shall supervise and direct the Work, using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract.
- 4.3.2 The Contractor shall be responsible to the Owner for the acts and omissions of his employees, Subcontractors and their agents and employees, and other persons performing any of the Work under a contract with the Contractor.
- 4.3.3 The Contractor shall not be relieved from his obligations to perform the Work in accordance with the Contract Documents either by the activities or duties of the Architect in his administration of the Contract, or by inspections, tests or approvals required or performed under Article 7 by persons other than the Contractor.
- 4.3.4 Where the Contract Documents refer to particular construction means, methods, techniques, sequences or procedures or indicate or imply that such are to be used in the Work, such mention is intended only to indicate that the operations of the Contractor shall be as to produce at least the quality of work implied by the operations described, but the actual determination of whether or not the described operations may be safely and suitably employed on the Work shall be the responsibility of the Contractor, who shall notify the Architect in writing of the actual means, methods, techniques, sequences or procedures which will be employed on the Work, if these differ from those mentioned in the Contract Documents. All loss, damage, or liability, or cost of correcting defective work arising from the employment of any construction means, methods, techniques, sequences or procedures shall be borne by the Contractor, notwithstanding that such construction means, methods, techniques, sequences or procedures are referred to, indicated or implied by the Contract Documents, unless the Contractor has given timely notice to the Architect in writing that such means, methods, techniques, sequences or procedures are not safe or suitable, and the Contractor has then been instructed in writing by the Owner to proceed at the Owner's risk.

4.4 LABOR AND MATERIALS

- 4.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. The word 'provide' shall mean furnish and install complete, including connections, unless otherwise specified.

- 4.4.2 The Contractor shall at all times enforce strict discipline and good order among his employees and shall not employ on the Work any unfit person or anyone not skilled in the task assigned to him.
- 4.4.3 The Contractor shall procure its materials from such sources and employ labor subject to contract terms and conditions so as to ensure harmonious labor relations on the site and prevent strikes or labor disputes. The Contractor, in the event of a labor dispute including strikes, shall take the necessary and appropriate action required at no expense to the Owner to prevent the disruption of the Work.

4.5 WARRANTY

- 4.5.1 The Contractor warrants to the Owner and the Architect that all materials and equipment furnished under this Contract will be new and of recent manufacture unless otherwise specified, and that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents. All Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective.
- 4.5.2 The Contractor shall be responsible for determining that all materials furnished for the Work meet all requirements of the Contract Documents. The Architect may require the Contractor to produce reasonable evidence that a material meets such requirements, such as certified reports of past tests by qualified testing laboratories, reports of studies by qualified experts, or other evidence which, in the opinion of the Architect, would lead to a reasonable certainty that any material used, or proposed to be used, in the Work meets the requirements of the Contract Documents. All such data shall be furnished at the Contractor's expense. This provision shall not require the Contractor to pay for periodic testing of different batches of the same material, unless such testing is specifically required by the Contract Documents to be performed at the Contractor's expense.
- 4.5.3 If the Contractor proposed to use a material which, while suitable for the intended use, deviates in any way from the detailed requirements of the Contract Documents, he shall inform the Architect in writing of the nature of such deviations at the time the material is submitted for approval, and shall request written approval of the deviation from the requirements of the Contract Documents.
- 4.5.4 In requesting approval of the deviations or substitutions, the Contractor shall provide, upon request, evidence leading to a reasonable certainty that the proposed substitution or deviation will provide a quality of result at least equal to that otherwise attainable. If, in the opinion of the Architect, the evidence presented by the Contractor does not provide a sufficient basis for such reasonable certainty, the Architect may reject such substitution or deviation without further investigation.
- 4.5.5 The Contract Documents are intended to produce a building of consistent character and quality of design. All components of the building including visible items of mechanical and electrical equipment have been selected to have a coordinated design in relation to the overall appearance of the building. The Architect shall judge the design and appearance of proposed substitutes on the basis of their suitability in relation to the overall design of the project, as well as for their intrinsic merits. The Architect will not

approve as equal to materials specified proposed substitutes, which, in his opinion, would be out of character, obtrusive, or otherwise inconsistent with the character or quality of design of the project. In order to permit coordinated design of color and finishes the Contractor shall, if required by the Architect, furnish the substituted material in any color, finish, texture, or pattern which would have been available from the manufacturer originally specified, at no additional cost to the Owner.

- 4.5.6 Any additional cost, or any loss or damage arising from the substitution of any material or any method for those originally specified shall be borne by the Contractor, notwithstanding approval or acceptance of such substitution by the Owner or the Architect, unless such substitution was made at the written request or direction of the Owner.
- 4.5.7 The warranty provided in this Article 4 shall be in addition to and not in limitation of any other warranty required by the Contract Documents or otherwise prescribed by law.
- 4.5.8 The Contractor shall procure and deliver to the Architect, no later than the date claimed by the Contractor as the date of Substantial Completion, all special warranties required by the Contract Documents. Delivery by the Contractor shall constitute the Contractor's guarantee to the Owner that the warranty will be performed in accordance with its terms and conditions.
- 4.5.9 The Contractor shall guarantee all Work for a period of a minimum of one year (unless otherwise required in the specifications to have a longer warranty time) after Date of Substantial Completion or by the terms of any special warranty required by the Contract Documents. The Contractor shall, upon written notice from the Architect, promptly correct defective Work or Work not in accordance with the Contract Documents.

4.6 TAXES

- 4.6.1 The Contractor shall pay all sales, consumer, use and other similar taxes for the Work or portions thereof provided by the Contractor which are legally enacted at the time bids are received, whether or not yet effective.
- 4.6.2 **IMPORTANT TAX NOTE:** This project, being constructed for a political subdivision of the Commonwealth of Massachusetts, is exempt from certain taxes. It is therefore required that the Contractor and all Subcontractors purchasing taxable goods covered by the governing tax codes make known to suppliers the tax-exempt status of the institution in order that such taxes will not appear in the Contract Sum. The Owner will provide the necessary evidence and certificates of its tax exemption upon request of those concerned. The most applicable taxes concerned are:
 - (1) Federal Excise Taxes as applied to articles, which are taxable under Chapter 12 of the Internal Revenue Code of 1954, as amended.
 - (2) Commonwealth of Massachusetts Sales Tax.
 - (3) Tax Exempt Number: 046-001-418.

4.7 PERMITS, FEES AND NOTICES

- 4.7.1 The Contractor and all subcontractors shall secure, coordinate and pay for the building permit and for all other permits and governmental fees, licenses and inspections necessary for the proper execution and completion of the Work.
- 4.7.2 The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations, and lawful orders of any public authority bearing on the performance of the Work.
- 4.7.3 It is not the responsibility of the Contractor to make certain the Contract Documents are in accordance with the applicable laws, statutes, building codes and regulations. If the Contractor observes that any of the Contract Documents are at variance therewith in any respect, he shall promptly notify the Architect in writing, and any necessary changes shall be accomplished by appropriate Modification.
- 4.7.4 If the Contractor performs any Work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Architect, he shall assume full responsibility therefore and shall bear all costs attributable thereto.

4.8 ALLOWANCES

- 4.8.1 Note that the use of such Allowances are prohibited in any contract or work subject to the provisions of M.G.L. c. 149, §44A.

4.9 PROJECT MANAGEMENT

- 4.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site full time daily including work performed outside normal working hours during the progress of the Work until the date of substantial completion, and for such additional time thereafter as the Architect may determine to be necessary for the expeditious completion of the Work. Only under extenuating circumstances, and with approval of the Architect and Owner, will the Contractor be allowed to substitute superintendents prior to the date of Substantial Completion. The superintendent shall represent the Contractor and all communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be so confirmed on written request in each case.
- 4.9.2 The Contractor shall retain a competent Registered Professional Engineer or Registered Land Surveyor, acceptable to the Architect and Owner who shall establish the exterior lines and required elevations of all buildings and structures to be erected on the site and shall establish sufficient lines and grades for the construction of associated work such as, but not limited to, roads, utilities and site grading. The Engineer or Land Surveyor shall certify as to the actual location of the constructed facilities in relation to property lines, building lines, easements, and other restrictive boundaries.
- 4.9.3 The Contractor shall attend job meetings with the Architect and such other persons as the Architect may from time to time wish to have present. The Contractor shall be represented by a principal, project manager, general superintendent or other authorized main office representative, as well as by the Contractor's own superintendent. An authorized representative of any Subcontractor or Sub-subcontractor shall attend such

meetings, if the representative's presence is requested by the Architect. Such representatives shall be empowered to make binding commitments on all matters to be discussed at such meetings including costs, payments, change orders, time schedules and manpower. Any notices required under the Contract may be serviced on such representatives. Refer to specification section 01200 Project Meetings for additional requirements.

4.9.4 The Contractor shall establish the building grades, lines, levels, column, wall, and partition lines required by the various subcontractors in laying out their work.

4.9.5 The Contractor shall coordinate and supervise the work performed by Subcontractors to the end that the work is carried out without conflict between trades and so that no trade at any time causes delay to the general progress of the Work. The Contractor and all Subcontractors shall at all times afford each trade, any separate contractor, or the Owner, every reasonable opportunity for the installation of work and the storage of materials.

4.10 PROGRESS SCHEDULE

4.10.1 The Contractor shall prepare and submit to the Architect a progress schedule as described in Article 8.

4.11 DOCUMENTS AND SAMPLES AT THE SITE

4.11.1 The Contractor shall maintain at the site for the Owner a record copy of all Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record all changes made during construction, and approved Shop Drawings, Product Data and Samples. These shall be available to the Architect and shall be delivered to him for the Owner upon completion of the Work.

4.11.2 Refer to Specifications Section 017700 entitled PROJECT CLOSEOUT, for additional requirements for Record Drawings and Operating and Maintenance Manuals.

4.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

4.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor, or any Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

4.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the Work.

4.12.3 Samples are physical examples, which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

4.12.4 The Contractor shall review, approve and submit, with reasonable promptness and in such sequence as to cause no delay in the Work or in the work of the Owner or any separate contractor, all Shop Drawings, Product Data and Samples required by the Contract Documents.

- 4.12.5 By approving and submitting Shop Drawings, Product Data, and, Samples, the Contractor thereby represents that he has determined and verified all dimensions, quantities, field dimensions, relations to existing work, coordination with work to be installed later, coordination with information on previously accepted Shop Drawings, Product Data, or Samples and verification of compliance with all the requirements of the Contract Documents. The accuracy of all such information is the responsibility of the Contractor. In reviewing Shop Drawings, Product Data, and Samples, the Architect shall be entitled to rely upon the Contractor's representation that such information is correct and accurate.
- 4.12.6 The Contractor shall not be relieved of responsibility for any deviation from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data or Samples under Article 2 unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submission and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data or Samples by the Architect's approval thereof.
- 4.12.7 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data or Samples, to revisions other than those requested by the Architect on previous submittals. Unless such written notice has been given, the Architect's approval of a resubmitted Shop Drawing, Product Data, or Sample shall not constitute approval of any changes not requested on the prior submittal.
- 4.12.8 No portion of the Work requiring submission of a Shop Drawing, Product Data or Sample shall be commenced until the submittal has been approved by the Architect as provided in Article 2. All such portions of the Work shall be in accordance with approved submittals.
- 4.12.9 Refer to Specifications Section 013300, SUBMITTALS, for additional requirements.

4.13 USE OF SITE

- 4.13.1 The right of possession of the premises and the improvements made thereon by the Contractor shall remain at all times in the Owner. The Contractor's right of entry and use thereof arises solely from the permission granted by the Owner under the Contract Documents. The Contractor shall confine their apparatus; the storage of materials and the operations of his workmen to limits indicated by law, ordinances, the Contract Documents and permits and/or directions by the Architect and shall not unreasonably encumber the premises with his materials.

4.14 CUTTING AND PATCHING WORK

- 4.14.1 The Contractor shall be responsible for all cutting, fitting or patching that may be required to complete the Work or to make its several parts fit together properly.
- 4.14.2 The Contractor shall not damage or endanger any portion of the Work or the work of the Owner or any separate contractors by cutting, patching or otherwise altering any work, or by excavation. The Contractor shall not cut or otherwise alter the work of the Owner

or any separate contractor except with the written consent of the Owner and of such separate contractor. The Contractor shall not unreasonably withhold from the Owner or any separate contractor his consent to cutting or otherwise altering the Work.

4.15 CLEANING UP

4.15.1 The Contractor at all times shall keep the premises free from accumulation of waste materials or rubbish caused by his operations. At the completion of the Work he shall remove all his waste materials and rubbish from and about the Project as well as all his tools, construction equipment, machinery and surplus materials. Immediately prior to the Architect's inspection for Substantial Completion, the Contractor shall completely clean the premises.

4.15.2 If the Contractor fails to maintain a clean site, free of accumulation of waste, rubbish and materials, the Owner may do so after twenty-four hour notification in accordance with Article 3 and the cost thereof shall be charged to the Contractor.

4.15.3 If the Contractor fails to clean up at the completion of the Work, the Owner may do so as provided in Article 3 and the cost thereof shall be charged to the Contractor. Refer to Specifications Section 017000, PROJECT CLOSEOUT, for additional requirements.

4.16 COMMUNICATIONS

4.16.1 The Contractor shall forward all communications to the Owner through the Architect. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall communicate through the Architect. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with other Owner's contractors shall be through the Architect.

4.17 ROYALTIES AND PATENTS

4.17.1 The Contractor shall pay all royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and shall save the Owner harmless from loss on account thereof, except that the Architect shall be responsible for all such loss when a particular design, process or the product of a particular manufacturer or manufacturers is specified, but if the Contractor has reason to believe that the design, process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the Architect.

4.18 INDEMNIFICATION

4.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Architect and their agents and employees from and against all claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of; or resulting from the performance of the Work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting there from and (2) is caused in whole or in part by any negligent act or

omission of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity, which would otherwise exist as to any party or person, described in this Article 4.

- 4.18.2 In any and all claims against the Architect or any of his agents or employees, by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this Article 4 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.
- 4.18.3 The obligations of the Contractor under this Article 4 shall not extend to the liability of the Architect, his agents or employees, arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications, or (2) the giving of or the failure to give directions or instructions by the Architect, his agents or employees provided, such giving or failure to give is the primary cause of the injury or damage.

ARTICLE 5 - SUBCONTRACTOR

5.1 DEFINITION

- 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform any of the Work at the site and as further defined by M.G.L. Chapter 30, Section 39F(3). The term Subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Subcontractor or his authorized representative. The term Subcontractor does not include any separate contractor or his subcontractors.
- 5.1.2 A Sub-subcontractor is a person or entity that has a direct or indirect contact with a Subcontractor to perform any of the Work at the site. The term Sub-subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Sub-subcontractor or an authorized representative thereof.

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

- 5.2.1 Unless otherwise required by the Contract Documents or the Bidding Documents, the Contractor, as soon as practicable after the award of the Contract, shall furnish to the Owner and the Architect, in writing, the names of the persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each of the principal portions of the Work. The Architect will promptly reply to the Contractor in writing stating whether or not the Owner or the Architect, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Architect to reply promptly shall constitute notice of no reasonable objection.

- 5.2.2 The Contractor shall not contract with any such proposed person or entity to which the Owner or the Architect has made reasonable objection under the provisions of Article 5. The Contractor shall not be required to contract with anyone to whom he has a reasonable objection.
- 5.2.3 If the Owner or the Architect has reasonable objection to any such proposed person or entity, the Contractor shall submit a substitute to whom the Owner or the Architect has no reasonable objection, and the Contract Sum shall be increased or decreased by the difference in cost occasioned by such substitution and an appropriate Change Order shall be issued; however, no increase in the Contract Sum shall be allowed for any such substitution unless the Contractor has acted promptly and responsively in submitting names as required by Article 5.
- 5.2.4 The Contractor shall make no substitution for any Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

5.3 SUBCONTRACTUAL RELATIONS

- 5.3.1 By an appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes toward the Owner and the Architect. Said agreement shall preserve and protect the rights of the Owner and the Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that the subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the Contractor-Subcontractor agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by these Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with his Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the Subcontract, copies of the Contract Documents to which the Subcontractor will be bound by this Article 5, and identify to the Subcontractor any terms and conditions of the proposed Subcontract which may be at variance with the Contract Documents. Each Subcontractor shall similarly make copies of such Documents available to his Sub-subcontractors.

ARTICLE 6 - WORK BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM WORK AND TO AWARD SEPARATE CONTRACTS

- 6.1.1 The Owner reserves the right to perform work related to the Project with his own forces, and to award separate contracts in connection with other portions of the Project or other work on the site under these or similar Conditions of the Contract. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, he shall make such claim as provided elsewhere in the Contract Documents.

- 6.1.2 When separate contracts are awarded for different portions of the Project or other work on the site, the term Contractor in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.
- 6.1.3 The Owner will provide for the coordination of the work of his own forces and of each separate contractor with the Work of the Contractor, who shall cooperate therewith as provided in Article 6.
- 6.1.4 The General Contractor shall permit the Owner to place and install as much equipment during the progress of the work as is possible before the completion of the various parts of the work, and agrees that such placing and the installation of equipment shall not in any way evidence the completion of the work or any portion of it, nor shall it signify the Owner's completion of the work or any portion thereof.

6.2 MUTUAL RESPONSIBILITY

- 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work, and shall connect and coordinate his Work with theirs as required by the Contract Documents.
- 6.2.2 If any part of the Contractor's Work depends for proper execution or results upon the work of the Owner or any separate contractor, the Contractor shall, prior to proceeding with the Work, promptly report to the Architect any apparent discrepancies or defects in such other work that render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acceptance of the Owner's or separate contractors' work as fit and proper to receive his Work, except as to defects, which may subsequently become apparent in such work by others.
- 6.2.3 Any costs caused by defective or ill-timed work shall be borne by the party responsible therefore.
- 6.2.4 Should the Contractor wrongfully cause damage to the work or property of the Owner, or to other work on the site, the Contractor shall promptly remedy such damages as provided in Article 10.
- 6.2.5 Should the Contractor wrongfully cause damage to the work or property of any separate contractor, the Contractor shall upon due notice promptly attempt to settle with such other contractor by agreement, or otherwise to resolve the dispute. If such separate contractor sues the Owner on account of any damage alleged to have been caused by the Contractor, the Owner shall notify the Contractor.

6.3 OWNER'S RIGHT TO CLEAN UP

- 6.3.1 If a dispute arises between the Contractor and separate contractors as to their responsibility for cleaning up as required by Article 4, the Owner may clean up and charge the cost thereof to the contractors responsible therefore as the Architect shall determine to be just.

ARTICLE 7 - MISCELLANEOUS PROVISIONS

7.1 GOVERNING LAW

- 7.1.1 The law of the Commonwealth of Massachusetts shall govern the Contract.

7.2 SUCCESSORS AND ASSIGNS

- 7.2.1 The Owner and the Contractor each binds himself, his partners, successors, assigns and legal representatives to the other party hereto and to the partners, successors, assigns and legal representatives of such other party with respect to all covenants, agreements, and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract or sublet it as a whole without the written consent of the other, nor shall the Contractor assign any moneys due or to become due to him hereunder, without the previous written consent of the Owner.
- 7.2.2 If, after making final payment, the Owner conveys to a third party any building or other improvement constructed under the Contract, any rights with respect to the property so conveyed which the Owner may have against the Contractor under Article 13 or by virtue of claims which, under the terms of Article 9, are reserved to the Owner after the making and acceptance of final payment, shall automatically transfer to such third party.

7.3 WRITTEN NOTICE

- 7.3.1 Written notice shall be deemed to have been duly served if delivered in person to an authorized representative of the person or entity for whom it was intended, or if delivered at or sent by registered or certified mail to the address of such person or entity set forth in the Agreement or in a subsequent written notice or by other means as specified in the Contract Documents.

7.4 CONSENT OR WAIVER

- 7.4.1 No consent or waiver, express or implied, by the Owner or the Architect to, or of, any breach of any covenant, condition or duty of the Contractor shall be construed as a consent to or waiver of any other breach of the same or any other covenant, condition or duty.

7.5 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

- 7.5.1 The Owner shall have the right to require the Contractor to furnish bonds covering the faithful performance of the Contract and the payment of all obligations arising there under if and as required in the Bidding Documents or in the Contract Documents.

7.6 RIGHTS AND REMEDIES

- 7.6.1 The duties and obligations imposed by the Contract Documents and the rights and remedies available there under shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law.

7.7 TESTS

- 7.7.1 If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any portion of the Work to be inspected, tested or approved, the Contractor shall give the Architect timely notice of its readiness so the Architect may observe such inspection, testing or approval. The Contractor shall bear all costs of such inspections, tests or approvals conducted by public authorities. Unless otherwise provided, the Owner shall bear all costs of other inspections, tests or approvals.
- 7.7.2 If the Architect determines that any Work requires special inspection, testing, or approval which Article 7 does not include, he will, upon written authorization from the Owner, instruct the Contractor to order such special inspection, testing or approval, and the Contractor shall give notice as provided in Article 7. If such special inspection or testing reveals a failure of the Work to comply with the requirements of the Contract Documents, the Contractor shall bear all costs thereof, including compensation for the Architect's additional services made necessary by such failure, otherwise the Owner shall bear such costs, and an appropriate Change Order shall be issued.
- 7.7.3 The Contractor shall obtain and deliver promptly to the Architect any occupancy permit or any certificates of final inspection of any part of his work or operating permits for any mechanical apparatus, such as elevators, escalators, boilers, air compressors, etc., which may be required by law to permit full use and occupancy of the premises by the Owner. Receipt of such permits or certificates by the Architect shall be a condition precedent to Substantial Completion of the Work.

ARTICLE 8 - TIME

8.1 DEFINITIONS

- 8.1.1 Unless otherwise provided, the Contract Time is the period of time allotted in the Contract Documents for Substantial Completion of the Work as defined in Article 8, including authorized adjustments thereto.
- 8.1.2 The Date of Commencement of the Work is the date of the execution of the Owner-Contractor Agreement. The Contractor shall not commence Work on the site until the Architect issues a Notice to Proceed.
- 8.1.3 The Date of Substantial Completion of the Work or designated portion thereof is the date certified by the Architect when construction is sufficiently complete, in accordance with the Contract Documents, so the Owner can occupy or utilize the Work or designated portion thereof for the use for which it is intended and only minor items which can be corrected or completed without substantial interference with the Owner's use of the Work remain to be corrected or completed. The Date of Substantial Completion shall be on or after the date of issuance of a Certificate of Occupancy as defined in 780 CMR for the Work without reservations or conditions by the Building Official.
- 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically designated.

- 8.1.5** The term "working day" shall mean any calendar day except Saturdays, Sundays, and legal holidays at the place of the building.

8.2 PROGRESS AND COMPLETION

- 8.2.1** All time limits stated in the Contract Documents are of the essence to the Contract.
- 8.2.2** The Contractor shall begin the Work on the date of commencement as defined in Article 8. He shall carry the Work forward expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.
- 8.2.3** Within two (2) weeks after award of the Contract, the Contractor shall submit to the Architect a Progress Schedule showing for each class of work included in the Schedule of Values, the percentage completion to be obtained and the total dollar value of work to be completed as of the first of each month until Substantial Completion. All calculations shall be on the basis of work in place, but not including the value of materials delivered but not in place.
- 8.2.4** The Progress Schedule shall be based on an orderly progression of the Work, allowing adequate time for each operation, and leading to a reasonable certainty of Substantial Completion by the date established in the Agreement. The Progress Schedule will be reviewed by the Architect for compliance with the requirements of this Article and will be accepted by him or returned to the Contractor for revision and resubmittal. Unless specifically required by law, no payment under this Contract shall be due until the Progress Schedule has been approved by the Architect.
- 8.2.5** If in any Application for Payment the total value of the completed Work in place, as certified by the Architect, is less than 90% of the total value of the Work in place estimated in the Progress Schedule, the Owner may, at his option, require the Contractor to accelerate the progress of the Work without cost to the Owner by increasing the work force or hours of work, or by other reasonable means approved by the Architect.
- 8.2.6** If each of three (3) successive applications, as certified by the Architect, indicate that the actual work completed is less than 90% of the values estimated in the Progress Schedule to be completed by the respective dates, the Owner may at his option, treat the Contractor's delinquency as a default justifying the action permitted under Article 13 of the document entitled CONTRACT, included elsewhere in the Contract Documents.
- 8.2.7** If the Architect has determined that the Contractor should be permitted to extend the time for completion, as provided in Paragraph 8.3, the calendar dates in the Progress Schedule shall be adjusted accordingly to retain their same relationship to the adjusted Date of Substantial Completion, and the dollar value of work to be completed as of the first of each month shall be adjusted pro-rata.
- 8.2.8** If the Contractor fails to submit any Application for Payment in any month, the Architect shall, for the purpose of this evaluation of progress, certify separately to the actual value of the work in place and completed as of the first of the month, to the best of his knowledge.

- 8.2.9 Nothing herein shall limit the Owner's right to liquidated or other damages for delays by the Contractor or to any other remedy which he may possess under other provisions of the Contract Documents or by law.

8.3 DELAYS AND EXTENSIONS OF TIME

- 8.3.1 Any delay and subsequent request for an extension of time shall be governed by M.G.L. Chapter 30, Section 39(O) and the Owner-Contractor Agreement.
- 8.3.2 No work shall be suspended without the written permission of the Owner or his representative.
- 8.3.3 If no agreement is made stating the dates upon which interpretations as provided in Article 2 shall be furnished, then no claim for delay shall be allowed on account of failure to furnish such interpretations until thirty (30) days after written request is made for them, and not unless such claim is reasonable.
- 8.3.4 This Article 8 does not exclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

- 9.1.1 The Contract Sum is stated in the Owner-Contractor Agreement and, including authorized adjustments thereto, is the total amount payable by the Owner to the Contractor for the performance of the Work under the Contract Documents.

9.2 SCHEDULE OF VALUES

- 9.2.1 Before the first Application for Payment, the Contractor shall submit to the Architect a Schedule of Values allocated to the various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Architect may require and shall be revised if later found by the Architect to be inaccurate. This schedule, unless object to by the Architect, shall be used only as a basis for the Contractor's Application for Payment.

9.3 APPLICATIONS FOR PAYMENT

- 9.3.1 In accordance with Section 012900 of the Specifications, the Contractor shall submit to the Architect an itemized Application for Payment, notarized and supported by such data substantiating the Contractor's right to payment as the Owner or the Architect may require, and reflecting retainage, if any, as provided in Supplemental General Conditions, Article I. The format and number of copies of such Applications for Payment shall be as noted in Section 012900.
- 9.3.2 Unless otherwise provided in the Contract Documents, payments will be made on account of materials or equipment not incorporated in the Work but delivered and suitably stored at the site and, if approved in advance by the Owner, payments may

similarly be made for materials or equipment suitably stored at some other location agreed upon in writing. Payments for materials or equipment stored on or off the site shall be conditioned upon submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title to such materials or equipment or otherwise protect the Owner's interest, including applicable insurance and transportation to the site for those materials and equipment stored off the site. The Contractor shall reimburse the Owner for any loss or damage to such unincorporated materials or equipment not covered by insurance.

- 9.3.3 The Contractor warrants that title to all Work, materials and equipment covered by an Application for Payment will pass to the Owner either by incorporation in the construction or upon the receipt of payment by the Contractor, whichever occurs first, free and clear of all liens, claims, security interests or encumbrances, hereinafter referred to in this Article 9 as "liens". The Contractor further agrees that the submission of any Application for Payment shall conclusively be deemed to waive all liens with respect to said work, materials and labor to which the Contractor then may be entitled; provided, however, that in no event shall such waiver of lien rights waive right to payment for said Work, materials and labor.
- 9.3.4 Each Application for Payment or periodic estimate requesting payment must be accompanied by a certificate from each Subcontractor stating that he has been paid all amounts due him on the basis of the previous periodic payment to the Contractor, or else stating the amount not so paid and the reason for the discrepancy. In the event, of any such discrepancy, the Contractor shall be required to furnish his own written explanation. See Section 01027.

9.4 CERTIFICATES FOR PAYMENT

- 9.4.1 The Architect will, within seven (7) days after the receipt of the Contractor's Application for Payment, either issue a Certificate for Payment to the Owner, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor in writing his reasons for withholding a Certificate as provided in Article 9.
- 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on his observations at the site as provided in Article 2 and the data comprising the Application for Payment, that the Work has progressed to the point indicated; that, to the best of his knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to the results of any subsequent tests required by or performed under the Contract Documents, to minor deviations from the Contract Documents correctable prior to completion, and to any specific qualifications stated in his Certificate); and that the Contractor is entitled to payment in the amount certified. However, by certifying a Certificate for Payment, the Architect shall not thereby be deemed to represent that he has made exhaustive or continuous on-site inspections to check the quality or quantity of the Work or that he has reviewed the construction means, methods, techniques, sequences or procedures, or that he has made any examination to ascertain how or for what purpose the Contractor has used the moneys previously paid on account of the Contract.

9.5 PROGRESS PAYMENTS

- 9.5.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents. The Owner retains the right to modify the amount of payment certified by the Architect. Reasons for modification shall be described in writing to the Architect and Contractor.
- 9.5.2 The Contractor shall promptly pay each Subcontractor upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's Work, the amount to which said Subcontractor is entitled, reflecting the percentage actually retained, if any, from payments to the Contractor on account of such Subcontractor's Work. The Contractor shall, by an appropriate agreement with each Subcontractor, require each Subcontractor to make payments to his Sub-subcontractors in similar manner.
- 9.5.3 The Architect may, on request and at his discretion, furnish to any Subcontractor, if practicable, information regarding the percentages of completion or the amounts applied for by the Contractor and the action taken thereon by the Architect on account of Work done by such Subcontractor.
- 9.5.4 Neither the Owner nor the Architect shall have any obligation to pay or to see the payment of any moneys to any Subcontractor except as may otherwise be required by law.
- 9.5.5 No Certificate for a progress payment, nor any progress payment, nor any partial or entire use or occupancy of the Project by the Owner, shall constitute an acceptance of any Work not in accordance with the Contract Documents.

9.6 PAYMENTS WITHHELD

- 9.6.1 The Architect may decline to certify payment and may withhold his Certificate in whole or in part, to the extent reasonably necessary to protect the Owner, if in his opinion he is unable to make representations to the Owner as provided in Article 9. If the Architect is unable to make representations to the Owner as provided in Article 9 and to certify payment in the amount of the Application, he will notify the contractor as provided in Article 9. If the Contractor and the Architect cannot agree on a revised amount, the Architect will promptly certify a Certificate for Payment for the amount for which he is able to make such representations to the Owner. The Architect may also decline to certify payment or because of subsequently discovered evidence or subsequent observations, he may nullify the whole or any part of any Certificate for Payment previously issued, to such extent as may be necessary in his opinion to protect the Owner from loss because of:
- (1) Defective Work not remedied,
 - (2) Third party claims filed or reasonable evidence indicating probable filing of such claims,
 - (3) Failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment,

- (4) Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum,
- (5) Damage to the Owner,
- (6) Reasonable evidence that the Work will not be completed within the Contract Time or
- (7) Persistent failure to carry out the Work in accordance with the Contract Documents, or
- (8) Failure of mechanical trades or electrical trades subcontractors to comply with mandatory requirements for maintaining record drawings. The Contractor shall be required to check record drawings each month. The Architect shall require written confirmation that the record drawings are "up-to-date" before approval of the Contractor's monthly payment requisition will be considered.

9.6.2 When the above grounds in Article 9 are removed, payment shall be made for amounts withheld because of them.

9.7 FAILURE OF PAYMENT

9.7.1 If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven (7) days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor as required by the Contract Documents any amount certified by the Architect, then the Contractor may, upon seven (7) additional days written notice to the Owner and the Architect, stop the Work until payment of the amount owing has been received.

9.8 SUBSTANTIAL COMPLETION

9.8.1 When the Contractor considers that the Work, or a portion thereof designated in the Contract Documents for separate completion, is substantially complete as defined in Article 8, the Contractor shall submit to the Architect (1) a list of items to be completed or corrected, and (2) all special warranties required by the Contract Documents endorsed by the Contractor and in a form reasonably acceptable to the Architect. The failure to include any items on the list mentioned in the preceding sentence does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. When the Architect on the basis of an inspection determines that the Work or designed portion thereof is substantially complete, and when the Contractor has submitted to the Architect the special warranties, as provided in the first sentence of this subparagraph, the Architect will then certify a Certificate of Substantial Completion which shall establish the Date of Substantial Completion, shall state the responsibilities of the Owner and the Contractor for security, maintenance, heat, utilities, damage to the Work, and insurance, and shall fix the time within which the Contractor shall complete the items listed therein. Warranties required by the Contract Documents shall commence on the Date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Certificate of Substantial Completion shall be submitted to the Owner and the Contractor for their written acceptance of the responsibilities assigned to them in such Certificate.

9.8.2 Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and certification by the Architect, the Owner shall make

payment, reflecting adjustment in retainage, if any, for such Work or portion thereof, as provided in the Contract Documents.

9.9 FINAL COMPLETION AND FINAL PAYMENT

- 9.9.1 Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when he finds the Work acceptable under the Contract Documents and the Contract fully performed, he will promptly certify a final Certificate of Payment stating that to the best of his knowledge, information and belief, and on the basis of his observations and inspections, the Work has been completed in accordance with the terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor, and noted in said final Certificate, is due and payable. The Architect's final Certificate for Payment will constitute a further representation that the conditions precedent to the Contractor's being entitled to final payment as set forth in Article 9 have been fulfilled.
- 9.9.2 Unless otherwise required by applicable law, neither the final payment nor the remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or his property might in any way be responsible, have been paid or otherwise satisfied, (2) consent of surety, if any, to final payment and (3), if required by the Owner, other data establishing payment or satisfaction of all such obligations, such as receipts, releases and waivers of liens, arising out of the Contract, to the extent and in such form as may be designated by the Owner. If the Contractor fails to furnish such releases or waivers as the Owner reasonably requires satisfying the Owner that there are not outstanding claims, the Owner may require the Contractor, as a condition of final payment, to furnish a bond satisfactory to the Owner to indemnify the Owner against any such claims.
- 9.9.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by the issuance of Change Orders affecting final completion, and the Architect so confirms, the Owners shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than the retainage stipulated in the Contract Documents, and if bonds have been furnished as provided in Article 7, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.
- 9.9.4 The making of final payment shall constitute a waiver of all claims by the Owner except those arising from: (1) unsettled claims under the Bonds required elsewhere in the Contract Documents, (2) faulty or defective Work appearing after Substantial Completion, (3) failure of the Work to comply with the requirements of the Contract Documents, or (4) terms of any special warranties required by the Contract Documents.

- 9.9.5 The acceptance of final payment shall constitute a waiver of all claims by the Contractor except those previously made in writing and identified by the Contractor as unsettled at the time of the final Application for Payment.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

- 10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work.

10.2 SAFETY OF PERSONS AND PROPERTY

- 10.2.1 The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to: (1) all employees on the Work and all other persons who may be affected thereby; (2) all the Work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of his Subcontractors or Sub-subcontractors; and (3) other neighboring property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.
- 10.2.2 The Contractor shall give all notices and comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the safety of persons or property or their protection from damage, injury or loss.
- 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and progress of the Work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.
- 10.2.4 When the use or storage of explosives or other hazardous materials or equipment is necessary for the execution of the Work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel.
- 10.2.5 The Contractor shall promptly remedy all damage or loss (other than damage or loss insured under Article 11) to any property referred to in Article 10 caused in whole or in part by the Contractor, any Subcontractor, any Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone whose acts any of them may be liable and for which the Contractor is responsible under Article 10 except damage or loss attributable to the acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either by of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to his obligations under Article 4.
- 10.2.6 The Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and the Architect.

10.2.7 The Contractor shall not load or permit any part of the Work to be loaded so as to endanger its safety.

10.2.8 The Contractor shall comply with the applicable requirements of NFPA 241: ***The Standard for Safeguarding Construction, Alteration, and Demolition*** in connection with the Work. Contractor shall, prior to commencing Work on any new building and/or any significant alteration of existing building, submit for review and approval to the Worcester Fire Department a report prepared by a registered fire protection engineer evidencing that the Work shall such comply.

10.3 EMERGENCIES

10.3.1 In any emergency affecting the safety of persons or property, the Contractor shall act, at his discretion, to prevent threatened damage, injury or loss. Any additional compensation or extension of time claimed by the Contractor on account of emergency work shall be determined as provided in Article 12 for the Changes in the Work.

ARTICLE 11 - INSURANCE

11.1 CONTRACTOR'S LIABILITY INSURANCE

11.1.1 The Contractor shall purchase and maintain in a company or companies to which the Owner has no reasonable objection, such insurance as will protect him from claims set forth below which may arise out of or result from the Contractor's operations under the Contract, whether such operations be by himself or by any Subcontractor or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- (1) Workmen's Compensation –Massachusetts Statutory / Employers Liability
- (2) Commercial Liability- Per Occurrence / Aggregate \$1,000,000 / \$2,000,000
- (3) Automobile Liability/Combined Single Limit - \$2,000,000 (all owned, hired and non-owned autos).
- (4) Excess / Umbrella Liability –\$2,000,000
- (5) Independent Contractors -Same limits as above
- (6) Products and Completed Operations -Same limits as above commencing with issuance of final Certificate of Payment.
- (7) Contractual Liability - Same limits as above.

11.1.2 The insurance required by Article 11 shall include all major divisions of coverage, and shall be on a comprehensive general basis including Premises and Operations (including X-C-U), Owner's and Contractor's Protective Products and Completed Operations, and Owned, Non-owned, and Hired Motor Vehicles. Such insurance shall be written for not less than any limits of liability required by law or those set forth below, whichever is greater.

- (1) Workmen's Compensation -Statutory/Employers Liability
- (2) Commercial Liability - Per Occurrence / Aggregate \$1,000,000.00 / 2,000,000.00
- (3) Automobile Liability/Combined Single Limit – \$2,000,000.00 (all owned, hired and non-owned autos).
- (4) Excess / Umbrella Liability - \$2,000,000.00
- (5) Independent Contractors -Same limits as above

- (6) Products and Completed Operations -Same limits as above commencing with issuance of final Certificate of Payment
- (7) Contractual Liability - Same limits as above

11.1.3 The insurance required by Article 11 shall include contractual liability insurance applicable to the Contractor's obligations under Article 4.

11.1.4 Certificates of Insurance acceptable to the Owner shall be filed with the Owner. These Certificates shall contain a provision that coverage afforded under the policies will not be canceled until at least thirty (30) days prior written notice has been given to the Owner.

11.1.5 These certificates shall set forth evidence of all coverage required by Article 11. The Contractor shall furnish to the Owner copies of any endorsements that are subsequently issued amending limits of coverage.

11.2 OWNER'S LIABILITY INSURANCE

11.2.1 The Owner shall be responsible for maintaining his own liability insurance and, at his option, may purchase and maintain such insurance as will protect him against claims, which may arise from operations under the Contract.

11.3 PROPERTY INSURANCE

11.3.1 The Contractor shall purchase and maintain property insurance upon the entire Work at the site as provided above in Article 11. This insurance shall include the interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work and shall include "all risk" insurance for physical loss or damage including, without duplication of coverage, theft, vandalism and malicious mischief.

11.3.2 The Owner shall purchase and maintain such boiler and machinery insurance as may be required by the Contract Documents or by law. This insurance shall include the interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Work.

11.3.3 Any loss insured under Article 11 is to be adjusted with the Contractor and made payable to the Contractor as trustee for the insureds, as their interests may appear, subject to the requirements of any applicable mortgagee clause and of Subparagraph.

11.3.4 The Contractor shall pay each Subcontractor a just share of any insurance moneys received by the Contractor, and by appropriate agreement, written where legally required for validity, shall require each Subcontractor to make payments to his Sub-subcontractors in similar manner.

11.3.5 The Contractor shall file a copy of all policies with the Owner before an exposure to loss may occur. All property insurance shall remain in effect until the date of final completion or the date Premises/Property is put in service by the Owner, whichever is earlier.

11.3.6 The Owner and Contractor waive all rights against (1) each other and the Subcontractors, Sub-subcontractors, agents and employees each of the other, and (2) the Architect and separate contractors, if any, and their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other perils to the

extent covered by insurance obtained pursuant to this Article 11 or any other property insurance applicable to the Work, except such rights as they may have to the proceeds of such insurance held by the Contractor as trustee. The foregoing waiver afforded the Architect, his agents and employees shall not extend to the liability imposed by Article 4. The Owner or the Contractor, as appropriate, shall require of the Architect, separate contractors, Subcontractors, and Sub-subcontractors by appropriate agreements, written where legally required for validity, similar waivers each in favor of all other parties enumerated in this Article 11.

11.3.7 If required in writing by any party in interest, the Contractor as trustee shall, upon the occurrence of an insured loss, give bond for the proper performance of his duties. He shall deposit in a separate account any money so received, and he shall distribute it in accordance with the direction of a court of competent jurisdiction.

11.3.8 The Contractor as trustee shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within five days after the occurrence of loss to the Contractor's exercise of this power. If such objection were made, the Contractor as trustee shall make settlement with the insurers in accordance with the direction of a court of competent jurisdiction.

11.4 LOSS OF USE INSURANCE

11.4.1 The Owner, at his option, may purchase and maintain such insurance as will insure him against loss of use of his property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of his property including consequential losses due to fire or other hazards however caused, to the extent covered by insurance under this Article 11.

ARTICLE 12 - CHANGES IN THE WORK

12.1 CHANGE ORDERS

12.1.1 The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and the Contract Time being adjusted accordingly. All such changes in the Work shall be authorized by Change Order, and shall be performed under the applicable conditions of the Contract Documents.

12.1.2 A Change Order is a written order to the Contractor signed by the Owner and the Architect, issued after execution of the Contract, authorizing a change in the Work or an adjustment in the Contract Sum or the Contract Time. Only Change Orders may change the Contract Sum and the Contract Time. A Change Order signed by the Contractor indicates his agreement therewith, including the adjustment in the Contract Sum or the Contract Time.

12.1.3 If the Contractor does not agree with the terms of the Change Order, the Contractor shall return the unsigned Change Order to the Owner. In such event, the Work, Contract Sum and/or Contract Time shall be adjusted as reflected in the Change Order, subject to the Contractor's rights under M.G.L. Chapter 30, Section 39J, but in no event shall the Contractor refuse to perform the Work as modified by the Change Order.

12.2 CLAIMS FOR ADDITIONAL COST

- 12.2.1 If the Contractor claims that any instructions or orders, whether oral, written, or drawings, or otherwise, involve extra cost or time, and such instructions or orders are not accompanied by a written acknowledgment by the Owner and Architect that extra payment will be made or time extended, he shall promptly so notify the Architect in writing and shall not proceed with the work until he has received a further written order to proceed, except, as provided in Article 10, in the case of an emergency affecting life or property.
- 12.2.2 Upon receipt from the Contractor of a written notice of claim as provided in Article 12, the Architect shall review such claim and if he determines that any work in dispute should proceed, he shall issue to the Contractor a written order, signed by the Owner, (1) to proceed in which he shall approve or deny the Contractor's claim, in whole or in part, or (2) to proceed subject to a later determination by the Architect of the Contractor's right to extra payment.
- 12.2.3 To the extent that the Architect, when issuing the written order to proceed described in Article 12, approves the contractor's claim, Change Order shall adjust the Contract Sum and/or Contract Time. If the Architect, when issuing his written order to proceed, denies, in whole or in part, the Contractor's claim, the Contractor shall proceed with the work without delay, subject to the Contractor's rights under M.G.L. Chapter 30, Section 39(J). If the Architect, when issuing his written order to proceed, instructs the Contractor to proceed with the work subject to a later determination by the Architect of the Contractor's right to extra payment or time, the Contractor shall proceed with the Work without delay or impact to the schedule.
- 12.2.4 No extension of time shall be granted because of seasonal or abnormal variations in temperature, humidity or precipitation, which conditions shall be wholly at the risk of the Contractor, whether occurring within the time originally scheduled for completion or within the period of any extension granted. There shall be no increase in the Contract Sum on account of any additional costs of operations or conditions resulting therefrom.
- 12.2.5 Time Limits on Claims: Claims by the Contractor must be made within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be made by written notice. An additional Claim made after the initial Claim has been implemented by Change Order will not be considered unless submitted in a timely manner.

12.3 MINOR CHANGES IN THE WORK

- 12.3.1 The Architect shall have the authority to order minor changes in the Work that do not involve an adjustment in the Contract Sum or an extension of the Contract Time, and are not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order, and shall be binding on the Owner and the Contractor. The Contractor shall carry out such written orders promptly without delay or impact to the schedule.

12.4 EQUITABLE ADJUSTMENTS

12.4.1 Equitable adjustments in the Contract Sum shall be determined according to one of the following methods, or a combination thereof; as determined by the Owner:

- (1) fixed price basis, provided that the price shall be inclusive of items 3(a) through 3(d), below, and shall be computed in accordance with those provisions.
- (2) estimated lump sum basis to be adjusted in accordance with Contract unit prices, or other agreed upon unit prices, provided that the unit prices shall be inclusive of all costs related to such equitable adjustments.
- (3) time and materials basis, based upon a not to exceed, predetermined upset amount to be subsequently adjusted on the basis of actual costs comprised of items (a) through (d) below:
 - (a) the costs at prevailing rates for direct labor, material and use of equipment;
 - (b) plus, the costs of Workmen's Compensation Insurance, Liability Insurance, Federal Social Security and Massachusetts Unemployment Compensation; or as an alternative, the Contractor may elect to add a flat twenty-five (25%) percent to the total labor rate in (a), above;
 - (c) plus, ten (10) percent of (a), above, for overhead, superintendence and profit which will be paid to the Contractor for the work of the Contractor and all his subcontractors. The contracting parties referred to in this subparagraph shall agree upon the distribution of the ten (10) percent as a matter of contract between each other;
 - (d) plus actual direct premium costs of payment and performance bonds required of the Contractor provided there would be an appropriate credit for premiums for a credit change order.

12.4.2 If the net change is an addition to the Contract Sum, it shall include the Contractor's overhead, superintendence and profit. On any change that involves a net credit, no allowance for overhead superintendence and profit shall be figured. For any change that does not include labor performed or materials installed in the Project, there will be no markup for the contractor's overhead, superintendence, and profit, notwithstanding any net increase in the Contract Sum. Charges for small tools known as "tools of the trade" are not to be computed in the amount of an equitable change.

ARTICLE 13 - UNCOVERING AND CORRECTION OF WORK

13.1 UNCOVERING OF WORK

13.1.1 If any portion of the Work should be covered contrary to the request of the Architect or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Architect, be uncovered for his observation and shall be replaced at the Contractor's expense.

13.1.2 If any other portion of the Work has been covered which the Architect has not specifically requested to observe prior to being covered, the Architect, with the approval of the Owner, may request to see such Work and it shall be uncovered by the Contractor. If such Work is found in accordance with the Contract Documents, appropriate Change Order shall charge the cost of uncovering and replacement charged to the Owner. If such Work is found not in accordance with the Contract Documents, the

Contractor shall pay such costs unless it is found that this condition was caused by the Owner or a separate contractor as provided in Article 6, in which event the Owner shall be responsible.

13.2 CORRECTION OF WORK

- 13.2.1 The Contractor shall promptly correct all Work rejected by the Architect as defective or as failing to conform to the Contract Documents whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such rejected Work, including compensation for the Architect's additional services made necessary thereby and any costs, loss, or damages to the Owner resulting from such failure or defect.
- 13.2.2 If, within one (1) year after the Date of Substantial Completion of the Work or designated portion thereof or within one (1) year after acceptance by the Owner of designated equipment or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of a written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This obligation shall survive termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.
- 13.2.3 The Contractor shall remove from the site all portions of the Work which are defective or non-conforming and which have not been corrected under Articles 4 and 13, unless the Owner waives removal.
- 13.2.4 If the Contractor fails to correct defective or non-conforming Work as provided in Articles 4 and 13, the Owner may correct it in accordance with Article 3.
- 13.2.5 If the Contractor does not proceed with the correction of such defective or non-conforming Work within a reasonable time fixed by written notice from the Architect, the Owner may remove it and may store the materials or equipment at the expense of the Contractor. If the Contractor does not pay the cost of such removal and storage within ten (10) days thereafter, the Owner may upon ten (10) additional days written notice, sell such Work at auction or at private sale and shall account for the net proceeds thereof, after deducting all the costs that should have been borne by the Contractor, including compensation for the Architect's additional services made necessary thereby. If such proceeds of sale do not cover all costs, which the Contractor should have borne, the difference shall be charged to the Contractor and an appropriate Change Order shall be issued. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.
- 13.2.6 The Contractor shall bear the cost of making good all work of the Owner or separate contractors destroyed or damaged by such correction or removal.
- 13.2.7 Nothing contained in this Article 13 shall be construed to establish a period of limitation with respect to any other obligation, which the Contractor might have under the Contract Documents, including Article 4 hereof. The establishment of the time period of one (1) year after the Date of Substantial Completion or such longer period of time as may be

prescribed by law or by the terms of any warranty required by the Contract Documents relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which his obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to his obligations other than specifically to correct the Work.

13.3 ACCEPTANCE OF DEFECTIVE OR NON-CONFORMING WORK

- 13.3.1 If the Owner prefers to accept defective or non-conforming Work, he may do so instead of requiring its removal and correction, in which case a Change Order will be issued to reflect a reduction in the Contract Sum where appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

END OF SECTION

SUPPLEMENTARY GENERAL CONDITIONS – PART I

STATUTORY PROVISIONS FOR MASSACHUSETTS
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SUPPLEMENTARY GENERAL CONDITIONS – PART I
STATUTORY PROVISIONS FOR MASSACHUSETTS
PUBLIC CONSTRUCTION CONTRACTS

The following provisions are required by or are intended to be consistent with requirements of Massachusetts statutes governing public construction contracts in the Commonwealth of Massachusetts (hereinafter referred by statute to be included herein shall be deemed to be so included. In addition, the parties recognize that other rights, duties, and obligations with respect to public construction contracts are provided for in the Contract Documents. In case of conflict between the provisions of these Supplementary General Conditions and other provisions in the Contract Documents, the provisions of these Supplementary General Conditions shall govern. In case of conflict between the provisions of these Supplementary General Conditions and the provisions of any applicable statute, the statutory provisions shall govern. Where the term “awarding authority” appears in the following paragraphs, it shall be taken as meaning the Owner.

ARTICLE 1 – PAYMENT, CONTRACT ADMINISTRATION, etc.

1.1 “Or Equal” Clause: (Statutory reference: M.G.L. Chapter 30, Section 39M(b))
This Paragraph 1.1 applies to every contract subject to M.G.L. Chapter 30, Section 39M(b).

This Paragraph 1.1 applies to every contract for the construction, reconstruction or repair of any public work or for the purchase of any material by the Commonwealth, any political subdivision thereof, or any county, city, town, district or housing authority (above certain dollar limits, as stated in the statute), and to contracts awarded pursuant to M.G.L. Chapter 149, Sections 44A through 44H. The said Sections 44A through 44H apply to every contract for the construction, reconstruction, installation, demolition, maintenance or repair of any building by a department, agency, board, commission, authority, or other instrumentality or the Commonwealth or political subdivision thereof, or two or more subdivisions thereof, but not including the Massachusetts Bay Transportation Authority, estimated to cost more than a dollar amount set forth in M.G.L. Chapter 149, Section 44A.

Every such contract shall provide that an item equal to that named or described in the said specifications may be furnished. Where products or materials are prescribed by manufacturer name, trade name, or catalog reference, the words “or approved equal” shall be understood to follow. An item shall be considered equal to the item so named or described if, in the opinion of the awarding authority:

- a. It is at least equal in quality, durability, appearance, strength, and design;
- b. it will perform at least equally the function imposed by the general design for the public work being contracted for or the material being purchased, and
- c. it conforms substantially, even with deviations, to the detailed requirements for the items as indicated by the specifications. For each item of material the specifications shall provide for either a minimum of three named brands of material or a description of material which can be met by a minimum of three manufacturers or producers, and for the equal of any one of said name or described materials.

Any structural or mechanical changes made necessary to accommodate substituted equipment under this paragraph shall be at the expense of the Contractor or Subcontractor responsible for the work item. See other paragraphs of General and Supplementary Conditions for procedures to be used in determining compliance with the standards of this paragraph.

1.2 Delays: (Statutory reference: Chapter 30, Section 39O). This Paragraph 1.2 applies to every contract subject to M.G.L. Chapter 30, Section 39M and to every contract subject to Chapter 149, Sections 44A through 44H.

In the event a suspension, delay, interruption or failure to act of the awarding authority increases the cost of performance to any subcontractor, that subcontractor shall have the same rights against the general contractor for payment for an increase in the cost of his performance as provisions (a) and (b) give the general contractor against the awarding authority, but nothing in provisions (a) and (b) shall in any way change, modify or alter any other rights which the general contractor or the subcontractor may have against each other.

Except as otherwise provided by law and by this Paragraph 1.2, the Contractor shall not be entitled to damages on account of any hindrances or delays, avoidable or unavoidable; but if such delay be occasioned by the awarding authority, the Contractor may be entitled to an extension of time only, in which to complete the work, to be determined by the Architect.

- (a) The awarding authority may order the general contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as it may determine to be appropriate for the convenience of the awarding authority; provided however, that if there is a suspension, delay or interruption for fifteen days or more or due to a failure of the awarding authority to act within the time specified in this contract, the awarding authority shall make an adjustment in the contract price for any increase in the cost of performance of this contract but shall not include any profit to the general contractor on such increase; and provided further, that the awarding authority shall not make any adjustment in the contract price under this provision for any suspension, delay, interruption or failure to act to the extent that such is due to any cause for which this contract provides for an equitable adjustment of the contract price under any other contract provisions.
- (b) The general contractor must submit the amount of a claim under provision (a) to the awarding authority in writing as soon as practicable after the end of the suspension, delay, interruption or failure to act and, in any event, not later than the date of final payment under this contract and, except for costs due to a suspension order, the awarding authority shall not approve any costs in the claim incurred more than twenty days before the general contractor notified the awarding authority in writing of the act or failure to act involved in the claim.

1.3 Deviations: (Statutory referenced: M.G.L. Chapter 30, section 39I) This Paragraph 1.3 applies to every contract for the construction, alteration, maintenance, repair or demolition of, or addition to, any public building or public works for the Commonwealth or any political subdivision thereof.

The Contractor shall perform all the work required by this contract in conformity with the plans and specifications contained therein. No willful and substantial deviation from said plans and specifications shall be made unless authorized in writing by the awarding authority or by the Engineer or Architect in charge of the work who is duly authorized by the awarding authority to approve such deviations. In order to avoid delays in the prosecution of the work required by such contract, such deviation from the plans or specifications may be authorized by a written order of the awarding authority or such Engineer or Architect so authorized to approve such deviation. Within thirty days thereafter, such written order shall be confirmed by a certificate of the awarding authority stating: (1) If such deviation involves any substitution or elimination of materials, fixtures or equipment, the reasons why such materials, fixtures or equipment were included in the first instance and the reasons for substitution or elimination, and, if the deviation is of any other nature, the reasons for such deviation, giving justification therefor (2) that the specified deviation does not materially injure the project as a whole; (3) that either the work substituted for the work specified is the same cost and quality, or that an equitable adjustment has been agreed upon between the awarding authority and the Contractor and the amount in dollars of said adjustment; and (4) that the deviation is in the best interest of the awarding authority.

Such certificate shall be signed under the penalties of perjury and shall be a permanent part of the file record of the work contracted for.

Whoever violates any provision of this section wilfully and with intent to defraud shall be punished by a fine of not more than five thousand dollars or by imprisonment for not more than six months, or both.

1.4 Finality of Decisions by Awarding Authority or Architect: (Statutory reference: M.G.L. Chapter 30, Section 39J) This Paragraph 1.4 applies to every contract for the construction, reconstruction, alteration, remodeling, repair or demolition of any public building or public works by the Commonwealth or by any county, city, district, board, commission, or other public body, when the amount of the contract exceeds the amount stated in M.G.L. Chapter 30, Section 39J.

Notwithstanding any contrary provision of this contract, a decision by the contracting body or by any administrative board, official or agency, or by any architect or engineer, on a dispute, whether of fact or of law, arising under said contract shall not be final or conclusive if such decision is made in bad faith, fraudulently, capriciously, or arbitrarily, is unsupported by substantial evidence, or is based upon error of law.

1.5 Differing Site Conditions: (Statutory reference: M.G.L. Chapter 30, Section 39N) This Paragraph 1.5 applies to every contract subject to M.G.L. Chapter 30, Section 39M and to every contract subject to M.G.L. Chapter 49, Sections 44A through 44H.

If, during the progress of the work, the Contractor or the awarding authority discovers that the actual subsurface or latent physical conditions encountered at the site differ substantially or materially from those shown on the plans or indicated in the Contract Documents, either the Contractor or the contracting authority may request an equitable adjustment in the contract price of the contract applying to work affected by the differing site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party making such claim to the other party as soon as possible after such conditions

are discovered. Upon receipt of such a claim from a Contractor, or upon its own initiative, the awarding authority shall make an investigation of such physical conditions, and, if they differ substantially or materially from those shown on the plans or indicated in the Contract Documents or from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the plans and Contract Documents and are such a nature as to cause an increase or decrease in the cost of the work, the contracting authority shall make an equitable adjustment in the contract price and the contract shall be modified in writing accordingly.

1.6 Timely Decision by Awarding Authority: (Statutory reference: M.G.L. Chapter 30, Section 39P) This Paragraph 1.6 applies to every contract subject to M.G.L. Chapter 30, Section 39M, and to every contract subject to M.G.L. Chapter 149, Sections 44A through 44H.

In every case in which this contract requires the awarding authority, any official, its Architect or Engineer to make a decision on interpretation of the specifications, approval of equipment, material or any other approval, or progress of the work, the decision shall be made promptly and, in any event, no later than thirty days after the written submission for decision; but if such decision requires extended investigation and study, the awarding authority, the official, Architect or Engineer shall, within thirty days after the receipt of the submission, give the party making the submission written notice of the reasons why the decision cannot be made within the thirty-day period and the date by which the decision will be made.

1.7 Certificate of Appropriation: (Statutory reference: M.G.L. Chapter 44, Section 31C) This Paragraph 1.7 applies to contracts for construction, reconstruction, alteration, remodeling, repair or demolition of any public building or public work by any city or town costing more than the amount set forth in M.G.L. Chapter 44, Section 31C.

This Contract shall not be deemed to have been made until the auditor or accountant or other officer of the city or town having similar duties has certified thereon that an appropriation in the amount of such contract is available therefor and that an officer or agent of the city, town, or awarding-authority has been authorized to execute said contract and approve all requisitions and change orders. No order to the Contractor for a change in or addition to the work to be performed under a contract subject to this section, whether in the form of a drawing, plan, detail or any other written instruction, unless it is an order which the Contractor is willing to perform without any increase in the contract price, shall be deemed to have been given until the auditor or accountant, or other officer of the awarding authority having similar duties, has certified thereon that an appropriation in the amount of such order is available therefor; but such certificate shall not be construed as an admission by the awarding authority of its liability to pay for such work. The certificate of the auditor or accountant or other officer of the awarding authority having similar duties, that an appropriation in the amount of such contract or order is available shall bar any defense by the awarding authority on the ground of insufficient appropriation; and any law barring payment in excess of appropriations shall not apply to amounts covered by any certificate under this section.

1.8 Method of Payment: (Statutory reference: M.G.L. Chapter 30, Section 39K) This Paragraph 1.8 applies to every contract for the construction, reconstruction, alteration, remodeling, repair or demolition of any public building by the Commonwealth, or by any

county, city, town, district, board, commission or other public body, when the amount is more than two thousand dollars, or the amount set forth in M.G.L. Chapter 30, Section 39K.

1.8.1 Within fifteen days after receipt from the Contractor, at the place designated by the awarding authority if such a place is so designated, of a periodic estimate requesting payment of the amount due for the preceding month, the awarding authority will make a periodic payment to the Contractor for the work performed during the preceding month and for the materials not incorporated in the work but delivered and suitably stored at the site (or at some location agreed upon in writing) to which the Contractor has title or to which a Subcontractor has title and has authorized the Contractor to transfer title to the awarding authority, upon certification by the contractor that he is the lawful owner and that the materials are free from all encumbrances, but less (1) a retention based on its estimate of the fair value of its claims against the Contractor and less (2) a retention for direct payments to Subcontractors based on demands for same in accordance with the provisions of Paragraph 1.10 of these Supplementary General Conditions, and less (3) a retention not exceeding five percent of the approved amount of the periodic payment. After the receipt of a periodic estimate requesting final payment and within sixty-five days after (a) the Contractor fully completes the work or substantially completes the work so that the value of the work remaining to be done is, in the estimate of the awarding authority, less than one percent of the original contract price, or (b) the Contractor substantially completes the work and the awarding authority takes possession for occupancy, whichever occurs first, the awarding authority shall pay the contractor the entire balance due on the contract less (1) a retention based on its estimate of the fair value of its claims against the Contractor and of the cost of completing the incomplete and unsatisfactory items of work and less (2) a retention for direct payments to Subcontractors based on demands for same in accordance with the provisions of Paragraph 1.10 of these Supplementary General Conditions, or based on the record of payments by the Contractor to the Subcontractors under this contract if such record of payment indicates that the Contractor has not paid Subcontractors as provided in Paragraph 1.10. If the awarding authority fails to make payment as herein provided, there shall be added to each such payment daily interest at the rate of three percentage points above the rediscount rate then charged by the Federal Reserve Bank of Boston commencing on the first day after said payment is due and continuing until the payment is delivered or mailed to the contractor; provided, that no interest shall be due, in any event, on the amount due on a periodic estimate for final payment until fifteen days...after receipt of such periodic estimate from the Contractor, at the place designated by the awarding authority if such a place is so designated. The Contractor agrees to pay to each Subcontractor a portion of any such interest paid in accordance with the amount due each Subcontractor.

1.8.2 The awarding authority may make changes in any periodic estimate submitted by the Contractor, and the payment due on said periodic estimate shall be computed in accordance with the change so made, but such changes or any requirement for a corrected periodic estimate shall not affect the due date for the periodic payment or the date for the commencement of interest charges on the amount of the periodic payment computed in accordance with the changes made, as provided herein; provided, that the awarding authority may, within seven days after receipt, return to the Contractor for correction, any periodic estimate which is not in the required form or which contains computations not arithmetically correct and, in that event, the date of receipt of such periodic estimate shall be the date of receipt of the corrected periodic estimate in proper

form and with arithmetically correct computations. The date of receipt of a periodic estimate received on a Saturday shall be the first working day thereafter.

1.8.3 All periodic estimates shall be submitted to the awarding authority, or to its designee as set forth in writing to the Contractor, and the date of receipt by the awarding authority or its designee shall be marked on the estimate. All periodic estimates shall contain a separate item for each subtrade and each sub-subtrade listed in sub-bid form as required by the specifications, and a column listing the amount paid to each subcontractor and sub-subcontractor as of the date the periodic estimate is filed. The person making payment for the awarding authority shall add the daily interest provided for herein to each payment for each day beyond the due date based on the date of receipt marked on the estimate.

1.8.4 A certificate of the Architect to the effect that the Contractor has fully or substantially completed the work shall, subject to the provisions of Paragraph 1.4 of these Supplementary General Conditions, be conclusive for the purposes of this Paragraph 1.8.

1.8.5 Notwithstanding the provisions of this section, at any time after the value of the work remaining to be done is, in the estimation of the awarding authority, less than 1 per cent of the adjusted contract price, or the awarding authority has determined that the contractor has substantially completed the work and the awarding authority has taken possession for occupancy, the awarding authority may send to the general contractor by certified mail, return receipt requested, a complete and final list of all incomplete and unsatisfactory work items, including, for each item on the list, a good faith estimate of the fair and reasonable cost of completing such item. The general contractor shall then complete all such work items within 30 days of receipt of such list or before the contract completion date, whichever is later. If the general contractor fails to complete all incomplete and unsatisfactory work items within 45 days after receipt of such items furnished by the awarding authority or before the contract completion date, whichever is later, subsequent to an additional 14 days written notice to the general contractor by certified mail, return receipt requested, the awarding authority may terminate the contract and complete the incomplete and unsatisfactory work items and charge the cost of same to the general contractor and such termination shall be without prejudice to any other rights or remedies the awarding authority may have under the contract. The awarding authority shall note any such termination in the evaluation form to be filed by the awarding authority pursuant to the provisions of section 44D of chapter 149.

1.9 Method of Payment: (Statutory reference: M.G.L. Chapter 30, section 39G) This Paragraph 1.9 applies to every contract for the construction, reconstruction, alteration, remodeling, repair or improvement of public ways; including bridges and other highway structures, sewers and water mains, airports and other public works entered into with the commonwealth, or any agency or political subdivision thereof.

1.9.1 Upon substantial completion of the work required by a contract with the commonwealth, or any agency or political subdivision thereof, for the construction, reconstruction, alteration, remodeling, repair or improvement of public ways, including bridges and other highway structures, sewers and water mains, airports and other public works, the contractor shall present in writing to the awarding authority its certification that the work has been substantially completed. Within twenty-one days thereafter, the awarding authority shall present to the contractor either a written declaration that the work

has been substantially completed or an itemized list of incomplete or unsatisfactory work items required by the contract sufficient to demonstrate that the work has not been substantially completed. The awarding authority may include with such list a notice setting forth a reasonable time, which shall not in any event be prior to the contract completion date, within which the contractor must achieve substantial completion of the work. In the event that the awarding authority fails to respond, by presentation of a written declaration or itemized list as aforesaid, to the contractor's certification within the twenty-one day period, the contractor's certification shall take effect as the awarding authority's declaration that the work has been substantially completed.

1.9.2 Within sixty-five days after the effective date of a declaration of substantial completion, the awarding authority shall prepare and forthwith send to the contractor for acceptance a substantial completion estimate for the quality and price of the work done and all but one percent retainage on that work, including the quantity, price and all but one percent retainage for the undisputed part of each work item and extra work item in dispute but excluding the disputed part thereof, less the estimated cost of completing all incomplete and unsatisfactory work items and less the total periodic payments made to date for the work. The awarding authority also shall deduct from the substantial completion estimate an amount equal to the sum of all demands for direct payments filed by subcontractors and not yet paid to subcontractors or deposited in joint accounts pursuant to section 1.10, but no contract subject to said section 1.10 shall contain any other provision authorizing the awarding authority to deduct any amount by virtue of claims asserted against the contract by subcontractors, material suppliers or others.

1.9.3 If the awarding authority fails to prepare and send to the contractor any substantial completion estimate required by section 1.9.2, on or before the date herein above set forth, the awarding authority shall pay to the contractor interest on the amount which would have been due to the contractor pursuant to such substantial completion estimate, at the rate of three percentage points above the rediscount rate then charged by the Federal Reserve Bank of Boston from such date to the date on which the awarding authority sends that substantial completion estimate to the contractor for acceptance or to the date of payment therefor, whichever occurs first. The awarding authority shall include the amount of such interest in the substantial completion estimate.

1.9.4 Within fifteen days after the effective date of the declaration of substantial completion, the awarding authority shall send to the contractor by certified mail, return receipt requested, a complete list of all incomplete or unsatisfactory work items, and unless delayed by causes beyond his control, the contractor shall complete all such work items within forty-five days after the receipt of such list or before the then contract completion date, whichever is later. If the contractor fails to complete such work within such time, the awarding authority may, subsequent to seven days' written notice to the contractor by certified mail, return receipt requested, terminate the contract and complete the incomplete or unsatisfactory work items and charge the cost of same to the contractor.

1.9.5 Within thirty days after receipt by the awarding authority of a notice from the contractor stating that all of the work required by the contract has been completed, the awarding authority shall prepare and forthwith send to the contractor for acceptance, a final estimate for the quantity and price of the work done and all retainage on that work less the payments made to date, unless the awarding authority's inspection shows that work items required by the contract remain incomplete or unsatisfactory, or that

documentation required by the contract has not been completed. If the awarding authority fails to prepare and sends to the contractor the final estimate within thirty days after receipt of notice of completion, the awarding authority shall pay to the contractor interest on the amount which would have been due to the contractor pursuant to such final estimate at the rate hereinabove provided from the thirtieth day after such completion until the date on which the awarding authority sends the final estimate to the contractor for acceptance or the date of payment therefor, whichever occurs first, provided that the awarding authority's inspection shows that no work items required by the contract remain incomplete or unsatisfactory. Interest shall not be paid hereunder on amounts for which interest is required to be paid in connection with the substantial completion estimate as hereinabove provided. The awarding authority shall include the amount of the interest required to be paid hereunder in the final estimate.

1.9.6 The awarding authority shall pay the amount due pursuant to any substantial completion or final estimate within thirty-five days after receipt of written acceptance for such estimate from the contractor and shall pay interest on the amount due pursuant to such estimate at the rate hereinabove provided from that thirty-fifth day to the day of payment. Within 15 days after receipt from the contractor, if such place is so designated by the awarding authority, if such place is so designated, of a periodic estimate requesting payment of the amount due for the preceding periodic estimate period, the awarding authority shall make a periodic payment to the contractor for the work performed during the preceding periodic estimate period and for the materials not incorporated in the work but delivered and suitably stored at the site, or at some location agreed upon in writing, to which the contractor has title or to which a subcontractor has title and has authorized the contractor to transfer title to the awarding authority, upon certification by the contractor that he is the lawful owner and that materials are free from all encumbrances. The awarding authority shall include with each such payment interest on the amount due pursuant to such periodic estimate at the rate herein above provided from the due date. In the case of periodic payments, the contracting authority may deduct from its payment a retention based on its estimate of the fair value of its claim against the contractor, a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section 1.10, and a retention to secure satisfactory performance of the contractual work not exceeding five percent of the approved amount of any periodic payment, and the same right to retention shall apply to bonded subcontractors entitled to direct payment under section 1.10; provided, that a five percent value of all items that are planted in the ground shall be deducted from the periodic payments until final acceptance.

1.9.7 No periodic, substantial completion or final estimate or acceptance or payment thereof shall bar a contractor from reserving all rights to dispute the quantity and amount of, or the failure of the awarding authority to approve a quantity and amount of, all or part of any work item or extra work item.

1.9.8 Substantial completion, for the purpose of this section 1.9, shall mean either that the work required by the contract has been completed except for work having a contract price of less than one percent of the then adjusted total contract price, or substantially all of the work has been completed and opened to public use except for minor incomplete or unsatisfactory work items that do not materially impair the usefulness of the work required by the contract.

1.10 Direct Payment: (Statutory reference: M.G.L. Chapter 30, Section 39F) This Paragraph 1.10 applies to every contract awarded pursuant to M.G.L. Chapter 149, Sections 44A through 44J, and (with the exception of Subparagraph 1.10.9) to every contract awarded pursuant to M.G.L. Chapter 30, Section 39M.

1.10.1 Forthwith after the General Contractor receives payment on account of a periodic estimate, the General Contractor shall pay to each subcontractor the amount paid for the labor performed and the materials furnished by that Subcontractor, less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the Subcontractor by the General Contractor.

1.10.2 Not later than the sixty-fifth day after each Subcontractor substantially completes the work in accordance with the plans and specifications, the entire balance due under the subcontract, less amounts retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the Subcontractor; and the awarding authority shall pay that amount to the General Contractor. The General Contractor shall forthwith pay to the Subcontractor the full amount received from the awarding authority less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the Subcontractor by the General Contractor.

1.10.3 Each payment made by the awarding authority to the General Contractor pursuant to Subparagraphs 1.10.1 and 1.10.2 of this Paragraph 1.10 for the labor performed and the materials furnished by a Subcontractor shall be made to the General Contractor for the account of that Subcontractor; and the awarding authority shall take reasonable steps to compel the General Contractor to make each such payment to each such Subcontractor. If the awarding authority has received a demand for direct payment from a Subcontractor for any amount which has already been included in a payment to the General Contractor for payment to the Subcontractor as provided in Subparagraphs 1.10.1 and 1.10.2, the awarding authority shall act upon the demand as provided in this Paragraph 1.10.

1.10.4 If, within seventy days after the Subcontractor has substantially completed the subcontract work, the Subcontractor has not received from the Contractor the balance due under the subcontract including any amount due for extra labor and materials furnished to the General Contractor, less any amount retained by the awarding authority as to the estimated cost of completing the incomplete and unsatisfactory items of work, the Subcontractor may demand direct payment of that balance from the awarding authority. The demand shall be by a sworn statement delivered to or sent by certified mail to the awarding authority, and a copy shall be delivered to or sent by certified mail to the General Contractor at the same time. The demand shall contain a detailed breakdown of the balance due under the subcontract and also a statement of the status of completion of the subcontract work. Any demand made after substantial completion of the subcontract work shall be valid even if delivered or mailed prior to the seventieth day after the Subcontractor has substantially completed the subcontract work. Within ten days after the Subcontractor has delivered or so mailed the demand to the awarding authority and delivered or so mailed a copy to the General Contractor, the General Contractor may reply to the demand. The reply shall be a sworn statement delivered to or sent by certified mail to the awarding authority, and a copy shall be delivered to or sent by certified mail to the Subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontract, including any amount due for extra labor and materials furnished to the

General Contractor and of the amount due for each claim made by the General Contractor against the Subcontractor.

1.10.5 Within fifteen days after receipt of the demand by the awarding authority, but in no event prior to the seventieth day after substantial completion of the subcontract work, the awarding authority shall make direct payment to the Subcontractor of the balance due under the subcontract, including any amount due for extra labor and materials furnished to the General Contractor, less any amount (i) retained by the awarding authority as the estimated cost of completing the incomplete or unsatisfactory items of work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the General Contractor in the sworn reply; provided, that the awarding authority shall not deduct from a direct payment any amount as provided in part (iii) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required by Subparagraph 1.10.4. The awarding authority shall make further direct payments to the Subcontractor forthwith after the removal of the basis for deduction from direct payments made as provided in parts (i) and (ii) of this Subparagraph.

1.10.6 The awarding authority shall forthwith deposit the amounts deducted from a direct payment as provided in part (iii) of the Subparagraph 1.10.5 in an interest-bearing joint account in the names of the General Contractor and the Subcontractor in a bank in Massachusetts selected by the awarding authority or agreed upon by the General Contractor and the Subcontractor and shall notify the General Contractor and the Subcontractor of the date of the deposit and the account, including accrued interest, as provided in an agreement between the General Contractor and the Subcontractor or as determined by decree of a court of competent jurisdiction.

1.10.7 All direct payments and all deductions from demands for direct payments deposited in an interest-bearing account or accounts in a bank pursuant to Subparagraph 1.10.6 shall be made out of amounts payable to the General Contractor at the time of receipt of a demand for direct payment from a Subcontractor and out of amounts which later become payable to the General Contractor and in the order or receipt of such demands from subcontractors. All direct payments shall discharge the obligation of the awarding authority to the Contractor to the extent of such payment.

1.10.8 The awarding authority shall deduct from payments to a General Contractor amounts which, together with the deposits in interest-bearing accounts pursuant to Subparagraph 1.10.6, are sufficient to satisfy all unpaid balances of demands for direct payments received from Subcontractors. All such amounts shall be earmarked for such direct payments, and the Subcontractors shall have a right in such deductions prior to any claims against such amounts by creditors of the General Contractor.

1.10.9 If the Subcontractor does not receive payment as provided in Subparagraph 1.10.1 or if the General Contractor does not submit a periodic estimate for the value of the labor or materials performed or furnished by the Subcontractor and the Subcontractor does not receive payment for same when due less the deductions provided for in Subparagraph 1.10.1, the Subcontractor may demand direct payment by following the procedure in Subparagraph 1.10.4 and the General Contractor may file a sworn reply as provided in that same Subparagraph. A demand made after the first day of the month following that for which the Subcontractor performed or furnished the labor and materials for which the Subcontractor seeks payment shall be valid even if delivered or mailed prior to the time

payment was due on a periodic estimate from the General Contractor. Thereafter the awarding authority shall proceed as provided in Subparagraphs 1.10.5, 1.10.6, 1.10.7 and 1.10.8.

1.10.10 Any assignment by a Subcontractor of the rights under this section to a surety company furnishing a bond under the provisions of M.G.L. Chapter 149, Section 29 shall be invalid. The assignment and subrogation rights of the surety to amounts included in a demand for direct payment which are in the possession of the awarding authority or which are on deposit pursuant to Subparagraph 1.10.6 shall be subordinate to the rights of all Subcontractors who are entitled to be paid under this section and who have not been paid in full.

1.10.11 "Subcontractor" as used in this Paragraph 1.10 (i) for contracts awarded as provided in M.G.L. Chapter 149, Sections 44A-44J, inclusive, shall mean a person who files a sub-bid and receives a subcontract as a result of that filed sub-bid or who is approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the General Contractor, (ii) for contracts awarded as provided in M.G.L. Chapter 30, Section 39M(a), shall mean a person approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the General Contractor.

1.10.12 A General Contractor or a Subcontractor shall enforce a claim to any portion of the amount of a demand for direct payment deposited as provided in Subparagraph 1.1.6 by a petition in equity in the superior court against the other and the bank shall not be a necessary party. A Subcontractor shall enforce a claim for direct payment or a right to require a deposit as provided in Subparagraph 1.10.6 by a petition in equity in the superior court against the awarding authority and the Contractor shall not be a necessary party. Upon motion of any party the court shall advance for speedy trial any petition filed as provided in this paragraph. M.G.L. Chapter 231, Sections 59 and 59B shall apply to such petitions. The Court shall enter an interlocutory decree upon which execution shall issue for any part of a claim found due pursuant to Sections 59 and 59B and, upon motion of any party, shall advance for speedy trial the petition to collect the remainder of the claim. Any party aggrieved by such interlocutory decree shall have the right to appeal therefrom as from a final decree. The court shall not consolidate for trial the petition of any Subcontractor with the petition of one or more Subcontractors or the same general contract unless the court finds that a substantial portion of the evidence of the same events during the course of construction (other than the fact that the claims sought to be consolidated arise under the same general contract) is applicable to the petitions sought to be consolidated and that such consolidation will prevent unnecessary duplication of evidence. A decree in any such proceeding shall not include interest on the disputed amount deposited in excess of the interest earned for the period of any such deposit. No person except a Subcontractor filing a demand for direct payment for which no funds due the Contractor are available for direct payment shall have a right to file a petition in a court of equity against the awarding authority claiming a demand for direct payment is premature, and such Subcontractor must file the petition before the awarding authority has made a direct payment to the Subcontractor and has made a deposit of the disputed portion as provided in part (iii) of Subparagraph 1.10.5 and in Subparagraph 1.10.6.

1.10.13 In any petition to collect any claim for which a Subcontractor has filed a demand for direct payment the court shall, upon motion of the General Contractor, reduce by the amount of any deposit of a disputed amount by the awarding authority as provided in part (iii) of Subparagraph 1.10.5 and in Subparagraph 1.10.6 any amount held under a trustee writ or pursuant to a restraining order or injunction.

1.11 Discharge or Release of Bonds (Statutory reference: M.G.L. c.30, section 40) This Paragraph 1.11 applies to every contract awarded for the construction or repair of public buildings or other public works.

1.11.1 Bonds given to the commonwealth, any county, city, town or political subdivision to secure the performance of contracts for the construction or repair of public buildings or other public works may be discharged or released by the awarding authority, upon such terms as it deems expedient, after the expiration of one year from the time of completion, subject to Section 1.8, of the work contracted to be done; provided that no claim filed under said bond is pending, and provided further, that no such bonds shall be discharged or released prior to the expiration of all special guarantees provided for in the contract unless new bonds in substitution therefor specifically relating to the unexpired guarantees shall be taken.

ARTICLE 2 – WAGES AND EMPLOYMENT PRACTICES

2.1 Preference To Veterans and Citizens In Public Works; Rate of Wages: (Statutory reference: M.G.L. c. 149, Section 26) This Paragraph 2.1 applies to every contract or subcontract for the construction of public works by the Commonwealth or by a county, town or district.

2.1.1 In the employment of mechanics and apprentices, teamsters, chauffeurs and laborers, preference shall first be given to citizens of the Commonwealth who have been residents of the Commonwealth for at least six months at the commencement of their employment, who are veterans as defined in M.G.L. Chapter 4, Section 7, clause 43, and who are qualified to perform the work to which the employment relates and, within such preference, preference shall be given to service-disabled veterans; and secondly, to citizens of the Commonwealth generally who have been residents of the Commonwealth for at least six months at the commencement of their employment, and if they cannot be obtained in sufficient numbers, then to citizens of the United States, and every contract for such work shall contain a provision to this effect. Each county, town or district in the construction of public works, or persons contracting or subcontracting for such works, shall give preference to veterans and citizens who are residents of such county, town, authority or district, and within such preference, preference shall be given to service-disabled veterans.

2.1.2 The rate per hour of the wages paid to said mechanics and apprentices, teamsters, chauffeurs and laborers in the construction of public works shall not be less than the rate or rates of wages to be determined by the Commissioner as hereinafter provided; provided that the wages paid to laborers employed on said works shall not be less than those paid to laborers in the municipal service of the town or towns where said works are being constructed; provided further, that where the same public work is to be constructed in two or more towns, the wages paid to laborers shall not be less than those paid to laborers in the municipal town paying the highest rate; provided further, that if, in

any of the towns where the works are to be constructed, a wage rate or wage rates have been established in certain trades and occupations by collective agreements or understandings in the private construction industry between organized labor and employers, the rate or rates to be paid on said works shall not be less than the rates so established; provided further, that in towns where no such rate or rates have been established, the wages paid to mechanics, teamsters, chauffeurs and laborers on public works, shall not be less than the wages paid to the employees in the same trades and occupations by private employers engaged in the construction industry. This section shall also apply to regular employees of the Commonwealth or a county, town, authority or district, when such employees are employed in the construction, addition to or alteration of public buildings for which special appropriations of more than one thousand dollars are provided. Payments by employers to health and welfare plans, pension plans and supplementary unemployment benefit plans under collective bargaining agreements or understandings between organized labor and employers shall be included for the purpose of establishing minimum wage rates as herein provided.

2.2 List of Jobs; Classifications; Determination of Rate of Wages; Schedule: (Statutory reference: M.G.L. Chapter 149, Section 27) This Paragraph 2.2. applies to every contract or subcontract for the construction of public works by the Commonwealth, or by a county, town or district.

2.2.1 The commissioner shall prepare, for the use of such public officials or public bodies whose duty it shall be to cause public works to be constructed, a list of the several jobs usually performed on various types of public works upon which mechanics and apprentices, teamsters, chauffeurs and laborers are employed, including the transportation of gravel or fill to the site of said public works or the removal of surplus gravel or fill from such site. The commissioner shall classify said jobs, and he may revise such classification from time to time, as he may deem advisable. Prior to awarding a contract for the construction of public works, said public official or public body shall submit to the commissioner a list of the jobs upon which mechanics and apprentices, teamsters, chauffeurs and laborers are to be employed, and shall request the commissioner to determine the rate of wages to be paid on each job. Each year after the awarding of the contract, the public official or public body shall submit to the commissioner a list of the jobs upon which mechanics and apprentices and laborers are to be employed and shall request that the commissioner update the determination of the rate of wages to be paid on each job. The general contractor shall annually obtain updated rates from the public official or public body and no contractor or subcontractor shall pay less than the rates so established. Said rates shall apply to all persons engaged in transporting gravel or fill to the site of said public works or removing gravel or fill from such site, regardless of whether such persons are employed by a contractor or subcontractor or are independent contractors or owner-operators. The commissioner, subject to the provisions of Section 2.1, shall proceed forthwith to determine the same, and shall furnish said official or public body with a schedule of such rate or rates of wages as soon as said determination shall have been made. In advertising or calling for bids for said works, the awarding official or public body shall incorporate said schedule in the advertisement or call for bids by an appropriate reference thereto, and shall furnish a copy of said schedule, without cost, to any person requesting the same. Said schedule shall be made a part of the contract for said works and shall continue to be the minimum rate or rates of wages for said employees during the life of the contract. Any person engaged in the construction of said works shall cause a legible copy of said schedule and subsequent updates to be kept

posted in a conspicuous place at the site of said works during the life of the contract. An apprentice performing work on a project subject to this section shall maintain in his possession an apprentice identification card issued pursuant to section M.G.L. Chapter 23, Section 11W. The aforesaid rates of wages in the schedule of wage rates shall include payments by employers to health and welfare plans, pension plans and supplementary unemployment benefit plans as provided in said Section 2.1, and such payments shall be considered as payments to persons under this section performing work as herein provided. Any employer engaged in the construction of such works who does not make payments to a health and welfare plan, a pension plan and a supplementary unemployment benefit plan, where such payments are included in said rates of wages, shall pay the amount of said payments directly to each employee engaged in said construction. Whoever shall pay less than said rate or rates of wages, including payments to health and welfare funds and pension funds, or the equivalent payment in wages, on said works to any person performing work within classifications as determined by the commissioner, and whoever, for himself, or as representative, agent or officer of another, shall take or receive for his own use or the use of any other person, as a rebate, refund or gratuity, or in any other guise, any part or portion of the wages, including payments to health and welfare funds and pension funds, or the equivalent payment in wages, paid to any such person for work done or service rendered on said public works, shall have violated this section and shall be punished or shall be subject to a civil citation or order as provided in M.G.L. Chapter 149, Section 27C. The president and treasurer of a corporation and any officers or agents having the management of such corporation shall also be deemed to be employers of the employees of any corporation within the meaning of Sections 2.1 to 2.3, inclusive.

Offers of restitution or payment of restitution shall not be considered in imposing such punishment.

2.2.2 When an investigation by the attorney general's office reveals that a contractor or subcontractor has violated this section by failing to pay said rate or rates of wages, including payments to health and welfare funds and pension funds, or the equivalent payment in wages, on said works to any person performing work within classifications as determined by the commissioner, or that a contractor or subcontractor has, for himself, or as representative, agent or officer of another, taken or received for his own use or the use of any other person, as a rebate, refund or gratuity, or in any other guise, any portion of the wages, including payments to health and welfare funds and pension funds, or the equivalent payment in wages, paid to any such person for work done or service rendered on said public works, the attorney general may, upon written notice to the contractor or subcontractor and the sureties of the contractor or subcontractor, and after a hearing thereon, order work halted on the part of the contract on which such wage violations occurred, until the defaulting contractor or subcontractor has filed with the attorney general's office a bond in the amount of such penal sum as the attorney general shall determine, conditioned upon payment of said rate or rates of wages, including payments to health and welfare funds and pension funds, or the equivalent payment in wages, on said works to any person performing work within classifications as determined by the commissioner.

An employee claiming to be aggrieved by a violation of this section may, 90 days after the filing of a complaint with the attorney general, or sooner if the attorney general assents in writing, and within 3 years after the violation, institute and prosecute in his own name and on his own behalf, or for himself and for others similarly situated, a civil action for injunctive relief, for any damages incurred, and for any lost wages and other benefits. An employee

so aggrieved who prevails in such an action shall be awarded treble damages, as liquidated damages, for any lost wages and other benefits and shall also be awarded the costs of the litigation and reasonable attorneys' fees.

2.3 Employment Records To Be Kept By Contractor, Subcontractors; Statement of Compliance: (Statutory reference: M.G.L. c. 149, Section 27B) This Paragraph 2.3 applies to every contract or subcontract for the construction of public works by the Commonwealth, or by a county, town or district.

Every Contractor, Subcontractor or public body engaged in said public works to which Paragraph 2.3 of these Supplementary General Conditions applies shall keep a true and accurate records of all mechanics and apprentices, teamsters, chauffeurs and laborers employed thereon, showing the name, address and occupational classification of each such employee on said works, and hours worked by, and wages paid to, each such employee, and shall promptly furnish to the Attorney General or his representative, upon his request, a copy of said record, signed by the employer or his authorized agent under the penalties of perjury. For every week in which an apprentice is employed by a contractor, subcontractor or public body subject to this section, a photocopy of the apprentice's apprentice identification card, issued pursuant to M.G.L. Chapter 23, Section 11W, shall be attached to the records submitted under this section. Such records shall be open to inspection by any authorized representative of the department at any reasonable time, and as often as may be necessary. Every contractor and subcontractor required to keep such a record shall submit a copy of said record to the awarding authority directly and on a weekly basis.

Each such Contractor, Subcontractor or public body shall preserve its payroll records for a period of three years from the date of completion of the contract.

Each such Contractor, Subcontractor or public body shall furnish to the awarding authority directly within fifteen days after completion of its portion of the work a statement, executed by the Contractor, Subcontractor, or public body who supervises the payment of wages, in the following form.

STATEMENT OF COMPLIANCE

I, _____
(Name of signatory party) (Title)

do hereby state:

That I pay or supervise the payment of the persons employed by

(Contractor, Subcontractor or public body)

on the _____ and that all mechanics
(building or project)

and apprentices, teamsters, chauffeurs and laborers employed on said project have been paid in accordance with wages determined under the provisions of sections twenty-six and twenty-seven of chapter one hundred and forty-nine of the General Laws.

Signature _____

Title _____

The above-mentioned copies of payroll records and statements of compliance shall be available for inspection by any interested party filing a written request to the awarding authority for such inspection and copying.

2.4 Wages Paid to Operators of Trucks and Other Equipment: (Statutory reference: M.G.L. c. 149, Section 27F) This Paragraph 2.4 applies to every contract for the construction of public works by the Commonwealth, or by a county, city, town or district.

No agreement of lease, rental or other arrangement, and no order or requisition under which a truck or any automotive or other vehicle or equipment is to be engaged in public works by the commonwealth or by a county, city, town or district, shall be entered into or given by any public official or public body unless said agreement, order or requisition contains a stipulation requiring prescribed rates of wages, as determined by the commissioner, to be paid to the operators of said trucks, vehicles or equipment. Any such agreement, order or requisition which does not contain said stipulation shall be invalid, and no payment shall be made thereunder. Said rates of wages shall be requested of said commissioner by said public official or public body, and shall be furnished by the commissioner in a schedule containing the classifications of jobs, and the rate of wages to be paid for each job. Said rates of wages shall include payments to health and welfare plans, or, if no such plan is in effect between employers and employees, the amount of such payments shall be paid directly to said operators. Whoever pays less than said rates of wages, including payments to health and welfare funds, or the equivalent in wages, on said works, and whoever accepts for his own use, or for the use of any other person, as a rebate, gratuity or in any other guise, any part or portion of said wages or health and welfare funds, shall have violated this section and shall be punished or shall be subject to a civil citation or order as provided in M.G.L. Chapter 149, Section 27C.

An employee claiming to be aggrieved by a violation of this section may, 90 days after the filing of a complaint with the attorney general, or sooner if the attorney general assents in writing, and within 3 years after the violation, institute and prosecute in his own name and on his own behalf, or for himself and for others similarly situated, a civil action for injunctive relief, for any damages incurred, and for any lost wages and other benefits. An employee so aggrieved who prevails in such an action shall be awarded treble damages, as liquidated damages, for any lost wages and other benefits and shall also be awarded the costs of the litigation and reasonable attorneys' fees.

2.5 Reserve Police Officers: (Statutory reference: M.G.L. Chapter 149, Section 34B) This Paragraph 2.5 applies to every contract for the construction, alteration, maintenance, repair or demolition of, or addition to, any public works for the Commonwealth or any political subdivision thereof.

The contractor shall pay to any reserve police officer employed by him in any city or town the prevailing rate of wages paid to regular police officers in such city or town.

2.6 Eight-hour Day, etc.: (Statutory reference: M.G.L. Chapter 149, Sections 30, 34, and 34A) This Paragraph 2.6 applies only to contracts which are subject to the provisions of the aforesaid sections of the Massachusetts General Laws.

No laborer, worker, mechanic, foreman or inspector working within this Commonwealth in the employ of the Contractor, Subcontractor or other person doing or contracting to do the whole or part of the work contemplated by the contract, shall be required or permitted to work more than eight hours in any one day or more than forty-eight hours in any one week, or more than six days in any one week, except in cases of extraordinary emergency.

2.7 Lodging, etc.: (Statutory reference: M.G.L. Chapter 149, Section 25) This paragraph 2.7 applies to every contract for the doing of public work with the Commonwealth, a county, city or town, or with a department, board, commission, or officer acting therefor.

Every employee under this contract shall lodge, board and trade where and with whom he elects, and neither the Contractor nor his agents or employees shall, either directly or indirectly, require as a condition of the employment of any person that the employee shall lodge, board or trade at a particular place or with a particular person.

2.8 Access to Contractor's Records: (Executive Order No. 195) This Paragraph 2.8 applies to every contract for the purchase of services or materials by any agency, bureau, board, commission, institution, or department of the Commonwealth or a municipal contract funded, in whole or in part, by the Commonwealth.

The Governor or his designee, the secretary of administration and finance, and the state auditor or his designee shall have the right at reasonable times and upon reasonable notice to examine the books, records and other compilations of data of the Contractor which pertain to the performance and requirements of this contract.

2.9 Worker's Compensation Insurance: (Statutory reference: M.G.L. chapter 149, Section 34) This Paragraph 2.9 applies to every contract for the construction, alteration,

maintenance, repair or demolition of, or addition to, any public building or other public works for the Commonwealth or any political subdivision thereof.

The Contractor shall, before commencing performance of the contract, provide by insurance for the payment of and the furnishing of other benefits under M.G.L. Chapter 152 to all persons to be employed under the contract, and the Contractor shall continue such insurance in full force and effect during the term of the contract. Sufficient proof of compliance with this Paragraph 2.9 must be furnished at the time of execution of this contract. Failure to provide and continue in force such insurance as aforesaid shall be deemed a material breach of the contract and shall operate as an immediate termination thereof. No cancellation of such insurance, whether by the insurer or by the insured, shall be valid unless written notice thereof is given by the party proposing cancellation to other party and to the awarding authority at least fifteen days prior to the intended effective date thereof, which date shall be expressed in said notice.

Notice of cancellation sent by the party proposing cancellation by registered mail, postage prepaid, with a return receipt of the addressee requested, shall be a sufficient notice. An affidavit of any officer, agent or employee of the insurer or of the insured, as the case may be, duly authorized for the purpose, that he has so sent such notice addressed as aforesaid shall be prima facie evidence of the sending thereof as aforesaid. This section shall apply to the legal representative, trustee in bankruptcy, receiver, assignee, trustee and the successor in interest of any such contractor. The superior court shall have jurisdiction in equity to enforce this section. Whoever violates any provision of this section shall be punished by a fine of not more than one hundred dollars or by imprisonment for six months, or both; and, in addition, any contractor who violates any provision of this section shall be prohibited from contracting, directly or indirectly, with the commonwealth or any political subdivision thereof, for the construction, alteration, demolition, maintenance or repair of, or addition to, any public works or public building for a period of two years from the date of conviction of said violation.

ARTICLE 3 – CONTRACTOR'S ACCOUNTING METHOD REQUIREMENTS

3.1 (Statutory reference: M.G.L. Chapter 30, Section 39R)

This Article 3 applies to "Contracts" and "Contractors", as defined in Subparagraph 3.1.1 and 3.1.2, below.

3.1.1 "Contractor" means any person, corporation, partnership, joint venture, sole proprietorship, or other entity awarded a contract pursuant to Sections 38A 1/2 to 38O, inclusive, of Chapter 7, Section 39M of Chapter 30, Sections 44A-44J, inclusive, of Chapter 149, or Section 11C of Chapter 25A which is for an amount or estimated amount that exceeds the dollar amount set forth in M.G.L. Chapter 30, Section 39R.

3.1.2 "Contract" means any contract awarded or executed pursuant to Sections 38A 1/2 to 38O, inclusive, of Chapter 7, Section 39M of Chapter 30, Sections 44A-44J, inclusive, of Chapter 149, or Section 11C of Chapter 25A which is for an amount or estimated amount that exceeds the dollar amount set forth in M.G.L. Chapter 30, Section 39R.

3.1.3 "Records" means books of original entry, accounts, checks, bank statements and all other banking documents, correspondence, memoranda, invoices, computer printouts, tapes, discs, papers and other documents or transcribed information of any type, whether expressed in ordinary or machine language.

3.1.4 "Independent Certified Public Accountant" means a person duly registered in good standing and entitled to practice as a certified public accountant under the laws of the place of his residence or principal office who is in fact independent. In determining whether an accountant is independent with respect to a particular person, appropriate consideration should be given to all relationships between the accountant and that person or any affiliate thereof. Determination of an accountant's independence shall not be confined to the relationships existing in connection with the filing of reports with the awarding authority.

3.1.5 "Audit", when used in regard to financial statements, means an examination of records by an independent certified public accountant in accordance with generally accepting accounting principles and auditing standards for the purpose of expressing a *certified* opinion thereon, or, in the alternative, a qualified opinion or a declination to express an opinion for stated reasons.

3.1.6 "Accountant's Report", when used in regard to financial statements, means a document in which an independent certified public accountant indicates the scope of the audit which he has made and sets his opinion regarding the financial statements taken as a whole with a listing of noted exceptions and qualifications, or an assertion to the effect that an overall opinion cannot be expressed. When an overall opinion cannot be expressed, the reasons therefor shall be stated. An accountant's report shall include as a part thereof a signed statement by the responsible corporate officer attesting that management has fully disclosed all material facts to the independent certified public accountant, and that the auditing financial statement is a true and complete statement of the financial condition of the Contractor.

3.1.7 "Management", when used herein, means the chief executive officers, partners, principals or other person or persons primarily responsible for the financial and operational policies and practices of the Contractor.

3.1.8 Accounting terms, unless otherwise defined herein, shall have a meaning in accordance with generally accepted accounting principles and auditing standards.

3.2 Subparagraph 3.1.2 hereof notwithstanding, every agreement or contract awarded or executed pursuant to Sections 38A 1/2 to 38O, inclusive, of Chapter 7, Section 39M of Chapter 30, Sections 44A-44J, inclusive, of Chapter 149, or Section 11C of Chapter 25A, shall provide that:

3.2.1 The Contractor shall make, and keep for at least six years after final payment, books, records, and accounts which in reasonable detail accurately and fairly reflect the transactions and dispositions of the Contractor; and

3.2.2 Until the expiration of six years after final payment, the awarding authority, office of inspector general, and the commissioner of capital asset management and maintenance shall have the right to examine any books, documents, papers or records of the Contractor

or his Subcontractors that directly pertain to, and involve transactions relating to, the Contractor or his Subcontractors; and

3.2.3 If the agreement is a contract as defined herein, the Contractor shall describe any change in the method of maintaining records or recording transactions which materially affect any statements filed with the awarding authority, including in his description the date of the change and reasons therefor, and shall accompany said description with a letter from the Contractor's independent certified public accountant approving or otherwise commenting on the changes.

3.2.4 If the agreement is a contract as defined herein, the Contractor has filed a statement of management on internal accounting controls as set forth in Paragraph 3.3 below prior to the execution of the contract.

3.2.5 If the agreement is a contract as defined herein, the Contractor has filed prior to the execution of the contracts and will continue to file annually, an audited financial statement for the most recent completed fiscal year as set forth in Paragraph 3.5 below.

3.3 Every Contractor awarded a contract shall file with the awarding authority a statement of management as to whether the system of internal accounting controls of the Contractor and its subsidiaries reasonably assures that:

3.3.1 transactions are executed in accordance with management's general and specific authorization:

3.3.2 transactions are recorded as necessary

(i) to permit preparation of financial statements in conformity with generally accepted accounting principles, and

(ii) to maintain accountability for assets;

3.3.3 Access to assets is permitted only in accordance with management's general or specific authorization; and

3.3.4 The recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action was taken with respect to any difference.

3.4 Every Contractor awarded a contract shall also file with the awarding authority a statement prepared and signed by an independent certified public accountant, stating that he/she has examined the statement of management on internal accounting controls, and expressing an opinion as to:

3.4.1 Whether the representations of management in response to this paragraph and Paragraph 3.2 above are consistent with the result of management's evaluation of the system of internal accounting controls; and

3.4.2 Whether such representations of management are, in addition, reasonable with respect to transactions and assets in amounts which would be material when measured in relation to the applicant's financial statements.

3.5 Every Contractor awarded a contract by the Commonwealth or by any political subdivision thereof shall annually file with the commissioner of capital asset management and maintenance during the term of the contract a financial statement prepared by an independent certified public accountant on the basis of an audit by such accountant. The final statement filed shall include the date of final payment. All statements shall be accompanied by an accountant's report.

ARTICLE 4 – MISCELLANEOUS

4.1 Weather Protection: This Paragraph 4.1 applies to every contract subject to M.G.L. Chapter 149, Section 44A.

4.1.1 The Contractor shall install weather protection and provide adequate heat in the protected area from November 1 to March 31, as required by M.G.L. Chapter 149 Section 44F(1).

4.2 Form for Sub-contract: This Paragraph 4.2 applies to every contract subject to M.G.L. Chapter 149 Section 44A.

4.2.1 The Contractor when sub-contracting with sub-bidders filed pursuant to M.G.L. Chapter 149, Section 44F shall use the form for sub-contract in Chapter 149 Section 44F(4)(c).

4.3 Foreign Corporations: This Paragraph 4.3 applies to every contract with the Commonwealth, a county, city, town, district, board, commission, or other public body for the construction, reconstruction, alteration, remodeling, repair, or demolition of any public building or other public works.

4.3.1 The Contractor, if a foreign corporation, shall comply with M.G.L. Chapter 30, Section 39L.

4.4 Shoring: (Statutory reference: M.G.L. Chapter 149, Section 129A). This Paragraph 4.4 applies to every construction project carried on by any city, town, county, or other subdivision of the Commonwealth in which a trench is to be dug to a depth of five feet or more, except a trench for laying of water pipes dug to a depth of six and one-half feet which will be open less than 48 hours, and except for digging of graves.

4.4.1 Such trenches shall be shored and braced in conformity with rules and regulations for the prevention of accidents in construction operations, as adopted and enforced by the Attorney General.

4.5 Certification of Compliance with Tax Laws: (Statutory reference: M.G.L. Chapter 62C, Section 49A) This Paragraph 4.5 applies to contracts for goods or services furnished by any department, board, commission, division, authority, district or other agency of the Commonwealth or any subdivision of the Commonwealth, including a city, town or district.

4.5.1 By executing this contract, the Contractor certifies, under penalties of perjury, that to the best of his information, knowledge and belief he has complied with all laws of the Commonwealth relating to taxes.

4.6 Verification of Construction Debris Disposal: (Worcester Revised Ordinances Chapter 8, Section 7) This paragraph 4.6 shall apply to every contract entered into by the City of Worcester for the demolition, renovation, rehabilitation, or alteration of a building or structure.

- a. In furtherance of the requirements set forth in G.L. c.40, §54, and §114.1.3 of the State Building Code, the building commissioner shall require any person who obtains a permit for the demolition, renovation, rehabilitation, or alteration of a building or structure to provide verification that the debris resulting from such activities was disposed of at the licensed solid waste facility named in conjunction with the permit application.
- b. The verification required under sub-section (a), above, shall consist of the following:
 - 1) a dated receipt, signed by the owner/operator of the licensed solid waste disposal facility where the debris was deposited.
 - 2) the receipt shall contain a description of the debris disposed of, and its weight, or volume.
 - 3) the permit holder shall also provide the building commissioner with an affidavit that the receipt submitted is true and accurate to the best of the permit holder's knowledge.
 - 4) if the permit holder cannot dispose of the debris at the location indicated, it shall be the permit holder's obligation to obtain an amendment to the permit reflecting the new disposal location. The building commissioner shall be so notified, and the permit amended, prior to the disposal of the debris at the new disposal location.
- c. This section shall not apply to the construction of a new building or structure.

4.7 Responsible Employer Ordinance: (Worcester Revised Ordinances, Chapter 2, Section 35) This paragraph 4.7 shall apply to every contract entered into by the City of Worcester for the construction, reconstruction, installation, demolition, maintenance or repair of any building, where the contract amount is more than one hundred thousand dollars.

- a. The city council hereby finds and determines that taxpayer money is most efficiently and productively spent by awarding construction contracts to firms that include and enforce provisions requiring compliance with state laws governing the payment of prevailing wages, the provision of workers compensation coverage, and the proper classification of individuals as employees and not as independent contractors, as well as provisions concerning health insurance coverage and state-certified apprenticeship programs. The city council hereby further finds and determines that it is appropriate for it to exercise its entrepreneurial discretion by requiring firms that are awarded such contracts to comply with this ordinance because failure to comply is injurious to the life, health, and happiness of individuals employed by such firms and is deleterious to the quality of life in the city where most of such individuals reside.

- b. Every contract awarded by the city under G.L. c.149 and G.L. 149A shall be deemed to incorporate by reference the provisions of sub-parts (c)(1) through (8) of together with the provisions of subsections (d) and (e) of this section. Any person, company or corporation shall acknowledge, in writing, receipt of said requirements with their bid or proposal.
- c. All bidders or proposers and all subcontractors and trade contractors, including subcontractors that are not subject to G.L. c.149, Section 44F, under the bidder for projects subject to G.L. c.149, Section 44A(2), and proposers under G.L. c. 149A, shall as a condition for bidding or subcontracting verify under oath and in writing at the time of bidding or subcontracting verify under oath and in writing at the time of bidding or submittal in response to and RFP or in any event prior to entering into a subcontract at any tier, that they comply with the following conditions for bidding or subcontracting and, for the duration of the project, shall comply with the following obligations:

- 1) The bidder or proposer and all trade contractors and subcontractors under the bidder or proposer must comply with the obligations established under G.L. c. 149 to pay the appropriate lawful prevailing wage rates to their employees.

The bidder or proposer and all trade contractors and subcontractors under the bidder or proposer must at a the time of bidding maintain or participate in a bona fide apprentice training program as defined by G.L. c.23, Sections 11H and 11I for each apprenticable trade or occupation represented in their workforce that is approved by the Division of Apprentice Standards of the Department of Labor and Workforce Development, regardless of whether or not the program qualifies as an employee welfare benefit plan under ERISA, and must register all apprentices with the Division and abide by the apprentice to journeyman ratio for each trade prescribed therein in the performance of any work on the project. This provision does not require the program to be an ERISA plan; the program need only have been approved by the Division of Apprentice Standards. All general bidders or proposers and all trade contractors and sub-bidders at every tier must submit with its bid or proposal an original, stamped Sponsor Verification letter from the Commonwealth of Massachusetts, Department of Labor and Workforce Development – Division Apprentice Standards, issued within the past 90 days, evidencing that at the time of submitting a bid or proposal, the bidder or proposer is currently an Approved Sponsor of Apprentices. Any bid or proposal submitted without the above documentation shall be rejected; **{COMPLIANCE WITH THE APPRENTICE TRAINING PROVISION OF THE RESPONSIBLE EMPLOYER ORDINANCE IS CURRENTLY SUSPENDED}**

- 2) The bidder or proposer and all trade contractors and subcontractors under the bidder or proposer must maintain appropriate industrial accident insurance coverage for all the employees on the project in accordance with G.L. c. 152;

- 3) The bidder or proposer and all trade contractors and subcontractors under the bidder must properly classify employees as employees rather than independent contractors and treat them accordingly for purposes of workers' compensation insurance coverage, unemployment taxes, social security taxes and income tax withholding. (G.L. c.149, Section 148B on employee classification);
 - 4) The bidder or proposer and all trade contractors and subcontractors under the bidder or proposer must at the time of bidding certify that, at the time employees begin work at the worksite, all employees will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration, and shall ensure that all employees working at the worksite possess such qualifications at all times throughout the duration of their work on the project and furnish documentation of successful completion of the course;
 - 5) The bidder or proposer and all trade contractors and subcontractors under the bidder or proposer must be in compliance with the health and hospitalization requirements of the Massachusetts Health Care Reform law established by Chapter 58 of the Acts of 2006, as amended, and regulations promulgated under that statute by the Commonwealth Health Insurance Connector Authority.
 - 6) The bidder or proposer and all trade contractors and subcontractors under the bidder or proposer must make arrangements to ensure that each employee of every contractor entering or leaving the project individually completes the appropriate entries in a daily sign-in/out log. The sign-in/out log shall include: the location of the project; current date; printed employee name; signed employee name; and the time of each entry or exiting. The log shall contain a prominent notice that employees are entitled under state law to receive the prevailing wage rate for their work on the project. Such sign-in/out logs shall be provided to the City on a daily basis.
 - 7) The bidder or proposer and all trade contractors and subcontractors under the bidder or proposer, prior to bidding or, if not subject to bidding requirements, prior to performing any work on the project, shall sign under oath and provide to the City a certification that they are not debarred or otherwise prevented from bidding for or performing work on a public project in the Commonwealth of Massachusetts or in the City.
- d. A proposal or bid submitted by any general bidder or by any trade contractor or subcontractor under the general bidder or proposer that does not comply with any of the foregoing conditions for bidding shall be rejected, and no subcontract for work outside the scope of G.L. c.149, Section 44F shall be awarded to a subcontractor that does not comply with the foregoing conditions.
 - e. All bidders or proposers and all trade contractors and subcontractors under the bidder or proposer who are awarded or who otherwise obtain contracts on the projects subject to G.L. c.149, Section 44A(2) or c.149A, shall comply with each of the

obligations set forth in this Section 4.7 for the entire duration of their work on the project, and an officer of each bidder or subcontractor under the bidder shall certify under oath and in writing on a weekly basis that they are in compliance with such obligations.

- f. Any proposer, bidder, trade contractor or subcontractor under the bidder or proposer who fails to comply with any one of the obligations set forth in this Section 4.7 for any period of time shall be, at the sole discretion of the City, subject to one or more of the following sanctions:
 - 1) cessation of work on the project until compliance is obtained;
 - 2) withholding of payment due under any contract or subcontract until compliance is obtained;
 - 3) permanent removal from any further work on the project;
 - 4) liquidated damages payable to the City in the amount of 5% of the dollar value of the contract.
- g. In addition to the sanctions outlined in subsection (f) above, a proposer, general bidder or contractor shall be equally liable for the violations of its subcontractor with the exception of violations arising from work performed pursuant to subcontracts that are subject to G.L. c.149, Section 44F. Any contractor or subcontractor that has been determined by the City or by any court or agency to have violated any of the obligations set forth in this Section 4.7 shall be barred from performing any work on any future projects for six months for a first violation, three years for a second violation and permanently for a third violation.

4.8 Regulation of Construction Noise: (Worcester Revised Ordinances, Chapter 8, Section 34) This paragraph 4.8 shall apply to anyone operating powered construction equipment delivering construction equipment and/or supplies at any construction site or project within the city of Worcester.

- a. It shall be unlawful for any person, firm, corporation, partnership, or other entity to operate powered construction equipment or to build, erect, construct, demolish, alter, repair, excavate or engage in hoisting, grading, site work, including tree and brush removal, dredging or pneumatic hammering, or to deliver construction equipment and/or supplies to the site on any building, road, tower, parking lot, machine, pipe, sewer, sidewalk, or any other construction project (hereafter collectively the "construction project"), except between the hours of 7:00 a.m. and 9:00 p.m. on weekdays and Saturday, except for "emergency work" which is performed in the interest of public safety or welfare and for which a permit has been issued by the commissioner of public works and parks or the commissioner of inspectional services.

It shall be unlawful for any person, firm, corporation, partnership, or other entity to engage in a construction project activity on Sundays or legal holidays without a permit from the police chief issued pursuant to G.L. c. 136, Section 7 or 15 and a permit issued by the commissioner of inspectional services hereunder.

- b. Emergency work permits may be issued in:

- 1) cases of urgent necessity and for the interests of health, safety and convenience of the public. The commissioner of inspectional services shall whether the reasons given for the urgent necessity are valid and reasonable, and whether the health, safety and convenience of the public will be protected or better served by granting the permit requested and whether the manner and amount of loss or inconvenience to the party in interest imposes a significant hardship; or,
 - 2) cases where, because the location and nature of the work, the noise caused by said work will not be heard by anyone not working on the project. The commissioner of inspectional services shall consider whether supplying machinery and/or materials to the construction project site will cause unreasonable noise along the routes to the construction project site, and whether such activity will impact residential neighborhoods, and shall not grant any emergency work permit unless unreasonable noise in residential areas will be prevented.
- c. Emergency work permits may be issued to the general contractor on a blanket basis that applies to all of the contractors working on the job, or may be issued to specific contractors on the construction project, at the discretion of the Commissioner. Emergency work permits may be issued for not more than one week at a time, and may be renewed for additional one week periods at the discretion of the Commissioner.
 - d. Prior to issuing or reissuing said emergency work permit, the commissioner of inspectional services shall review the work being conducted and all attendant circumstances, and shall prescribe whatever limitations possible to minimize the generation of noise, and to minimize the impact of noise on the neighbors to the construction project.
 - e. Emergency repair work performed by the Department of Public Works and/or any public utility is exempt from this section.
 - f. The fee for each such Emergency work permits issued under this section shall be set in accordance with Chapter 2, § 24 of the City of Worcester Revised Ordinances of 2008.
 - g. On any project for the construction, reconstruction, installation, demolition, maintenance or repair of any building, or public work, to be funded in whole or in part by city funds, or funds which, in accordance with a federal or state grant, program, or otherwise, the city expends or administers, or any such project to which the city is a signatory to the contract therefor, the provisions of this section shall apply and the same shall be referred in every invitation to bid for such project and, the following paragraphs shall be contained in every resulting contract therefrom:

“It shall be a material breach of this contract if the contractor and each subcontractor shall not at all times adhere to the provisions of § 34 of chapter eight of the Revised Ordinances of the city, by limiting their on-site,

noise producing construction and related work to the hours specified by the Ordinance.

A waiver from the above requirements may, in certain circumstances, be granted in accordance with subsections (b), (c) and (d) of § 34 of chapter eight of the Revised Ordinances of the city.”

- h. The commissioner of inspectional services shall have the authority to adopt any rules and regulations he or she deems necessary to implement this section.
- i. Nothing in this section shall be deemed to prevent an individual from performing work on his or her own property, so long as the work is being done by the owner of the property or by direct relative(s) of the owner, and said work is not being done for profit.
- j. This section may be enforced by the commissioner of inspectional services, the building commissioner, the chief of police or their subordinates.
- k. Any violation of this section by any person, firm, corporation, partnership, or other entity, shall be individually punished with a fine of \$100.00. Each day upon which a violation of this section occurs shall be considered a separate violation. Employers shall be deemed the violator for violations committed by their employees.

4.9 Regulation of Excessive and Unreasonable Noise: (Worcester Revised Ordinances, Chapter 9, Section 1A(e)(9) This paragraph 4.9 shall apply to anyone operating powered construction equipment delivering construction equipment and/or supplies at any construction site or project within the city of Worcester.

- a. No person shall operate any powered construction equipment or build, erect, construct, demolish, alter, repair, excavate or engage in hoisting, grading, site work, including tree and brush removal, dredging or pneumatic hammering, or deliver construction equipment and/or supplies to the site on any building, road, tower, parking lot, machine, pipe, sewer, sidewalk, or any other construction project, except between the hours of 7:00 a.m. and 9:00 p.m. on weekdays and Saturday, and between the hours of 9:00 a.m. and 7:00 p.m. on Sundays, except for work performed by a public service or municipal utility department or “emergency work” performed with the express written permission of the commissioner of inspectional services or the commissioner of public works and parks. Emergency work shall be limited to such work that is clearly essential to respond to a sudden and unexpected threat to public health or public safety. Emergency work permission may be granted to a general or sub-contractor on a blanket basis governing all persons working on a specified portion of a particular job. Emergency work permission may be granted for not more than one week at a time, and may be renewed for additional one week periods at the discretion of the commissioner who granted the initial permission.

END OF SECTION

Document 00 31 32
GEOTECHNICAL DATA

1.1 SUMMARY

- A. Subsurface soil investigations had been made by Yankee Engineering and Testing, who reviewed the structural backfill at the existing school.
- B. They noted the existing structural fill is sufficient for the vestibule addition footings. The owner will retain and contract with a geotechnical/ soils testing firm to review the vestibule additions excavations, proof rolling, and compaction and provide a report.

End of Document



CITY OF WORCESTER
FORM FOR GENERAL BID

BIDDER'S NAME _____

This bid must be accompanied by a deposit in the form of cash, or bid bond, or a certified check, treasurer's check, or cashier's check, payable to the City of Worcester (hereinafter referred to as the "Owner", or the "Awarding Authority") in the amount of five (5) percent of the value of the bid. No other form of bid security will be accepted.

By submitting this bid the undersigned represents to the Owner that it has examined and understands the Advertisement for Bids, Instructions to Bidders, contract forms, Conditions of the Contract (General and Supplementary), Drawings, Specifications and all other Contract Documents and has examined the site, as defined therein, and that this bid is made with distinct reference and relation to all said Contract Documents; but the undersigned declares that in regard to the conditions affecting the work to be done and the labor and materials needed, this bid is based solely on its own investigation and research and not in reliance upon any drawings, surveys, measurements, dimensions, calculations, estimates, or other tests or representations of any employee, officer, agent or consultant of the Owner. By submitting this bid, the undersigned agrees that it shall be subject to the jurisdiction of the courts of the Commonwealth of Massachusetts with respect to any actions arising out of or related to this bid or any contract that may be entered into based upon this bid, and that any such actions commenced by the undersigned shall be commenced in the courts of the Commonwealth of Massachusetts.

A bidder wishing to amend this bid after transmittal to the Owner may do so only by withdrawing this bid and resubmitting another bid prior to the time for opening bids.

To the Awarding Authority: The City of Worcester, Massachusetts

- A. The undersigned proposes to furnish all labor and materials required for the Worcester Technical High School Tufts Vet Tech Renovation, Worcester, Massachusetts, in accordance with the accompanying Drawings, Specifications and Addenda, prepared by Lamoureux Pagano Associates | Architects Inc., 108 Grove Street, Suite 300, Worcester, MA 01605, for the contract price specified

below, subject to additions or deductions according to the terms of the Plans and Specifications.

B. This Bid includes Addenda numbered _____.

C. The Proposed Contract Price is (Total of Items 1 and 2):

_____ Dollars (\$_____)

D. Alternates None

E. Unit Prices None

F. Item 1: The work of the General Bidder, being all work other than that covered by Item 2:

_____ Dollars (\$_____)

G. Item 2: The work of Filed Sub-bidders. Fill in the name, sub-bid amount and bonding requirement of selected filed sub-bidders.

SUBTRADE SECTION	NAME OF SUB-BIDDER	SUB-BID AMOUNT	BONDS REQUIRED? "YES" OR "NO"
Division 04 Masonry			
Division 07 Roofing & Flashing			
Division 9 Acoustical Ceilings			
Division 9 Painting			
Division 9 Resilient Flooring			
Division 21 Fire Protection			
Division 22 Plumbing			
Division 23 HVAC			
Division 26 Electrical			
TOTAL ITEM 2			

- H. The undersigned agrees that the above named sub-bidders will be used for the work indicated at the amount stated, unless a substitution is made. The undersigned further agrees to pay the premiums of the performance and payment bonds furnished by sub-bidders as requested herein and that all the cost of such premium is included in the amount set forth in ITEM 1 of this bid.
- I. The undersigned agrees that, if he is selected as a General Contractor, he will promptly confer with the Awarding Authority on the question of the sub-bidder(s); and that the Awarding Authority may substitute for any Sub-Bid listed above a Sub-Bid filed with the Awarding Authority by another sub-bidder for the sub-trade against whose standing and ability the undersigned makes no objection; and that the undersigned will use all such finally selected sub-bidder(s) at the amount named in their work as if they had been originally named in this general bid, the total contract price being adjusted to conform thereto.
- J. The undersigned agrees that, if he is selected as General Contractor, he will within five (5) days, Saturdays, Sundays and legal holidays excluded, after presentation thereof by the Awarding Authority, execute a contract in accordance with the terms of this bid and furnish a performance bond and also a labor and materials or payment bond, each of a surety company qualified to do business under the laws of the Commonwealth of Massachusetts and satisfactory to the Awarding Authority and each in the sum of the contract price, the premiums for which are to be paid by the General Contractor and are included in the contract price.
- K. The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work and that he will comply fully with all laws and regulations applicable to awards made subject to Section 44A of Chapter 149 of the Massachusetts General Laws.
- L. The undersigned further certifies under penalties of perjury that this bid is in all respects bona-fide, fair and made without collusion or fraud with any other person. As used herein the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned further certifies under penalties of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of Section Twenty-nine F of Chapter Twenty-nine, or any other applicable debarment provisions of any other Chapter of the Massachusetts General Laws or any rule or regulation promulgated there under.
- M. The undersigned hereby certifies that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; and that they will comply fully with all laws and regulations applicable to awards made subject to M.G.L. c.149 sec.44A-J.

_____	_____
Date	Print Name of Bidder
_____	By _____
Social Security Number or Federal Identification Number	Name of Person Signing Bid and Title
_____	_____
Telephone Number	Business Street Address
_____	_____
	City, State and ZIP Code

E-Mail Address	

The Bidder shall fill in the following information about its business organization.

1. If the Bidder is a Corporation, indicate the state of incorporation.

President:	State of Incorporation:
Treasurer:	Secretary:
If a Foreign Corporation: (incorporated or organized under laws other than laws of the Commonwealth of Massachusetts)	Is the Corporation registered with the Secretary of State of Massachusetts? Yes _____ No _____
If the Bidder is selected for the work referred to above, it is required under Massachusetts General Laws, Chapter 30, Section 39L to furnish to the Awarding Authority a certificate of the Secretary of State stating that the Corporation has complied with Massachusetts General Laws, Chapter 181, Sections 3 and 5 and the date of such compliance.	

2. If the Bidder is a Partnership, give full names and addresses of all
partners:

Name of Partner:	Residence Address:
Name of Partner:	Residence Address:

Name of Partner:	Residence Address:
Name of Partner:	Residence Address:

3. If the Bidder is an Individual, give residential address if different from business address:

Name:	Residence Address:

4. If the Bidder is an Individual doing business under a Firm name:

Name of Firm:	Business Address:
Name of Individual:	Residence Address:

Other form of business organization:

- N. The Bidder will give below the name and address of the Surety Company who will sign the bonds.

Name:	Address:

END OF SECTION



CITY OF WORCESTER

FORM FOR SUB-BID

SUB-TRADE: _____

NAME OF SUB-BIDDER: _____

This bid must be accompanied by a bid deposit in the form of cash, or a bid bond, or a certified check, treasurer's check, or cashier's check, payable to the City of Worcester (hereinafter referred to as the "Owner" or the "Awarding Authority") in the amount of five (5) percent of the value of the bid. No other form of bid security will be accepted.

By submitting this bid the undersigned represents to the Owner that it has examined and understands the Advertisement for Bids, Instructions to Bidders, Contract Forms, Conditions of the Contract (General and Supplementary), Drawings, Specifications and all other Contract Documents and has examined the site, as defined therein, and that this bid is made with distinct reference and relation to all said Contract Documents, but the undersigned declares that in regard to the conditions affecting the work to be done and the labor and materials needed, this bid is based solely on its own investigation and research and not in reliance upon any drawings, surveys, measurements, dimensions, calculations, estimates, or other tests or representations of any employee, officer, agent or consultant of the Owner. By submitting this bid, the undersigned agrees that it shall be subject to the jurisdiction of the courts of the Commonwealth of Massachusetts with respect to any actions arising out of or relating to this bid or any contract that may be entered into based upon this bid, and that any such actions commenced by the undersigned shall be commenced in the courts of the Commonwealth of Massachusetts.

A bidder wishing to amend this bid after transmittal to the Owner may do so only by withdrawing this bid and resubmitting another bid prior to the time for opening bids. See: General Bid Form

To all General Bidders except those excluded:

- A. The undersigned proposes to furnish all labor and materials required for completing the Work specified in

Section No. _____

Section Name _____

of the Specifications for the Worcester Technical High School Tufts Vet Tech Clinic Renovation, Worcester, Massachusetts, in accordance with the accompanying Drawings, Specifications and Addenda, prepared by Lamoureux Pagano Associates | Architects, Inc., 108 Grove Street, Suite 300, Worcester, MA 01605, for the contract price specified below, subject to additions or deductions according to the terms of the Plans and Specifications.

B. This Bid includes Addenda numbered _____.

C. The Proposed Contract Price is:
_____ Dollars (\$_____)

C. Alternates & Unit Prices: None

D. To restrict General Bidders, insert "X" on one option only and fill in blanks following that selection. If no General Bidders are excluded disregard this item.

_____ **"RESTRICTED FROM"** – This Sub-bid may be used by any General Bidder except:

_____ **"RESTRICTED TO"** – This Sub-bid may be used only by the following General Bidders:

E. The names of all persons, firms and corporations furnishing to the undersigned labor or labor and materials for the class or classes or part thereof of work for which the provisions of the section of the specifications for this sub-trade require a listing in this paragraph, including the undersigned, if customarily furnished by persons on his own payroll and in the absence of a contrary provisions in the specifications, the name of each such class of work or part thereto and the bid price for such class of work or part thereof are:

NAME	CLASS OF WORK	BID PRICE

(Do not give bid price for any class or part thereof furnished by undersigned.)

- F. The undersigned agrees that, if he is selected as a sub-bidder, he will, within five (5) days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the general bidder selected as the general contractor, execute with such General Bidder a subcontract in accordance with the terms of this sub-bid, and contingent upon the execution of the general contract, and, if requested so to do in the general bid by such general bidder, who shall pay the premiums therefore, furnish a performance and payment bond of a surety company qualified to do business under the laws of the Commonwealth of Massachusetts and satisfactory to the awarding authority, in the full sum of the subcontract price.
- G. The undersigned agrees that the above list of bids to the undersigned represents bona-fide bids based on the hereinbefore described drawings, specifications and addenda and that, if the undersigned is awarded the contract, they will be used for the work indicated at the amounts stated, if satisfactory to the Awarding Authority.
- H. The undersigned further agrees to be bound to the General Contractor by the terms of the hereinbefore-described drawings, specifications, including all general conditions stated therein, and addenda, and to assume toward him all the obligations and responsibilities that he, by those documents, assumes toward the Owner.
- I. The undersigned offers the following information as evidence of his qualifications to perform the work as bid upon according to all requirements of the drawings and specifications:
1. The undersigned has been in the present business name _____ years.
 2. Has the undersigned ever failed to complete any work awarded? _____
 3. Provide a Bank Reference: _____
 4. List one or more recent project with names of the General Contractor and Architect on which you served as a Subcontractor for work of similar character as required for the above-named project.

PROJECT NAME	GENERAL CONTRACTOR	ARCHITECT	AMOUNT OF CONTRACT

- J. The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work and that he will comply fully with all laws and regulations applicable to awards made subject to Section 44A of Chapter 149 of the Massachusetts General Laws.
- K. The undersigned further certifies under penalties of perjury that this bid is in all respects bona-fide, fair and made without collusion or fraud with any other person. As used herein the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned further certifies under penalties of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of Section Twenty-nine F of Chapter Twenty-nine, or any other applicable debarment provisions of any other Chapter of the Massachusetts General Laws or any rule or regulation promulgated there under.
- L. The undersigned hereby certifies that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; and that they will comply fully with all laws and regulations applicable to awards made subject to M.G.L. c.149 sec.44A-J.

_____	_____
Date	Print Name of Bidder
_____	By _____
Social Security Number or Federal Identification Number	Name of Person Signing Bid and Title
_____	_____
Telephone Number	Business Street Address
_____	_____
E-Mail Address	City, State and ZIP Code

- M. The Bidder shall fill in the following information about its business organization.

1. If the Bidder is a Corporation, indicate the state of incorporation.

President:	State of Incorporation:
Treasurer:	Secretary:
If a Foreign Corporation: (incorporated or organized under laws other than laws of the Commonwealth of Massachusetts)	Is the Corporation registered with the Secretary of State of Massachusetts? Yes _____ No _____
If the Bidder is selected for the work referred to above, it is required under Massachusetts General Laws, Chapter 30, Section 39L to furnish to the Awarding Authority a certificate of the Secretary of State stating that the Corporation has complied with Massachusetts General Laws, Chapter 181, Sections 3 and 5 and the date of such compliance.	

2. If the Bidder is a Partnership, give full names and addresses of all partners:

Name of Partner:	Residence Address:
Name of Partner:	Residence Address:
Name of Partner:	Residence Address:
Name of Partner:	Residence Address:

3. If the Bidder is an Individual, give residential address if different from business address:

Name:	Residence Address:

4. If the Bidder is an Individual doing business under a Firm name:

Name of Firm:	Business Address:
Name of Individual:	Residence Address:

5. Other form of business organization:

N. The Bidder will give below the name and address of the Surety Company who will sign the bonds.

Name:	Address:

END OF SECTION

c. 149 Projects

OWNER-CONTRACTOR AGREEMENT

THIS AGREEMENT made on _____ 20____, at Worcester, in the County of Worcester, Commonwealth of Massachusetts by and between _____, (hereinafter called the Contractor) and the City of Worcester, a municipal corporation within said County of Worcester (hereinafter called the City).

WITNESSETH:

That the Contractor, in consideration of the payments hereinafter mentioned and of the fulfillment of the agreements herein mutually entered into, agrees with the City as follows:

SCOPE OF WORK:

(1) The Contractor shall, pursuant to the terms of this Agreement, provide all the supplies, materials and equipment, and perform all the labor, services and supervision necessary and proper to undertake and complete the _____, including Alternate(s)# _____ at _____ (hereinafter called the "Project") in the City of Worcester, Massachusetts, and to accomplish any and all work incidental thereto.

BONDS:

(2) The Contractor shall obtain and deposit with the City the following bond(s) in the amount of:

PERFORMANCE BOND: _____ Dollars and no cents
(\$_____.00)

PAYMENT BOND: _____ Dollars and no cents
(\$_____.00)

with sureties satisfactory to the Contracting Officer to (a) guarantee the faithful performance by the Contractor of all its obligations under this Agreement and (b) constitute the security required by Massachusetts General Laws Chapter 149, Section 29, and Chapter 30, Section 39A, as amended, for the payment by the Contractor and its subcontractors for all labor performed or furnished and for all materials used or employed in connection with this Agreement.

CONTRACTING OFFICER:

(3) (a) Wherever used in this Agreement the term "Contracting Officer" shall mean the City official so designated below, or the individual duly appointed by him/her for the performance of any of his/her functions or responsibilities under this Agreement. The work under this Agreement shall be carried out under the direction and subject to the approval and acceptance of Brian E. Allen, Superintendent, Worcester Public Schools (hereinafter called the Contracting Officer).

(b) Anything to the contrary in the preceding paragraph notwithstanding, the City's contract compliance officer is and shall be a designee of the Contracting Officer for all notices, demands, sanctions and other communications relative to such officer's administration, monitoring and enforcement of the City's Minority/Women Enterprise Program and the Responsible Employer Ordinance. Each and every communication from the contract compliance officer directly to the Contractor shall be validly delivered notwithstanding any other contrary provision of this Agreement or other Contract Documents.

INCORPORATED DOCUMENTS:

(4) The performance of this Agreement is subject to the provisions of the following documents, all of which are attached hereto and intended to be an integral part of this Agreement (hereinafter periodically and collectively referred to as "the Contract Documents").

- (a) Information to Bidders
- (b) Bid Proposal, dated _____, 20____.
- (c) Specifications and Related Drawings

The Contract Documents are to be read collectively and complementary to one another; any requirement under one shall be as binding as if required by all. In the event of any conflict or inconsistency between the provisions of this Agreement and any of the other Contract Documents, the provisions of this Agreement shall prevail. In the event of any conflict or inconsistency between this Agreement, the other Contract Documents and any applicable state law, the applicable statutory provisions shall prevail. The Contract Documents set forth the entire legal relationship and requirements of the parties, as well as the technical requirements of the Project, and as such constitute the Contract, as hereinafter referred to.

TIME FOR PERFORMANCE:

(5) Time is of the essence for this Agreement. The Work of this Agreement shall be substantially completed no later than February 19, 2027 from execution of the contract. Final completion of the Work of this Agreement shall be no later than 30 days after the date of substantial completion. The Date of Substantial Completion shall remain the same, as stated above, regardless of any alternate(s) chosen to be included in the Contract by the Owner.

PRICE:

(6) The City will pay the Contractor for all materials delivered or furnished and for all the work performed pursuant to Article (1) hereof a sum of money as follows:

_____ Dollars and no cents (\$_____.00)

PAYMENT:

(7) Payment to the Contractor shall be made by the City in accordance with General Laws Chapter 30, Section 39K, as amended, which is included in the Supplementary General Conditions to the Contract.

(a) The payment shall be in full for furnishing all materials, supplies, labor, services, supervision, tools and equipment and the use thereof as embraced under the Agreement, and except as may be provided under Article (10)(d), shall also constitute the payment for all loss or damage to the Contractor arising out of the nature of the work or from the action of the elements or from any unforeseen difficulties or obstructions which may arise or be encountered during the execution of the work until its final approval by the Contracting Officer, and for all risks to the Contractor of every description connected with the execution of the work or infringement of patents, trade marks, or copyrights and for completing the work in an acceptable manner.

(b) The payment of any periodic estimate or of any retained percentage shall in no way constitute an acceptance of the work or in no way prejudice or affect the obligation of the Contractor at his own cost or expense to repair, correct, renew, or replace any defects or imperfections in the construction as well as all damages due or attributable to such defects, nor shall any such payment for any current estimate or of any retained percentages prejudice or affect the rights of the City to hold the Contractor liable for breach of contract or to avail itself of the remedies under Article (15), hereof.

(c) If at any time there shall be evidence of any lien or other claim for which, if established, the City may become liable, directly or indirectly, and which is chargeable to the Contractor, the City may retain out of any payment then due or thereafter to become due, an amount sufficient to completely indemnify it against any such claim. If there prove to be any such claims after all the payments are made, the Contractor shall refund to the City all moneys that the City pays in discharging such claim in consequence of the Contractor's default.

(d) The Contractor, and each subcontractor, at every tier, to the Contractor, represents, warrants and certifies that it has complied with all laws of the Commonwealth of Massachusetts relating to taxes and all Ordinances and Orders of the City of Worcester relating to taxes, fees and charges, or is lawfully contesting the validity of the same. The Contractor, and each subcontractor, at every tier, further represents, warrants and certifies that it will remain in such compliance during the term of this Agreement, including any amendments or extensions hereto. Breach of any of these provisions shall be deemed a material breach which shall entitle the City to immediately terminate this Agreement and take any other action authorized by law to collect any amounts due the City.

PAYMENT OF SUBCONTRACTORS:

(8) Payment to subcontractors shall be made in accordance with General Laws Chapter 30, Section 39F, as amended, which is included in the Supplementary General Conditions.

NOTICE:

(9) Wherever in this Agreement the City is to give or receive a notice, the Contracting Officer as defined in Article (3) shall be the City's Agent for such purpose.

PERFORMANCE:

(10) (a) The Contractor shall give his personal attention constantly to the faithful execution of the work and shall keep the same under his personal control. He shall not assign by power of attorney, or otherwise, the work or any part thereof without the previous written consent of the Contracting Officer. He shall not either legally or equitably assign any of the moneys payable under this Agreement or any claim thereto unless by and with like consent on the part of the Contracting Officer and the City Treasurer. He shall be responsible for all the acts and omissions of his employees and of all persons directly or indirectly employed by him in connection with the execution of this work.

(b) The Contractor shall provide sufficient and proper facilities at all times for the inspection of the work by the City. He shall, after receiving written notice that certain work or construction is improper, unsafe or defective or that such construction in any way fails to conform to the Contract Documents, forthwith remove such unsafe or defective construction and reconstruct the same in a manner satisfactory to the Contracting Officer. Upon failure of the Contractor to remedy the construction after being so notified, the Contracting Officer in accordance with Article 3.4.1 of the General Conditions may cause such defective work to be remedied or replaced and the City may deduct the cost thereof from any moneys due or to become due the Contractor.

(c) The City, acting through the Contracting Officer, or the project Architect, shall have the authority to suspend the work wholly or any part thereof for such period as deemed necessary due to failure of the Contractor to carry out orders given or to perform any provision of the Agreement. Upon receipt of written order from the Contracting Officer or Architect, the Contractor shall immediately suspend the work or such part thereof in accordance with the order. No work shall be suspended without the written permission of the Contracting Officer or Architect. The work shall be resumed when conditions so warrant or deficiencies have been corrected and the condition of the Contract satisfied as ordered or approved in writing by the Contracting Officer or Architect. No allowance of any kind will be made for suspension of work by order of the Contracting Officer or Architect pursuant to this paragraph.

(d) Any request for an adjustment in the contract price by the Contractor or the City, due to differing subsurface or latent physical conditions, shall be governed by the provisions of General Laws Chapter 30, section 39N, as amended, which is included in the Supplementary General Conditions.

(e) The Contractor agrees that it shall have no claim for damages of any kind on account of any delay in commencement of the work. Post commencement, the Contractor shall have no claim for damages of any kind on account of any delay or suspension of any portion of the work except as hereinafter provided. Adjustments, if any, in the contract price due to a suspension, delay, interruption or failure to act by the City shall be governed by the provisions of General Laws Chapter 30, section 39(O), as amended, which is included in the Supplementary General Conditions. Provided, however, the provisions of this paragraph shall not apply to any suspension pursuant to Section (10)(c), or for any suspension, delay, interruption or failure to act to the extent that such is due to any cause for which this Agreement provides for an equitable adjustment of the contract price, or time, under any other provision. Provided, further, that no adjustment shall be made if the performance of the Contractor would have been prevented by other causes, even if the work had not been so suspended, delayed or interrupted by the City. Provided, further, that a subcontractor shall have the same rights against the Contractor for payment for an increase in the cost of his performance as the provisions of this paragraph gives the Contractor against the City, but nothing herein shall in any way change, modify or alter any other rights which the Contractor and subcontractor may have against each other.

(f) The City may award other contracts for additional work. The Contractor shall cooperate fully with other contractors and carefully fit his own work to that of other contracts as may be directed by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor.

(g) The Contractor shall comply with all the laws, state and federal, applicable to the work and construction provided for herein. This Agreement is made subject to all laws, state and federal; and if any clause hereof does not conform to such law, then such clause shall be void and the law operative shall be inserted in lieu thereof. Any violation by the Contractor of state or federal laws relating to the employment of labor upon the work or the construction contemplated by this Agreement shall be a sufficient cause for the City to cancel the Agreement without in any way being liable in damages therefor. Should the City cancel the Agreement because of the failure on the part of the Contractor to observe the state or federal laws, or the rules and regulations relating to employment of labor upon the work herein contemplated, then upon cancellation the City reserves all rights and benefits herein or by law provided against the Contractor for the breach of the conditions of this Agreement.

(h) It shall be a material breach of this Agreement if the Contractor and each subcontractor shall not at all times adhere to the provision of § 1A(e)(9) of chapter nine of the Revised Ordinances of the city by limiting their on-site, noise producing construction and related work to the hours specified by said ordinance.

(i) When the use of explosives is necessary for the execution of the work, the Contractor shall take the utmost care not to endanger life and property. Whenever directed, the number and size of the charges shall be reduced. All explosives shall be stored in a secure manner. All such storage places shall be marked clearly "DANGEROUS-EXPLOSIVES", and shall be in the care of competent watchmen at all times. The method of storage and handling explosives and highly inflammable materials shall conform to all the state laws and regulations, as well as any local requirements.

(j) Upon the completion of the work the Contractor shall, at his own expense, remove all equipment, temporary Contractor's buildings and sheds, fencing, rubbish and waste material in and about the area that has been worked and he shall leave the premises and the work performed all in a neat and proper condition.

(k) Before commencing the work the Contractor shall, if required, submit a schedule of operations for approval of the Contracting Officer or Architect. The schedule shall show the methods and order of operations that the Contractor proposes to use. The approval of the schedule by the Contracting Officer or Architect shall not be construed as relieving the Contractor from any responsibility.

(l) Should the Contractor be obstructed or delayed in the execution of the work as a result of damage which may be caused by lightning, earthquake, rain, storm, or cyclone, then the time fixed for completion may be extended for a period equivalent to the time lost by reason of any of the foregoing causes. No such extension shall be made unless a claim therefor is presented in writing to the Contracting Officer within forty-eight (48) hours of the occurrence of such delay. The Contractor shall have no claim against the City for damages on account of such delay. The duration of the extension itself must be certified to by the Contracting Officer or Architect.

ADDITIONAL WORK:

(11) (a) The Contractor agrees to perform any work related to the subject matter of the Contract, but not within its original scope, upon written order of the Contracting Officer or Architect, the payment for such extra work to be made in accordance with whichever of the following methods the Contracting Officer elects: (i) a price agreed upon between the parties and stipulated in the order for the extra work; or (ii) a price based on the unit prices of the contract; or (iii) a price determined to be the reasonable cost of the extra work as computed by the Contracting Officer in accordance with paragraph (b) below.

(b) In computing reasonable cost for the purposes of (iii) above, the Contracting Officer shall include the reasonable cost to the Contractor,

(i) of the cost of prevailing rates for direct labor, material, and use of equipment;

(ii) plus the cost of worker's compensation insurance, liability insurance, federal Social Security insurance, and Massachusetts unemployment compensation insurance or, as an alternative, the Contractor may elect to use a flat twenty-five percent (25%) of the total labor rate in (a);

(iii) plus ten percent (10%) of the total labor rate in (a) for overhead, superintendence and profit, which will be paid to the Contractor for Item 1 work, which is the work of the Contractor and all its non-filed subcontractors. On Item 2 work, which is the work of filed subcontractors, this ten percent (10%) will be allowed only to the filed subcontractor and is not applicable to any Paragraph E sub-subcontractors. The Contractor or the filed subcontractor, as the case may be, shall agree upon the distribution of the ten percent (10%) to their respective subcontractors as a matter of contract therewith;

(iv) for work performed by a filed subcontractor, the Contractor shall accept an additional five percent (5%) of the filed subcontractor's price (less the 10% mark-up), as full compensation for processing forms and assuming full responsibility for the faithful performance of such work by the filed subcontractor(s);

(v) plus actual direct premium costs of payment and performance bonds required of the Contractor and filed subcontractors, provided there will be an appropriate credit for premiums for a credit change order; and

(vi) if the extra work requires the use of heavy equipment, cranes and hoisting equipment, machinery, and special tools not on site and not originally required to be used upon the work, then the cost of transportation to and from the work site, not exceeding 100 miles, shall be included. The cost of extra work shall not include any cost or rental of small tools, buildings, or any portion of the time of Contractor's management or office personnel, or any allowance for use of capital.

(c) The Contracting Officer or Architect may make alterations in the line, grade, plan, form, dimensions, or materials of the subject matter of the Contract, or any part thereof, either before or after commencement of construction. Where such alterations increase the quantity or standard of the work to be done, payment for such increase shall be made in the same way that payment is made for extra work under (a) and (b) above. Where such alterations diminish the quantity or standard of the work to be done, an adjustment shall be made to the benefit of the City based upon the unit prices where used or, where unit prices are not used, as the Contracting Officer shall determine.

EMPLOYMENT:

(12) (a) The Contractor shall employ competent workers and if notified by the Contracting Officer, in writing, that any person engaged upon the work is incompetent, unfaithful, disorderly or otherwise unsatisfactory, then such worker shall be discharged from the work.

(b) In the performance of this Agreement, the Contractor shall comply with the provisions of Worcester Revised Ordinances Chapter 2, Section 35 as amended, which are included in the Supplemental General Conditions to the Contract.

(c) The parties shall comply with the provisions of section 179A of Chapter 149 of the Gen. Laws (Ter. Ed.). Notwithstanding any provisions to the contrary contained in the General or Supplemental Conditions to the Contract, in the employment of persons including mechanics, teamsters, chauffeurs and laborers, under this Contract, preference shall be given:

First:	To citizens of the Commonwealth who are residents of the City of Worcester and who have served in the Armed Forces of the United States in time of war and have been honorably discharged therefrom or released from active duty therein, and who are qualified to perform the work to which the employment relates.
Second:	To citizens of the Commonwealth who are residents of the City of Worcester and are qualified to perform the work to which the employment relates.

- Third: To citizens of the Commonwealth who have served in the Armed Forces of the United States in time of war and have been honorably discharged therefrom or released from active duty therein and who are qualified to perform the work to which the employment relates.
- Fourth: To citizens of the Commonwealth generally.
- Fifth: To citizens of the United States.

The foregoing provisions shall not apply to those persons employed in a supervisory capacity. In so far as practicable preference is to be given Worcester Truckers in hauling materials.

(d) No laborer, worker, mechanic, foreman, or inspector working within the Commonwealth of Massachusetts in the employ of the Contractor, sub-contractors, or other persons doing or contracting to do the whole or part of the work contemplated by this Agreement, shall be required or permitted to work more than eight (8) hours in any one (1) calendar day; or more than forty-eight (48) hours in one (1) week, or more than six (6) days in any one (1) week in full compliance with provisions of G.L. c. 149, s. 34, except in cases of emergency.

(e) Every employee in the work covered by the Contract shall lodge, board and trade where and with whom he elects and neither the Contractor nor his agents or employees shall directly or indirectly require as a condition of employment therein that an employee shall lodge, board or trade at a particular place or with a particular person.

(f) The Contractor shall provide and maintain in a neat and sanitary condition such accommodations for the use of his employees as may be necessary to comply with the requirements of the Department of Public Health, local health officials or of other appropriate authorities. The maintenance of all sanitary facilities shall be subject to the laws of the Commonwealth and to the rules and regulations of the State Board of Health and of the Commissioner of Public Health for the City of Worcester.

(g) The Contractor shall, before commencing the work, provide by insurance for the payment of compensation and the furnishing of other benefits under Chapter 152 of the General Laws to all persons employed under the Agreement, and he shall continue such insurance in force and effect during the term hereof. The City may require the Contractor to deliver certificates of insurance as sufficient proof of compliance with the foregoing. Failure to provide and continue in force such insurance as aforesaid shall be deemed a material breach of the Agreement and shall entitle the City to terminate the Agreement without in any way being liable in damages therefor.

(h) The Contractor shall keep a true and accurate register of all mechanics, teamsters, chauffeurs and laborers employed upon the work contemplated by this Contract, showing the name, address and occupational classification of each such employee, the hours worked by and the wages paid to each such employee, and shall furnish the Massachusetts Department of Labor and Industries, upon its request, a true statement thereof.

(i) Minimum wage rates under the provisions of General Laws chapter 149, section 27, as amended, have been determined by the Commissioner of Labor and Industries for the Commonwealth, and the Contractor shall in the payment of wages be bound by them

during the life of the Agreement. The applicable schedule of minimum wage rates, as so determined, are incorporated elsewhere within the Contract Documents.

TERMINATION:

(13) (a) If the Contractor shall be adjudged as bankrupt, or if he shall make a general assignment for the benefit of his creditors, or if a receiver of his property shall be appointed, or if the work to be done under the Agreement shall be abandoned, or if the Agreement or any part of shall be sublet without the previous written consent of the Contracting Officer, or if the Contract or any claim hereunder shall be assigned by the Contractor otherwise than as herein specified, or if at any time the Contracting Officer shall be of the opinion that the work, or any part thereof, is unnecessarily or unreasonably delayed, or that the Contractor has violated any of the provisions of the Agreement, the Contracting Officer, for and in behalf of the City, may notify the Contractor to discontinue all work, or any part thereof; and thereupon the Contractor shall discontinue such work or such part thereof as the Contracting Officer may designate, remove his equipment, tools, supplies and materials as the Contracting Officer directs, and the City may thereupon, by contract or otherwise, as it may determine, complete the work, or such part thereof, and charge the entire expense of so completing the work or any part thereof to the Contractor.

(b) If the Contracting Officer or Architect shall certify by written notice to the Contractor that the rate of progress is not satisfactory, the City may, instead of notifying the Contractor to discontinue all of the work or any part thereof, notify him from time to time to increase the force, equipment and plant, or any of them, employed on the whole or any part of the work, stating the amount of increase required. Unless the Contractor shall, within seven (7) work days after such notice, increase his force, equipment and plant to the extent required therein, and maintain and employ the same from day to day until the completion of the work or such part thereof or until the conditions as to the rate of progress shall, in the opinion of the Contracting Officer or Architect, be fulfilled, the City may employ and direct the labors of such additional force, equipment and plant as may, in the opinion of the Contracting Officer or Architect, be necessary to ensure the completion of the work or such part thereof within the time specified or at the earliest possible date thereafter, and charge the expense thereof to the Contractor. Neither the notice from the Contracting Officer or Architect to the Contractor to increase his force, equipment or plant nor the employment of additional force, equipment or plant by the City shall be held to prevent a subsequent notice to the Contractor from the City to discontinue the work under the provisions of the preceding portion of this Article.

(c) All expenses charged under this Article shall be deducted by the City out of moneys then due or to become due the Contractor under this Agreement, or any part hereof. In such accounting the City shall not be obligated to obtain the lowest figures for the work of completing the contract or any part thereof, or for insuring its proper completion, and all sums actually paid by the City shall be charged to the Contractor. If the expense so charged is greater than the sum which would have been payable under the Agreement, if the same had been completed by the Contractor, then the Contractor shall pay the amount of the excess to the City upon completion of the work and without further demand being made therefor.

(d) The Contractor shall not be relieved of liability to the City by virtue of any termination of this Agreement and any claim for damages against the Contractor relating to the Contractor's performance hereunder shall survive any termination hereunder.

GUARANTEES:

(14) (a) The Contractor guarantees the work under this Contract and the materials furnished by him for use in connection therewith to be free from defects or flaws for one (1) year after the completion of the work, unless a greater period of time is prescribe by law, or by terms of any special guarantee required under any other provisions of the Contract Documents. It is expressly understood, however, that this guarantee provision shall not absolve the Contractor from any liability to the City arising out of a failure to substantially comply with the terms of the Agreement.

(b) If at any time within said guaranty period, any part of the work constructed under the terms of this Agreement shall, in the opinion of the Contracting Officer or Architect, require repairing due to defective work or materials furnished by the Contractor, he may notify the Contractor in writing to make the required repairs. If the Contractor shall neglect to start such repairs within ten (10) work days of the date of giving him notice thereof and to complete the same to the satisfaction of the Contracting Officer or Architect with reasonable dispatch, then the latter may employ other persons to make such repairs. The City shall charge the expense thereof to the Contractor and may use any moneys still retained to pay for the same, and if such sum is insufficient, the Contractor shall be obligated to pay the balance thereof.

INDEMNIFICATION:

(15) (a) The Contractor shall indemnify and save harmless the City of Worcester and all of its officers, agents and employees against all suits, claims or liability of every name, nature, and description arising out of or in consequence of the acts or omissions of the Contractor in the performance of the work covered by the Agreement and/or his failure to comply with the terms and conditions hereof, and will at his own cost and expense defend any and all such suits and actions.

(b) The Contractor shall bear all losses resulting from the use or storage of explosives and highly inflammable materials, and shall save the City harmless from all claims for bodily injuries or death to any person and from all claims for property damage or destruction arising out of the use or storage of explosives and highly inflammable materials.

(c) The Contractor further covenants to hold and save the City, its officers, servants and employees harmless from and against all and every demand or demands, of any nature or kind for or on account of the use of any patented invention, article or appliance included in the materials and equipment agreed to be furnished, supplied or used under this Agreement.

INSURANCE:

(16) (a) The Contractor shall carry public liability insurance with an insurance company satisfactory to the City so as to save the City harmless from any and all claims for

damages arising out of bodily injury to, or death of, any person or persons and for all claims for damages arising out of injury to, or destruction of, property caused by accidents resulting from the use of implements, equipment or labor used in the performance of the Agreement or from any neglect, default omission or want of proper care or misconduct on the part of the Contractor or of any one in his employ during the execution of the work. Such insurance shall include coverage for blasting and explosion, if explosives are to be used.

(b) The Contractor shall carry any other types of insurance as may be required elsewhere in the Contract Documents. All insurance policies required in the Contract Documents shall be provided by companies satisfactory to the City.

(c) Prior to starting work under this Agreement, the Contractor shall deposit, with the City's Law Department, certificates from the insurers to the effect that the insurance policies required in the above paragraphs have been issued to the Contractor. The certificates must be on a form satisfactory to the Law Department.

(d) Unless greater amounts of insurance coverage are required elsewhere in the Contract Documents, the amounts of such public liability insurance shall not be less than the minimum amounts set forth below:

- (1) Workmen's Compensation –Massachusetts Statutory / Employers Liability
- (2) Commercial Liability- Per Occurrence / Aggregate \$1,000,000 / \$2,000,000
- (3) Automobile Liability/Combined Single Limit - \$2,000,000 (all owned, hired and non-owned autos).
- (4) Excess / Umbrella Liability –\$2,000,000
- (5) Independent Contractors -Same limits as above
- (6) Products and Completed Operations -Same limits as above commencing with issuance of final Certificate of Payment.
- (7) Contractual Liability - Same limits as above.

(e) Unless greater amounts of insurance coverage are required elsewhere in the Contract Documents, the Contractor shall also carry bodily injury and property damage insurance in amounts not less than those set forth above, covering the operation of all motor vehicles owned by the Contractor and engaged in this work.

(f) No cancellation of any insurance whether by the insurer or by the insured shall be effective unless written notice thereof is given to the City at least fifteen (15) days prior to the intended effective date thereof, which date has been expressed in the notice. Prior to the effective date of any such cancellation the Contractor shall take out new insurance to cover the policies so cancelled. The Insurance Companies shall remain liable, however, until new and satisfactory insurance policies have been delivered to, and accepted by, the City.

CONFLICT OF INTEREST:

(17) (a) The Contractor warrants that he has complied with all provisions of law regarding the award of this Contract and that he, or his employees, agents, officers,

directors or trustees have not offered or attempted to offer anything of any value to any employee of the City in connection herewith.

(b) The Contractor further warrants that no elected official or employee of the City of Worcester, including unpaid members of City boards and commissions, serves as an officer, director, trustee or employee of Contractor, and that no elected officials or employees of the City of Worcester have or will have a direct or indirect financial interest in this Agreement. The foregoing shall not apply, however, if the Contractor qualifies for an exemption and complies with the applicable disclosure provision(s) under G. L. c. 268A.

(c) Violation of this Article shall be a material breach of this Agreement and shall be grounds for immediate termination hereof by the City without regard to any enforcement activities undertaken or completed by any enforcement agency. Termination of this Agreement pursuant to this Article shall not waive any claims for damages the City may have against the Contractor resulting from the Contractor's violation of the terms of this Article.

SEVERABILITY:

(18) If any provision of this Agreement is held invalid by any court or body of competent jurisdiction, the remainder of this Contract shall remain in full force and effect.

HEADINGS:

(19) The section headings in this Agreement are for convenience and reference only and in no way define or limit the scope or content of this Agreement or in any way affect its provisions.

AMENDMENTS:

(20) This Agreement may be amended or modified only by written instrument duly executed by the parties.

ENTIRE AGREEMENT:

(21) This Agreement contains the entire understanding of the parties and supercedes all prior agreements, representations, proposals and undertakings of the parties.

IN WITNESS WHEREOF the Contractor has hereunto set his hand and seal and the City has caused its corporate seal to be hereto affixed and this Agreement to be executed in its name and behalf by a duly authorized officer thereof the day and year first above written.

CITY OF WORCESTER

RECOMMENDED:

CONTRACTOR

Brian E. Allen
Superintendent
Worcester Public Schools

BY: _____(SEAL)

APPROVED AS TO LEGAL FORM:

CERTIFICATION OF FUNDING

I certify that an appropriation of funds in
the amount of this Agreement is contained
in account number

_____.

Robert V. Stearns
City Auditor

APPROVED:

Eric D. Batista
City Manager

PAYMENT BOND

KNOW ALL BY THESE PRESENTS, that _____, a _____ corporation duly established by law and having a usual place of business at _____, as PRINCIPAL, and _____, a corporation organized under the laws of the State or Commonwealth of _____, and duly authorized and admitted, under the provisions of Chapter 175 of the Massachusetts General Laws, as amended, to transact the business of a fidelity and surety company in Massachusetts, as SURETY, are held and firmly bound unto the City of Worcester, a municipal corporation within the Commonwealth of Massachusetts, in the sum of _____ Dollars and no cents (\$_____.00) lawful money of the United States of America, to be paid to the City of Worcester, its successors and assigns, to the payment of which, well and truly to be made, the PRINCIPAL and the SURETY bind themselves, their respective heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the said PRINCIPAL has entered into an Agreement of even date herewith with the City of Worcester, said Agreement being for the _____ at _____ in the City of Worcester, Massachusetts;

NOW THEREFORE, the condition of this obligation is such that if the PRINCIPAL shall pay for all labor performed or furnished and for all materials used or employed or any appliance and equipment used or employed or rented or hired out in the execution of said Agreement and in any and all duly authorized modifications, alterations, extensions of time, changes or additions to said Agreement that may hereafter be made, notice to the SURETY of such modifications, alterations, extensions of time, changes or additions being hereby waived, the foregoing to include any other purposes or items set out in, and to be subject to, the provisions of Massachusetts General Laws, Chapter 149, Section 29 and Chapter 30, Section 39A, as amended, then this obligation shall become null and void; otherwise it shall remain in full force and virtue.

IN TESTIMONY WHEREOF, the PRINCIPAL has hereunto caused its name and seal to be affixed, and the SURETY has caused its corporate seal to be hereunto affixed by a duly authorized officer thereof and this instrument to be executed and delivered in its name and behalf by its attorney-in-fact, duly authorized by its by-laws and votes, powers of attorney, and letters of appointment and authorization, certificated copies of which documents are annexed to this bond and may be introduced in evidence as if a part hereof.

(PRINCIPAL) _____ (SEAL)

By: _____

(SURETY) _____ (SEAL)

Attorney-in-Fact

PERFORMANCE BOND

KNOW ALL BY THESE PRESENTS, that _____, a _____ corporation duly established by law and having a usual place of business at _____ as PRINCIPAL, and _____, a corporation organized under the laws of the State or Commonwealth of _____, and duly authorized and admitted, under the provisions of Chapter 175 of the Massachusetts General Laws, as amended, to transact the business of a fidelity and surety company in Massachusetts, as SURETY, are held and firmly bound unto the City of Worcester, a municipal corporation within said Commonwealth of Massachusetts, in the sum of \$ _____ Dollars and no cents (\$ _____ .00) lawful money of the United States of America, to be paid to said City of Worcester, its successors and assigns, to the payment of which, well and truly to be made, the PRINCIPAL and the SURETY bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the said PRINCIPAL has entered into an Agreement of even date herewith with the City of Worcester, said Agreement being for the _____, inclusive, at _____ in the City of Worcester, Massachusetts;

NOW THEREFORE, the condition of this obligation is such that if the said PRINCIPAL shall well and faithfully perform all the terms and conditions of said Agreement on its part to be kept and performed as therein stipulated, including guarantee and maintenance provisions therein, and shall pay for all materials furnished and for all labor performed in the execution of said Agreement, and shall indemnify and save harmless the said City of Worcester as therein stipulated, then this obligation shall be of no effect; otherwise it shall remain in full force and virtue.

And the said SURETY, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of said Agreement, or to the work to be performed thereunder, or to the specifications accompanying the same, shall in any way effect its obligation on this bond; and it does hereby waive notice of any change, extension of time, alterations or additions to the terms of said Agreement, or to the work, or to the specifications.

In the event that the Agreement is abandoned by the Contractor, or is terminated by the City of Worcester, under the provisions thereof, said SURETY hereby further agrees that it shall, if requested in writing by the City of Worcester, take such action as is necessary to complete said Agreement.

IN TESTIMONY WHEREOF, the PRINCIPAL has hereunto caused its name and seal to be affixed, and the SURETY has caused its corporate seal to be hereunto affixed by a duly authorized officer thereof and this instrument to be executed and delivered in its name and behalf by its attorney-in-fact, duly authorized by its by-laws and votes, powers of attorney, and letters of appointment and authorization, certificated copies of which documents are annexed to this bond and may be introduced in evidence as if a part hereof.

(PRINCIPAL) _____ (SEAL)

By: _____

(SURETY) _____ (SEAL)

Attorney-in-Fact

STATE LAW NOW MANDATES THAT TO DO BUSINESS WITH THE CITY OF WORCESTER the Massachusetts Revenue Enforcement and Protection Program of 1983 requires that the following be supplied:

DATE: _____

Pursuant to Mass. G.L. c. 62C, Section 49A, I Certify under the Penalties of Perjury That I, To My Best Knowledge and Belief, Have Filed All Massachusetts State Tax Returns and Paid ALL Massachusetts State and City Taxes Required under Law.

Company Name _____

Street & No. _____

Signature of Individual
or
Corporate Officer
(if applicable)

City or Town _____ Tel No. _____

STATE _____ Zip Code _____

SOCIAL SECURITY NUMBER
OR
FEDERAL IDENTIFICATION NUMBER

CERTIFICATE OF VOTE OF AUTHORIZATION

Date _____

I hereby certify that at a meeting of the Board of Directors of:

_____ duly called and held on the _____ day of _____, 20____, at which time it was voted that _____ (name), _____ (title) be and hereby is authorized to execute and deliver for and in behalf of the corporation, a contract with the City of Worcester for _____ (the "Project") in the City of Worcester and, as Principal to execute a Performance Bond and Labor and Materials Bond in connection therewith, which Contract and Bonds were presented to and made a part of the records of said meeting.

I further certify that _____ is the duly qualified and acting _____ of the Corporation and that said vote has not been repealed, rescinded or amended.

A true copy of the record,

ATTEST

Clerk of the Corporation

(Corporate Seal)

Sworn to and subscribed to me this ____ day of _____, 20____.

Notary Public
My Commission Expires:

Certificate of Acknowledgement of Contractor if a Corporation

for AGREEMENT

State of _____)

ss

County of _____)

On this ____ day of _____, 20____, before me personally came _____ to me known, who being by me duly sworn, did depose and say as follows:

That he/she resides at _____

and is the _____ (title) of _____,

the corporation described in and which executed the foregoing instrument; that he/she knows the corporate seal of said corporation; that the seal affixed to the foregoing instrument is such corporate seal and it was so affixed by order of the Board of Directors of said corporation; and that by the like order he/she signed thereto his/her name and official designation.

Notary Public (Seal)

My Commission Expires: _____

Certificate of Acknowledgment of Contractor if a Corporation

FOR CONTRACT BONDS

State of _____)

ss

County of _____)

On this ____ day of _____, 20____, before me personally came
_____ to me known, who being by me duly sworn, did depose and
say as follows:

That he/she resides at

and is the _____ (title) of _____,
the corporation described in and which executed the foregoing instrument; that he/she
knows the corporate seal of said corporation; that the seal affixed to the foregoing
instrument is such corporate seal and it was so affixed by order of the Board of Directors
of said corporation; and that by the like order he/she signed thereto his/her name and
official designation.

Notary Public (Seal)

My Commission Expires: _____

END OF SECTION 00600

Document 00 63 25
SUBSTITUTION REQUEST FORM

Project: _____ Architect's Project Number: _____

To: _____ Substitution Request Number: _____

Re: _____ Date: _____
_____ From: _____
_____ Contract For: _____

Section Title: _____ Description: _____
Section No.: _____ Page: _____ Article/Paragraph: _____

Proposed substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No./Color: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New Product ☐ 1 – 4 years old ☐ 5 – 10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

☐ Point-by-point comparative data attached – REQUIRED BY ARCHITECT

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

Savings to Owner for accepting substitution: _____ (\$ _____).

Proposed substitution changes Contract Time: _____ ☐ No ☐ Yes [Add] [Deduct]
days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests
☐ Reports ☐ Sustainability

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be correct in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: _____

ARCHITECT'S REVIEW AND ACTION

- ☐ Substitution approved – Make submittals per Division 01 Section "Substitution Procedures."
☐ Substitution approved as noted – Make submittals per Division 01 Section "Substitution Procedures."
☐ Substitution rejected – Use specified materials.
☐ Substitution Request received too late – Use specified materials.

Signed by: _____ Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E
☐ Other _____



CITY OF WORCESTER
FORM OF SUBCONTRACT

(Revised 1/6/93)

CONTRACT

THIS AGREEMENT made this _____ day of _____, 20____,

by and between _____
(a Corporation organized and existing under the laws of _____),
(a Partnership consisting of _____),
(an Individual doing business as _____),

hereinafter called the "Contractor",

and _____
(a Corporation organized and existing under the laws of _____),
(a Partnership consisting of _____),
(an Individual doing business as _____),

hereinafter called the "Subcontractor".

WITNESSETH, that the Contractor and the Subcontractor for the considerations hereafter named, agree as follows:

1. The Subcontractor agrees to furnish all labor and materials required for the completion of all work specified in Section No. _____ of the specifications for _____ (Name of Sub-Trade) and the drawings referred to therein and addenda Nos. _____, _____, _____, and _____ for the Worcester Technical High School Tufts Vet Tech Clinic Renovations (complete title of the project and the project number taken from title page of the project manual) as prepared by Lamoureux Pagano Associates | Architects Inc., 108 Grove Street, Suite 300, Worcester, MA 01605, for the sum of _____ (\$ _____) and the Contractor agrees to pay the Subcontractor said sum of said work.

- a) The Subcontractor agrees to be bound to the Contractor by the terms of the hereinbefore described drawings, specifications (including all general conditions stated therein) and addenda Nos. _____, _____, _____, and _____, and to assume to the Contractor all the obligations and responsibilities that the Contractor by those documents assumes to _____ (hereinafter called the "Awarding Authority"), except to the extent that provisions contained therein are by their terms or by law applicable only to the Contractor.

- b) The Contractor agrees to be bound to the Subcontractor by the terms of the hereinbefore described documents and to assume to the Subcontractor all the obligations and responsibilities that the Awarding Authority, by the terms of the hereinbefore described documents, assumes to the Contractor, except to the extent that provisions contained therein are by their terms or by law applicable only to the Awarding Authority.
 - c) Anything contained herein to the contrary notwithstanding, to the fullest extent allowed by law, the Subcontractor shall indemnify and hold harmless the Contractor, Architect, and Awarding Authority, their agents and employees, from and against all claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from the performance of the work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting there from and (2) is caused in whole or in part by any negligent act or omission of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity, which would otherwise exist as to any party or person, described in this provision.
- 2. The Contractor agrees to begin, prosecute and complete the entire work specified by the Awarding Authority in an orderly manner so that the Subcontractor will be able to begin, prosecute and complete the work described in this subcontract; and, in consideration thereof, upon notice from the Contractor, either oral or in writing, the Subcontractor agrees to begin, prosecute and complete the work described in this Subcontract in an orderly manner and with due consideration to the date or time specified by the Awarding Authority for the completion of the entire work.
 - 3. The Subcontractor agrees to furnish to the Contractor within a reasonable time after the execution of this subcontract, evidence of workmen's compensation insurance as required by law and evidence of public liability and property damage insurance of the type and in limits required to be furnished to the Awarding Authority by the Contractor.
 - 4. The Contractor agrees that no claim for services rendered or materials furnished by the Contractor to the Subcontractor shall be valid unless written notice thereof is given by the Contractor to the Subcontractor during the first ten (10) days of the calendar month following that in which the claim originated.
 - 5. This agreement is contingent upon the execution of a general contract between the Contractor and the Awarding Authority for the complete work.
 - 6. Responsible Employer Ordinance:

- a) The performance of the work derived from this contract is subject to the city's Responsible Employer Ordinance, Chapter 2, Section 35 of the Worcester Revised Ordinance (2008).

IN WITNESS WHEREOF, the parties hereto have executed this agreement the day and year first above-written.

SEAL

ATTEST:

(Name of Subcontractor)

By:_____

SEAL

ATTEST:

(Name of Contractor)

By:_____

END OF SECTION



SECTION 00 80 00

PREVAILING WAGE RATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections are hereby made a part of this Section.

1.2 SUMMARY

- A. This Section specifies the List of Jobs; Classifications; Determination of Rate of Wages; Schedule: as established under Statutory reference: M.G.L. Chapter 149, Section 26 and 27. These requirements apply to every contract or subcontract performing work on this public works project.
- B. Related Sections: Sections which contain requirements that relate to this Section include, but are not limited to the following:
 - 1. Section 001500
 - 2. Section 009500
- C. The aforesaid rates of wages in the schedule of wage rates shall include payments by employers to health and welfare plans, pension plans and supplementary unemployment benefit plans as indicated in Supplementary Conditions section 00300, and such payments shall be considered as payments to persons under this section performing work as herein provided. Any employer engaged in the construction of such work who does not make payments to a health and welfare plan, a pension plan and supplementary unemployment benefit plan, where such payments are included in said rates of wages, shall pay the amount of said payments directly to each employee engaged in said construction.
- D. Every Contractor and Sub-Contractor at any and all tiers shall complete the "WEEKLY PAYROLL REPORT FORM" and submit a copy to the Project Coordinator (indicated below) for each week consecutively, after the start of that trades work.
- E. "WEEKLY PAYROLL REPORTS" shall be required to be submitted consecutively, for each week from the start of work until the completion of his work, regardless of whether work was actually being performed on or off-site.

- F. When work is not performed; indicate on the form the corresponding week ending dates and post "NO WORK PERFORMED" conspicuously on the front of said form.
- G. Weekly reports shall be required until the contractor executes and furnishes to the Department of Labor and Workforce Development/Division of Occupational Safety the final "STATEMENT OF COMPLIANCE" bound herein.
- H. SUBMIT TO:
- Purchasing Division
- Joshua M. Kasuba
Certifiedpayrollrecords@worcesterma.gov
Purchasing Division
455 Main Street
Worcester, MA 01605
Tel (508) 799-1220

1.3 SAMPLE FORMS FOLLOW THIS PAGE.

NOTE: Pursuant to MGL c. 149, s. 27B, every contractor and subcontractor is required to submit a **true and accurate** copy of their certified weekly payroll records to the awarding authority by first-class mail or e-mail. In addition, each weekly payroll must be accompanied by a statement of compliance signed by the employer. Failure to comply may result in the commencement of a criminal action or the issuance of a civil citation.

CITY OF WORCESTER

Monthly Workforce Report

PROJECT NAME _____

Construction Manager: _____

Project: _____ Contract #: _____

Period Covered: _____ through _____

		GOAL - 38%		GOAL - 10%			
PROJECT-TO-DATE:		PEOPLE OF COLOR		FEMALE		MINORITY OWNED	WOMEN OWNED
Contractor/Sub-Contractor	Total Hours	PTD Hours	PTD Percentage	PTD Hours	PTD Percentage		
XX	600		0.0%		0.0%	YES / NO	YES / NO
						YES / NO	YES / NO
						YES / NO	YES / NO
						YES / NO	YES / NO
MONTHLY TOTAL:		600.0	0.00	0.0	0.0%		

PROJECT NAME _____

Construction Manager: _____

Project: _____ Contract #: _____

Period Covered: _____ through _____

		GOAL - 38%		GOAL - 10%			
PROJECT-TO-DATE:		PEOPLE OF COLOR		FEMALE			
Trade	Total Hours	PTD Hours	PTD Percentage	PTD Hours	PTD Percentage		
Carpenter	600.0	0.0	0.0%	0.0	0.0%		
X							
X							
X							
X							
X							
MONTHLY TOTALS		600.0	0.0	0.0	0.0%		

WEEKLY PAYROLL RECORDS REPORT & STATEMENT OF COMPLIANCE

In accordance with Massachusetts General Law c. 149, §27B, a true and accurate record must be kept of all persons employed on the public works project for which the enclosed rates have been provided. A Payroll Form has been printed on the reverse of this page and includes all the information required to be kept by law. Every contractor or subcontractor is required to keep these records and preserve them for a period of three years from the date of completion of the contract.

In addition, every contractor and subcontractor is required to submit, on a weekly basis, a copy of their weekly payroll records to the awarding authority. For every week in which an apprentice is employed, a photocopy of the apprentice's identification card must be attached to the payroll report. Once collected, the awarding authority is also required to preserve those reports for three years.

In addition, each such contractor, subcontractor, or public body shall furnish to the awarding authority directly, within fifteen days after completion of its portion of the work, a statement, executed by the contractor, subcontractor or public body who supervises the payment of wages, in the following form:

STATEMENT OF COMPLIANCE	
_____, 200_____	
I, _____ (Name of signatory party)	_____, _____ (Title)
do hereby state that I pay or supervise the payment of the persons employed by	
_____ on the _____ (Contractor, subcontractor or public body)	_____ (Building or project)
and that all mechanics and apprentices, teamsters, chauffeurs and laborers employed on said project have been paid in accordance with wages determined under the provisions of sections twenty-six and twenty-seven of chapter one hundred and forty nine of the General Laws.	
Signature _____	
Title _____	

DIVISION OF OCCUPATIONAL SAFETY, 399 WASHINGTON STREET, 5TH FLOOR, BOSTON, MA. 02108

Company Name: _____

Project Name: _____

Awarding Auth :

Work Week Ending: _____

Print Name & Title:

Print Name & Title:

NOTE: Every contractor and subcontractor is required to submit a copy of their weekly payroll records to the awarding authority.

**THE MASSACHUSETTS
PREVAILING WAGE
LAW
(MGL. c149, §§26-27H)**

**AN IMPORTANT GUIDE FOR
CONTRACTORS
DOING PUBLIC WORKS
PROJECTS
IN
MASSACHUSETTS**

PREVAILING WAGE SCHEDULES

Every contractor should obtain a schedule of prevailing wage rates for every public works project from the Awarding Authority (city, town, county, district, state agency or authority). It is the awarding authority's responsibility to ensure that a copy of the wage schedule is provided to all contractors from whom estimates or bids are solicited for all projects. The Department of Labor and Industries (DLI) will not issue wage schedules directly to contractors or employees.

Once a wage schedule has been issued for a project by DLI, it will remain in effect for the entire project. Appeals of wage determinations or classifications of employment may be made to the DLI commissioner.

A copy of the wage schedule is required to be posted at the work site.

A wage schedule issued for a project may not be used on any other project. If, by chance, an Awarding Authority fails to provide you with a wage schedule to use when figuring your bid, do not use one you may have from another project.

In this case, you should contact DLI immediately and urge the awarding authority to contact DLI to correct the oversight.

The failure of an Awarding Authority to provide a wage schedule does not excuse a contractor from paying the prevailing rate.

BIDDING

The Attorney General's Division of Fair Labor & Business Practices enforces the prevailing wage law. All bids must reflect prevailing wage rates. Contractors may be required by an Awarding Authority to "demonstrate ... how (they) could complete the project and comply with Mass. Gen. Laws." The Division issued an "Advisory" discussing these and other points. For a copy, please contact the Attorney General's Office.

PAYING EMPLOYEES

Prevailing wages must be paid to all employees on public works projects regardless of whether they are employed by the general contractor, a filed sub-bidder or any sub-contractor. The prevailing wage applies equally to unionized and non-unionized workers.

All employees who perform work on a public works project must be paid hourly according to the wage schedule issued for the particular project.

The wage schedule issued for each project is in effect for the duration of that project. All wage increases listed on the schedule must be paid on the specified dates.

Employers are limited in the deductions that can be made from the hourly rate (represented as the "total rate" on the wage schedules). Only contributions to the following plans may be deducted:

1. Health Plan
2. Pension
3. Supplementary Unemployment

All contributions must be made to bona fide plans.

If an employer contributes to any, or all, of the above plans, it may deduct the hourly amount contributed from the "total rate." If the employer does not contribute to any of the benefit plans listed above, then the employee's hourly rate of pay will be the "total rate" from the wage schedule.

All other deductions, including and not limited to the following," from the wage schedule.

All other deductions, including and not limited to the following, may not be subtracted from the employee's hourly wage rate:

1. Vacation Time
2. Sick Time
3. Training Funds
4. Charitable Contributions
5. Worker's Compensation
6. Unemployment Insurance
7. Uniforms

Overtime, which must be paid to all employees who work more than 40 hours per week, shall be at least time-and-one-half the base rate ("total rate" less benefits, if any).

Any "separate check" given to an employee as the "benefit portion" of the prevailing wage may not be treated differently than the check for "base wages." All "separate checks" are considered wages and subject to state and federal taxes, unemployment insurance, and worker's compensation requirements.

PAYROLL RECORDS

Employers are required to submit weekly-certified payroll reports to the Awarding Authority and keep them on file for three (3) years. A reporting form is sent along with each wage schedule that may be used. Each report must contain at least: the employee's name, address, occupational classification, hours worked and wages paid. Do not submit weekly payroll reports to DLI.

After each contractor completes its portion of the public works project, the contractor must submit a Statement of Compliance to DLI. A Statement of Compliance form is also sent along with each wage schedule issued.

APPRENTICES

If your company employs apprentices, they must be registered with the Division of Apprentice Training. All persons not registered with DAT must be paid the "total rate" listed on the wage schedule. An apprentice sheet showing percentages based on the apprentice steps is included with all wage schedules.

PENALTIES

Failure to pay the prevailing wage subjects the contractor to potential civil and criminal liability.

Wage schedules are issued by:

MA Dept. of Labor & Industries
100 Cambridge St., 11th Fl.
Boston, MA 02202
(617) 727-3492

Enforcement is carried out by:

Office of the Attorney General,
Fair Labor & Business Practices Div.
100 Cambridge St., 11th Fl.
Boston, MA 02202
(617) 727-3477

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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**THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF LABOR AND WORKFORCE DEVELOPMENT
DEPARTMENT OF LABOR STANDARDS
Prevailing Wage Rates**

MAURA HEALEY
Governor

KIM DRISCOLL
Lt. Governor

**As determined by the Director under the provisions of the
Massachusetts General Laws, Chapter 149, Sections 26 to 27H**

LAUREN JONES
Secretary
MICHAEL FLANAGAN
Director

Awarding Authority:	Worcester	City/Town:	WORCESTER
Contract Number:	8647-F6		
Description of Work:	Renovation and Addition of a Vet Tech Clinic		
Job Location:	1 Officer Manny Familia Way, Worcester, MA 01605		

Information about Prevailing Wage Schedules for Awarding Authorities and Contractors

- The wage rates will remain in effect for the duration of the project, except in the case of multi-year public construction projects. For construction projects lasting longer than one year, awarding authorities must request an updated wage schedule no later than two weeks before the anniversary of the date the contract was executed by the awarding authority and the general contractor. For multi-year CM AT RISK projects, the awarding authority must request an annual update no later than two weeks before the anniversary date, determined as the earlier of: (a) the execution date of the GMP Amendment, or (b) the execution date of the first amendment to permit procurement of construction services. The updated wage schedule must be provided to all contractors, including general and sub-contractors, working on the construction project.
- This annual update requirement is generally not applicable to 27F “rental of equipment” contracts. For such contracts, the prevailing wage rates issued by DLS shall remain in effect for the duration of the contract term. However, if the prevailing wage rate sheet issued does not contain wage rates for each year covered by the contract term, the Awarding Authority must request updated rate sheets from DLS and provide them to the contractor to ensure the correct rates are being paid throughout the duration of the contract. Additionally, if an Awarding Authority exercises an option to renew or extend the contract term, they must request updated rate sheets from DLS and provide them to the contractor.
- This wage schedule applies only to the specific project referenced at the top of this page and uniquely identified by the “Wage Request Number” on all pages of this schedule.
- An Awarding Authority must request an updated wage schedule if it has not opened bids or selected a contractor within 90 days of the date of issuance of the wage schedule. For CM AT RISK projects (bid pursuant to G.L. c.149A), the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work must be within 90-days of the wage schedule issuance date.
- The wage schedule shall be incorporated in any advertisement or call for bids for the project as required by M.G.L. c. 149, § 27. The wage schedule shall be made a part of the contract awarded for the project. The wage schedule must be posted in a conspicuous place at the work site for the life of the project in accordance with M.G.L. c. 149 § 27. The wages listed on the wage schedule must be paid to employees performing construction work on the project whether they are employed by the prime contractor, a filed sub-bidder, or a sub-contractor.
- Apprentices working on the project are required to be registered with the Massachusetts Division of Apprentice Standards (DAS). Apprentices must keep their apprentice identification card on their persons during all work hours on the project. An apprentice registered with DAS may be paid the lower apprentice wage rate at the applicable step as provided on the prevailing wage schedule. **Any apprentice not registered with DAS regardless of whether they are registered with another federal, state, local, or private agency must be paid the journeyworker's rate.**
- Every contractor or subcontractor working on the construction project must submit weekly payroll reports and a Statement of Compliance directly to the awarding authority by mail or email and keep them on file for three years. Each weekly payroll report must contain: the employee's name, address, occupational classification, hours worked, and wages paid. Do not submit weekly payroll reports to DLS. For a sample payroll reporting form go to <http://www.mass.gov/dols/pw>.
- Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at (617) 626-6953.
- Contractors must obtain the wage schedules from awarding authorities. Failure of a contractor or subcontractor to pay the prevailing wage rates listed on the wage schedule to all employees who perform construction work on the project is a violation of the law and subjects the contractor or subcontractor to civil and criminal penalties.
- Employees not receiving the prevailing wage rate set forth on the wage schedule may file a complaint with the Fair Labor Division of the office of the Attorney General at (617) 727-3465.

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
(2 AXLE) DRIVER - EQUIPMENT	1/1/2026	\$40.95	\$16.17	\$21.78	\$0.00	\$0.00	\$78.90
TEAMSTERS JOINT COUNCIL NO. 10	6/1/2026	\$41.95	\$16.17	\$21.78	\$0.00	\$0.00	\$79.90
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	12/1/2026	\$41.95	\$16.17	\$23.52	\$0.00	\$0.00	\$81.64
	1/1/2027	\$41.95	\$16.77	\$23.52	\$0.00	\$0.00	\$82.24
(3 AXLE) DRIVER - EQUIPMENT	1/1/2026	\$41.02	\$16.17	\$21.78	\$0.00	\$0.00	\$78.97
TEAMSTERS JOINT COUNCIL NO. 10	6/1/2026	\$42.02	\$16.17	\$21.78	\$0.00	\$0.00	\$79.97
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	12/1/2026	\$42.02	\$16.17	\$23.52	\$0.00	\$0.00	\$81.71
	1/1/2027	\$42.02	\$16.77	\$23.52	\$0.00	\$0.00	\$82.31
(4 & 5 AXLE) DRIVER - EQUIPMENT	1/1/2026	\$41.14	\$16.17	\$21.78	\$0.00	\$0.00	\$79.09
TEAMSTERS JOINT COUNCIL NO. 10	6/1/2026	\$42.14	\$16.17	\$21.78	\$0.00	\$0.00	\$80.09
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	12/1/2026	\$42.14	\$16.17	\$23.52	\$0.00	\$0.00	\$81.83
	1/1/2027	\$42.14	\$16.77	\$23.52	\$0.00	\$0.00	\$82.43
ADS/SUBMERSIBLE PILOT	8/1/2024	\$117.16	\$10.08	\$11.62	\$12.67	\$0.00	\$151.53
PILE DRIVER LOCAL 56							
PILE DRIVER LOCAL 56 (ZONE 2)							
For apprentice rates see "Apprentice- PILE DRIVER"							
AIR TRACK OPERATOR	12/1/2025	\$41.22	\$10.65	\$9.75	\$9.11	\$0.00	\$70.73
LABORERS	6/1/2026	\$42.66	\$10.65	\$9.75	\$9.11	\$0.00	\$72.17
LABORERS - ZONE 2	12/1/2026	\$44.10	\$10.65	\$9.75	\$9.11	\$0.00	\$73.61
	6/1/2027	\$45.55	\$10.65	\$9.75	\$9.11	\$0.00	\$75.06
	12/1/2027	\$47.00	\$10.65	\$9.75	\$9.11	\$0.00	\$76.51
	6/1/2028	\$48.50	\$10.65	\$9.75	\$9.11	\$0.00	\$78.01
	12/1/2028	\$50.00	\$10.65	\$9.75	\$9.11	\$0.00	\$79.51
For apprentice rates see "Apprentice- LABORER"							
AIR TRACK OPERATOR (HEAVY & HIGHWAY)	12/1/2025	\$41.22	\$10.65	\$9.75	\$9.21	\$0.00	\$70.83
LABORERS	6/1/2026	\$42.66	\$10.65	\$9.75	\$9.21	\$0.00	\$72.27
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2026	\$44.10	\$10.65	\$9.75	\$9.21	\$0.00	\$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
ASBESTOS WORKER (PIPES & TANKS)	12/1/2025	\$44.80	\$14.50	\$4.30	\$6.75	\$0.00	\$70.35
HEAT & FROST INSULATORS LOCAL 6							
HEAT & FROST INSULATORS LOCAL 6 (WORCESTER)							
ASPHALT RAKER	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.11	\$0.00	\$70.23
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.11	\$0.00	\$71.67
LABORERS - ZONE 2	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.11	\$0.00	\$73.11
	6/1/2027	\$45.05	\$10.65	\$9.75	\$9.11	\$0.00	\$74.56
	12/1/2027	\$46.50	\$10.65	\$9.75	\$9.11	\$0.00	\$76.01
	6/1/2028	\$48.00	\$10.65	\$9.75	\$9.11	\$0.00	\$77.51
	12/1/2028	\$49.50	\$10.65	\$9.75	\$9.11	\$0.00	\$79.01
For apprentice rates see "Apprentice- LABORER"							
ASPHALT RAKER (HEAVY & HIGHWAY)	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.21	\$0.00	\$70.33
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.21	\$0.00	\$71.77
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.21	\$0.00	\$73.21

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)							
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE	12/1/2025	\$59.28	\$16.05	\$13.25	\$3.25	\$0.00	\$91.83
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$60.58	\$16.05	\$13.25	\$3.25	\$0.00	\$93.13
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$62.03	\$16.05	\$13.25	\$3.25	\$0.00	\$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
BACKHOE/FRONT-END LOADER	12/1/2025	\$59.28	\$16.05	\$13.25	\$3.25	\$0.00	\$91.83
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$60.58	\$16.05	\$13.25	\$3.25	\$0.00	\$93.13
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$62.03	\$16.05	\$13.25	\$3.25	\$0.00	\$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
BARCO-TYPE JUMPING TAMPER	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.11	\$0.00	\$70.23
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.11	\$0.00	\$71.67
LABORERS - ZONE 2	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.11	\$0.00	\$73.11
	6/1/2027	\$45.05	\$10.65	\$9.75	\$9.11	\$0.00	\$74.56
	12/1/2027	\$46.50	\$10.65	\$9.75	\$9.11	\$0.00	\$76.01
	6/1/2028	\$48.00	\$10.65	\$9.75	\$9.11	\$0.00	\$77.51
	12/1/2028	\$49.50	\$10.65	\$9.75	\$9.11	\$0.00	\$79.01
For apprentice rates see "Apprentice- LABORER"							
BLOCK PAVER, RAMMER / CURB SETTER	12/1/2025	\$41.22	\$10.65	\$9.75	\$9.11	\$0.00	\$70.73
LABORERS	6/1/2026	\$42.66	\$10.65	\$9.75	\$9.11	\$0.00	\$72.17
LABORERS - ZONE 2	12/1/2026	\$44.10	\$10.65	\$9.75	\$9.11	\$0.00	\$73.61
	6/1/2027	\$45.55	\$10.65	\$9.75	\$9.11	\$0.00	\$75.06
	12/1/2027	\$47.00	\$10.65	\$9.75	\$9.11	\$0.00	\$76.51
	6/1/2028	\$48.50	\$10.65	\$9.75	\$9.11	\$0.00	\$78.01
	12/1/2028	\$50.00	\$10.65	\$9.75	\$9.11	\$0.00	\$79.51
For apprentice rates see "Apprentice- LABORER"							
BLOCK PAVER, RAMMER / CURB SETTER (HEAVY & HIGHWAY)	12/1/2025	\$41.22	\$10.65	\$9.75	\$9.21	\$0.00	\$70.83
LABORERS	6/1/2026	\$42.66	\$10.65	\$9.75	\$9.21	\$0.00	\$72.27
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2026	\$44.10	\$10.65	\$9.75	\$9.21	\$0.00	\$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)							
BOILER MAKER	1/1/2024	\$48.12	\$7.07	\$14.60	\$6.00	\$0.00	\$75.79
BOILERMAKERS LOCAL 29							
BOILERMAKERS LOCAL 29							

Apprentice: BOILER MAKER**Effective Date: 1/1/2024**

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	65.00	\$31.28	\$7.07	\$9.32	\$3.90	\$0.00	\$51.57
2	65.00	\$31.28	\$7.07	\$9.32	\$3.90	\$0.00	\$51.57
3	70.00	\$33.68	\$7.07	\$10.03	\$4.20	\$0.00	\$54.98
4	75.00	\$36.09	\$7.07	\$10.74	\$4.50	\$0.00	\$58.40
5	80.00	\$38.50	\$7.07	\$11.45	\$4.80	\$0.00	\$61.82
6	85.00	\$40.90	\$7.07	\$12.18	\$5.10	\$0.00	\$65.25

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: BOILER MAKER Effective Date: 1/1/2024							
		Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
7	90.00	\$43.31	\$7.07	\$12.88	\$5.40	\$0.00	\$68.66
8	95.00	\$45.71	\$7.07	\$13.62	\$5.70	\$0.00	\$72.10
Apprentice to Journeyworker Ratio: 1:4							
BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING)	2/1/2026	\$65.81	\$12.84	\$15.57	\$7.33	\$0.00	\$101.55
BRICKLAYERS LOCAL 3	8/1/2026	\$68.01	\$12.84	\$15.57	\$7.33	\$0.00	\$103.75
BRICKLAYERS LOCAL 3 (WORCESTER)	2/1/2027	\$69.41	\$12.84	\$15.57	\$7.33	\$0.00	\$105.15
Apprentice: BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) Effective Date: 2/1/2026							
		Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$32.91	\$12.84	\$15.57	\$7.33	\$0.00	\$68.65
2	60.00	\$39.49	\$12.84	\$15.57	\$7.33	\$0.00	\$75.23
3	70.00	\$46.07	\$12.84	\$15.57	\$7.33	\$0.00	\$81.81
4	80.00	\$52.65	\$12.84	\$15.57	\$7.33	\$0.00	\$88.39
5	90.00	\$59.23	\$12.84	\$15.57	\$7.33	\$0.00	\$94.97
Apprentice: BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) Effective Date: 8/1/2026							
		Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$34.01	\$12.84	\$15.57	\$7.33	\$0.00	\$69.75
2	60.00	\$40.81	\$12.84	\$15.57	\$7.33	\$0.00	\$76.55
3	70.00	\$47.61	\$12.84	\$15.57	\$7.33	\$0.00	\$83.35
4	80.00	\$54.41	\$12.84	\$15.57	\$7.33	\$0.00	\$90.15
5	90.00	\$61.21	\$12.84	\$15.57	\$7.33	\$0.00	\$96.95
Apprentice to Journeyworker Ratio: 1:5							
BULLDOZER/GRADER/SCRAPER	12/1/2025	\$58.62	\$16.05	\$13.25	\$3.25	\$0.00	\$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$59.90	\$16.05	\$13.25	\$3.25	\$0.00	\$92.45
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$61.34	\$16.05	\$13.25	\$3.25	\$0.00	\$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
CAISSON & UNDERPINNING BOTTOM MAN	12/1/2025	\$49.10	\$10.65	\$9.75	\$9.80	\$0.00	\$79.30
LABORERS	6/1/2026	\$50.65	\$10.65	\$9.75	\$9.80	\$0.00	\$80.85
LABORERS - FOUNDATION AND MARINE	12/1/2026	\$52.15	\$10.65	\$9.75	\$9.80	\$0.00	\$82.35
For apprentice rates see "Apprentice- LABORER"							
CAISSON & UNDERPINNING LABORER	12/1/2025	\$47.95	\$10.65	\$9.75	\$9.80	\$0.00	\$78.15
LABORERS	6/1/2026	\$49.50	\$10.65	\$9.75	\$9.80	\$0.00	\$79.70

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
LABORERS - FOUNDATION AND MARINE	12/1/2026	\$51.00	\$10.65	\$9.75	\$9.80	\$0.00	\$81.20
For apprentice rates see "Apprentice- LABORER"							
CAISSON & UNDERPINNING TOP MAN	12/1/2025	\$48.28	\$10.65	\$9.75	\$9.80	\$0.00	\$78.48
LABORERS	6/1/2026	\$49.83	\$10.65	\$9.75	\$9.80	\$0.00	\$80.03
LABORERS - FOUNDATION AND MARINE	12/1/2026	\$51.33	\$10.65	\$9.75	\$9.80	\$0.00	\$81.53
For apprentice rates see "Apprentice- LABORER"							
CARBIDE CORE DRILL OPERATOR	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.11	\$0.00	\$70.23
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.11	\$0.00	\$71.67
LABORERS - ZONE 2	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.11	\$0.00	\$73.11
	6/1/2027	\$45.05	\$10.65	\$9.75	\$9.11	\$0.00	\$74.56
	12/1/2027	\$46.50	\$10.65	\$9.75	\$9.11	\$0.00	\$76.01
	6/1/2028	\$48.00	\$10.65	\$9.75	\$9.11	\$0.00	\$77.51
	12/1/2028	\$49.50	\$10.65	\$9.75	\$9.11	\$0.00	\$79.01
For apprentice rates see "Apprentice- LABORER"							
CARPENTER	9/1/2025	\$50.35	\$10.33	\$11.47	\$8.50	\$0.00	\$80.65
CARPENTERS	3/1/2026	\$51.60	\$10.33	\$11.47	\$8.50	\$0.00	\$81.90
CARPENTERS -ZONE 2 (Eastern Massachusetts)	9/1/2026	\$52.85	\$10.33	\$11.47	\$8.50	\$0.00	\$83.15
	3/1/2027	\$54.10	\$10.33	\$11.47	\$8.50	\$0.00	\$84.40

Apprentice: CARPENTER**Effective Date: 9/1/2025**

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	\$22.66	\$10.33	\$0.00	\$1.73	\$0.00	\$34.72
2	45.00	\$22.66	\$10.33	\$0.00	\$1.73	\$0.00	\$34.72
3	55.00	\$27.69	\$10.33	\$0.00	\$3.40	\$0.00	\$41.42
4	55.00	\$27.69	\$10.33	\$0.00	\$3.40	\$0.00	\$41.42
5	70.00	\$35.25	\$10.33	\$11.41	\$5.10	\$0.00	\$62.09
6	70.00	\$35.25	\$10.33	\$11.41	\$5.10	\$0.00	\$62.09
7	80.00	\$40.28	\$10.33	\$11.44	\$6.80	\$0.00	\$68.85
8	80.00	\$40.28	\$10.33	\$11.44	\$6.80	\$0.00	\$68.85

Apprentice: CARPENTER**Effective Date: 3/1/2026**

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	\$23.22	\$10.33	\$0.00	\$1.73	\$0.00	\$35.28
2	45.00	\$23.22	\$10.33	\$0.00	\$1.73	\$0.00	\$35.28
3	55.00	\$28.38	\$10.33	\$0.00	\$3.40	\$0.00	\$42.11
4	55.00	\$28.38	\$10.33	\$0.00	\$3.40	\$0.00	\$42.11
5	70.00	\$36.12	\$10.33	\$11.41	\$5.10	\$0.00	\$62.96
6	70.00	\$36.12	\$10.33	\$11.41	\$5.10	\$0.00	\$62.96
7	80.00	\$41.28	\$10.33	\$11.44	\$6.80	\$0.00	\$69.85
8	80.00	\$41.28	\$10.33	\$11.44	\$6.80	\$0.00	\$69.85

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice to Journeyworker Ratio: 1:5							
CARPENTER WOOD FRAME	10/1/2025	\$27.75	\$7.02	\$3.80	\$1.00	\$0.00	\$39.57
CARPENTERS	10/1/2026	\$28.85	\$7.02	\$3.80	\$1.00	\$0.00	\$40.67
CARPENTERS-ZONE 3 (Wood Frame)							
All Aspects of New Wood Frame Work							

Apprentice: CARPENTER WOOD FRAME							
Effective Date: 10/1/2025							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	\$16.65	\$7.02	\$0.00	\$0.00	\$0.00	\$23.67
2	60.00	\$16.65	\$7.02	\$0.00	\$0.00	\$0.00	\$23.67
3	65.00	\$18.04	\$7.02	\$0.00	\$1.00	\$0.00	\$26.06
4	70.00	\$19.43	\$7.02	\$0.00	\$1.00	\$0.00	\$27.45
5	75.00	\$20.81	\$7.02	\$3.80	\$1.00	\$0.00	\$32.63
6	80.00	\$22.20	\$7.02	\$3.80	\$1.00	\$0.00	\$34.02
7	85.00	\$23.59	\$7.02	\$3.80	\$1.00	\$0.00	\$35.41
8	90.00	\$24.98	\$7.02	\$3.80	\$1.00	\$0.00	\$36.80

Apprentice: CARPENTER WOOD FRAME							
Effective Date: 10/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	\$17.31	\$7.02	\$0.00	\$0.00	\$0.00	\$24.33
2	60.00	\$17.31	\$7.02	\$0.00	\$0.00	\$0.00	\$24.33
3	65.00	\$18.75	\$7.02	\$0.00	\$1.00	\$0.00	\$26.77
4	70.00	\$20.20	\$7.02	\$0.00	\$1.00	\$0.00	\$28.22
5	75.00	\$21.64	\$7.02	\$3.80	\$1.00	\$0.00	\$33.46
6	80.00	\$23.08	\$7.02	\$3.80	\$1.00	\$0.00	\$34.90
7	85.00	\$24.52	\$7.02	\$3.80	\$1.00	\$0.00	\$36.34
8	90.00	\$25.97	\$7.02	\$3.80	\$1.00	\$0.00	\$37.79

Apprentice to Journeyworker Ratio: 1:5

CEMENT MASONRY/PLASTERING	1/1/2026	\$53.24	\$13.35	\$16.43	\$7.78	\$1.80	\$92.60
PLASTERERS AND CEMENT MASONS LOCAL 534	7/1/2026	\$54.49	\$13.35	\$16.43	\$7.78	\$1.80	\$93.85
Plasterers and Cement Masons - Zone 1	1/1/2027	\$55.94	\$13.35	\$16.43	\$7.78	\$1.80	\$95.30
	7/1/2027	\$57.29	\$13.35	\$16.43	\$7.78	\$1.80	\$96.65
	1/1/2028	\$58.64	\$13.35	\$16.43	\$7.78	\$1.80	\$98.00

Apprentice: CEMENT MASONRY/PLASTERING							
Effective Date: 1/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$26.62	\$13.35	\$16.43	\$0.00	\$0.00	\$56.40
2	60.00	\$31.94	\$13.35	\$16.43	\$7.78	\$1.80	\$71.30

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: CEMENT MASONRY/PLASTERING							
Effective Date: 1/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
3	65.00	\$34.61	\$13.35	\$16.43	\$7.78	\$1.80	\$73.97
4	70.00	\$37.27	\$13.35	\$16.43	\$7.78	\$1.80	\$76.63
5	75.00	\$39.93	\$13.35	\$16.43	\$7.78	\$1.80	\$79.29
6	80.00	\$42.59	\$13.35	\$16.43	\$7.78	\$1.80	\$81.95
7	90.00	\$47.92	\$13.35	\$16.43	\$0.00	\$0.00	\$77.70
Apprentice: CEMENT MASONRY/PLASTERING							
Effective Date: 7/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$27.25	\$13.35	\$16.43	\$0.00	\$0.00	\$57.03
2	60.00	\$32.69	\$13.35	\$16.43	\$7.78	\$1.80	\$72.05
3	65.00	\$35.42	\$13.35	\$16.43	\$7.78	\$1.80	\$74.78
4	70.00	\$38.14	\$13.35	\$16.43	\$7.78	\$1.80	\$77.50
5	75.00	\$40.87	\$13.35	\$16.43	\$7.78	\$1.80	\$80.23
6	80.00	\$43.59	\$13.35	\$16.43	\$7.78	\$1.80	\$82.95
7	90.00	\$49.04	\$13.35	\$0.00	\$7.78	\$0.00	\$70.17
Apprentice to Journeyworker Ratio: 1:5							
CHAIN SAW OPERATOR	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.11	\$0.00	\$70.23
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.11	\$0.00	\$71.67
LABORERS - ZONE 2	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.11	\$0.00	\$73.11
	6/1/2027	\$45.05	\$10.65	\$9.75	\$9.11	\$0.00	\$74.56
	12/1/2027	\$46.50	\$10.65	\$9.75	\$9.11	\$0.00	\$76.01
	6/1/2028	\$48.00	\$10.65	\$9.75	\$9.11	\$0.00	\$77.51
	12/1/2028	\$49.50	\$10.65	\$9.75	\$9.11	\$0.00	\$79.01
For apprentice rates see "Apprentice- LABORER"							
CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES	12/1/2025	\$60.48	\$16.05	\$13.25	\$3.25	\$0.00	\$93.03
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$61.81	\$16.05	\$13.25	\$3.25	\$0.00	\$94.36
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$63.29	\$16.05	\$13.25	\$3.25	\$0.00	\$95.84
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
COMPRESSOR OPERATOR	12/1/2025	\$37.97	\$16.05	\$13.25	\$3.25	\$0.00	\$70.52
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$38.83	\$16.05	\$13.25	\$3.25	\$0.00	\$71.38
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$39.78	\$16.05	\$13.25	\$3.25	\$0.00	\$72.33
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
DELEADER (BRIDGE)	1/1/2026	\$59.56	\$10.35	\$12.00	\$12.60	\$0.00	\$94.51
PAINTERS LOCAL 35							
PAINTERS LOCAL 35 - ZONE 2							

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: DELEADER (BRIDGE) Effective Date: 1/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$29.78	\$10.35	\$0.00	\$0.00	\$0.00	\$40.13
2	55.00	\$32.76	\$10.35	\$0.00	\$6.93	\$0.00	\$50.04
3	60.00	\$35.74	\$10.35	\$0.00	\$7.56	\$0.00	\$53.65
4	65.00	\$38.71	\$10.35	\$0.00	\$8.19	\$0.00	\$57.25
5	70.00	\$41.69	\$10.35	\$12.00	\$8.82	\$0.00	\$72.86
6	75.00	\$44.67	\$10.35	\$12.00	\$9.45	\$0.00	\$76.47
7	80.00	\$47.65	\$10.35	\$12.00	\$10.08	\$0.00	\$80.08
8	90.00	\$53.60	\$10.35	\$12.00	\$11.34	\$0.00	\$87.29
Apprentice to Journeyworker Ratio: 1:1							
DEMO: ADZEMAN LABORERS LABORERS - ZONE 2	12/1/2025	\$48.00	\$10.65	\$9.75	\$9.65	\$0.00	\$78.05
	6/1/2026	\$49.55	\$10.65	\$9.75	\$9.65	\$0.00	\$79.60
	12/7/2026	\$51.05	\$10.65	\$9.75	\$9.65	\$0.00	\$81.10
	6/7/2027	\$52.65	\$10.65	\$9.75	\$9.65	\$0.00	\$82.70
	12/6/2027	\$54.25	\$10.65	\$9.75	\$9.65	\$0.00	\$84.30
	6/5/2028	\$55.93	\$10.65	\$9.75	\$9.65	\$0.00	\$85.98
	12/4/2028	\$57.60	\$10.65	\$9.75	\$9.65	\$0.00	\$87.65
For apprentice rates see "Apprentice- LABORER"							
DEMO: BACKHOE/LOADER/HAMMER OPERATOR LABORERS LABORERS - ZONE 2	12/1/2025	\$49.00	\$10.65	\$9.75	\$9.65	\$0.00	\$79.05
	6/1/2026	\$50.55	\$10.65	\$9.75	\$9.65	\$0.00	\$80.60
	12/7/2026	\$52.05	\$10.65	\$9.75	\$9.65	\$0.00	\$82.10
	6/7/2027	\$53.65	\$10.65	\$9.75	\$9.65	\$0.00	\$83.70
	12/6/2027	\$55.25	\$10.65	\$9.75	\$9.65	\$0.00	\$85.30
	6/5/2028	\$56.93	\$10.65	\$9.75	\$9.65	\$0.00	\$86.98
	12/4/2028	\$58.60	\$10.65	\$9.75	\$9.65	\$0.00	\$88.65
For apprentice rates see "Apprentice- LABORER"							
DEMO: BURNERS LABORERS LABORERS - ZONE 2	12/1/2025	\$48.75	\$10.65	\$9.75	\$9.65	\$0.00	\$78.80
	6/1/2026	\$50.30	\$10.65	\$9.75	\$9.65	\$0.00	\$80.35
	12/7/2026	\$51.80	\$10.65	\$9.75	\$9.65	\$0.00	\$81.85
	6/7/2027	\$53.40	\$10.65	\$9.75	\$9.65	\$0.00	\$83.45
	12/6/2027	\$55.00	\$10.65	\$9.75	\$9.65	\$0.00	\$85.05
	6/5/2028	\$56.68	\$10.65	\$9.75	\$9.65	\$0.00	\$86.73
	12/4/2028	\$58.35	\$10.65	\$9.75	\$9.65	\$0.00	\$88.40
For apprentice rates see "Apprentice- LABORER"							
DEMO: CONCRETE CUTTER/SAWYER LABORERS LABORERS - ZONE 2	12/1/2025	\$49.00	\$10.65	\$9.75	\$9.65	\$0.00	\$79.05
	6/1/2026	\$50.55	\$10.65	\$9.75	\$9.65	\$0.00	\$80.60
	12/7/2026	\$52.05	\$10.65	\$9.75	\$9.65	\$0.00	\$82.10
	6/7/2027	\$53.65	\$10.65	\$9.75	\$9.65	\$0.00	\$83.70
	12/6/2027	\$55.25	\$10.65	\$9.75	\$9.65	\$0.00	\$85.30
	6/5/2028	\$56.93	\$10.65	\$9.75	\$9.65	\$0.00	\$86.98
	12/4/2028	\$58.60	\$10.65	\$9.75	\$9.65	\$0.00	\$88.65

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- LABORER"							
DEMO: JACKHAMMER OPERATOR	12/1/2025	\$48.75	\$10.65	\$9.75	\$9.65	\$0.00	\$78.80
LABORERS	6/1/2026	\$50.30	\$10.65	\$9.75	\$9.65	\$0.00	\$80.35
LABORERS - ZONE 2	12/7/2026	\$51.80	\$10.65	\$9.75	\$9.65	\$0.00	\$81.85
	6/7/2027	\$53.40	\$10.65	\$9.75	\$9.65	\$0.00	\$83.45
	12/6/2027	\$55.00	\$10.65	\$9.75	\$9.65	\$0.00	\$85.05
	6/5/2028	\$56.68	\$10.65	\$9.75	\$9.65	\$0.00	\$86.73
	12/4/2028	\$58.35	\$10.65	\$9.75	\$9.65	\$0.00	\$88.40
For apprentice rates see "Apprentice- LABORER"							
DEMO: WRECKING LABORER	12/1/2025	\$48.00	\$10.65	\$9.75	\$9.65	\$0.00	\$78.05
LABORERS	6/1/2026	\$49.55	\$10.65	\$9.75	\$9.65	\$0.00	\$79.60
LABORERS - ZONE 2	12/7/2026	\$51.05	\$10.65	\$9.75	\$9.65	\$0.00	\$81.10
	6/7/2027	\$52.65	\$10.65	\$9.75	\$9.65	\$0.00	\$82.70
	12/6/2027	\$54.25	\$10.65	\$9.75	\$9.65	\$0.00	\$84.30
	6/5/2028	\$55.93	\$10.65	\$9.75	\$9.65	\$0.00	\$85.98
	12/4/2028	\$57.60	\$10.65	\$9.75	\$9.65	\$0.00	\$87.65
For apprentice rates see "Apprentice- LABORER"							
DIRECTIONAL DRILL MACHINE OPERATOR	12/1/2025	\$58.62	\$16.05	\$13.25	\$3.25	\$0.00	\$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$59.90	\$16.05	\$13.25	\$3.25	\$0.00	\$92.45
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$61.34	\$16.05	\$13.25	\$3.25	\$0.00	\$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
DIVER	8/1/2024	\$78.11	\$10.08	\$11.62	\$12.67	\$0.00	\$112.48
PILE DRIVER LOCAL 56							
PILE DRIVER LOCAL 56 (ZONE 2)							
as of 8-1-24, Apprentices with diving licenses begin at second year. % of Diver wage 70/80/90 2A \$69.83, 3A \$91.79,4A \$102.14 Total Rate							
DIVER TENDER	8/1/2024	\$51.97	\$10.08	\$11.62	\$12.67	\$0.00	\$86.34
PILE DRIVER LOCAL 56							
PILE DRIVER LOCAL 56 (ZONE 2)							
as of 8-1-24, Apprentices with diving licenses begin at second year. % of Piledriver wage 70/80/90 2A \$54.20, 3A \$73.93,4A \$82.05 Total Rate							
DIVER TENDER (EFFLUENT)	8/1/2024	\$83.69	\$10.08	\$11.62	\$12.67	\$0.00	\$118.06
PILE DRIVER LOCAL 56							
PILE DRIVER LOCAL 56 (ZONE 2)							
For apprentice rates see "Apprentice- PILE DRIVER"							
DIVER/SLURRY (EFFLUENT)	8/1/2024	\$117.16	\$10.08	\$11.62	\$12.67	\$0.00	\$151.53
PILE DRIVER LOCAL 56							
PILE DRIVER LOCAL 56 (ZONE 2)							
For apprentice rates see "Apprentice- PILE DRIVER"							
DRAWBRIDGE OPERATOR (Construction)	7/1/2020	\$26.77	\$6.67	\$3.93	\$0.00	\$0.16	\$37.53
DRAWBRIDGE - SEIU LOCAL 888							
DRAWBRIDGE - SEIU LOCAL 888							
ELECTRICIAN	9/7/2025	\$48.16	\$14.98	\$14.30	\$5.30	\$0.00	\$82.74
ELECTRICIANS LOCAL 96	9/6/2026	\$49.38	\$15.96	\$14.57	\$5.43	\$0.00	\$85.34
ELECTRICIANS LOCAL 96							

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: ELECTRICIAN Effective Date: 9/7/2025							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	40.00	\$19.26	\$14.98	\$0.58	\$0.00	\$0.00	\$34.82
2	45.00	\$21.67	\$14.98	\$0.65	\$0.00	\$0.00	\$37.30
3	48.00	\$23.12	\$14.98	\$13.55	\$2.54	\$0.00	\$54.19
4	55.00	\$26.49	\$14.98	\$13.65	\$2.92	\$0.00	\$58.04
5	65.00	\$31.30	\$14.98	\$13.80	\$3.45	\$0.00	\$63.53
6	80.00	\$38.53	\$14.98	\$14.02	\$4.24	\$0.00	\$71.77
Apprentice: ELECTRICIAN Effective Date: 9/6/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	40.00	\$19.75	\$15.96	\$0.59	\$0.00	\$0.00	\$36.30
2	45.00	\$22.22	\$15.96	\$0.67	\$0.00	\$0.00	\$38.85
3	48.00	\$23.70	\$15.96	\$13.80	\$2.61	\$0.00	\$56.07
4	55.00	\$27.16	\$15.96	\$13.90	\$2.99	\$0.00	\$60.01
5	65.00	\$32.10	\$15.96	\$14.05	\$3.53	\$0.00	\$65.64
6	80.00	\$39.50	\$15.96	\$14.28	\$4.35	\$0.00	\$74.09
Apprentice to Journeyworker Ratio: 2:3							
ELEVATOR CONSTRUCTOR	1/1/2026	\$69.23	\$16.38	\$11.06	\$10.70	\$0.00	\$107.37
ELEVATOR CONSTRUCTORS LOCAL 41	1/1/2027	\$72.23	\$16.48	\$11.16	\$11.00	\$0.00	\$110.87
ELEVATOR CONSTRUCTORS LOCAL 41							
Apprentice: ELEVATOR CONSTRUCTOR Effective Date: 1/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$34.62	\$16.38	\$0.00	\$0.00	\$0.00	\$51.00
2	55.00	\$38.08	\$16.38	\$11.06	\$10.70	\$0.00	\$76.22
3	65.00	\$45.00	\$16.38	\$11.06	\$10.70	\$0.00	\$83.14
4	70.00	\$48.46	\$16.38	\$11.06	\$10.70	\$0.00	\$86.60
5	80.00	\$55.38	\$16.38	\$11.06	\$10.70	\$0.00	\$93.52
Apprentice: ELEVATOR CONSTRUCTOR Effective Date: 1/1/2027							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$36.12	\$16.48	\$0.00	\$0.00	\$0.00	\$52.60
2	55.00	\$39.73	\$16.48	\$11.16	\$11.00	\$0.00	\$78.37
3	65.00	\$46.95	\$16.48	\$11.16	\$11.00	\$0.00	\$85.59

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: ELEVATOR CONSTRUCTOR Effective Date: 1/1/2027							
		Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
4	70.00	\$50.56	\$16.48	\$11.16	\$11.00	\$0.00	\$89.20
5	80.00	\$57.78	\$16.48	\$11.16	\$11.00	\$0.00	\$96.42
Apprentice to Journeyworker Ratio: 1:1							
ELEVATOR CONSTRUCTOR HELPER	1/1/2026	\$48.46	\$16.38	\$11.06	\$10.70	\$0.00	\$86.60
ELEVATOR CONSTRUCTORS LOCAL 41	1/1/2027	\$50.56	\$16.48	\$11.16	\$11.00	\$0.00	\$89.20
ELEVATOR CONSTRUCTORS LOCAL 41							
For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"							
FENCE & GUARD RAIL ERECTOR (HEAVY & HIGHWAY) LABORERS	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.21	\$0.00	\$70.33
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.21	\$0.00	\$71.77
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.21	\$0.00	\$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY	11/1/2025	\$53.56	\$16.05	\$13.25	\$3.25	\$0.00	\$86.11
OPERATING ENGINEERS LOCAL 4	5/1/2026	\$55.00	\$16.05	\$13.25	\$3.25	\$0.00	\$87.55
OPERATING ENGINEERS LOCAL 4	11/1/2026	\$56.29	\$16.05	\$13.25	\$3.25	\$0.00	\$88.84
OPERATING ENGINEERS LOCAL 4	5/1/2027	\$57.72	\$16.05	\$13.25	\$3.25	\$0.00	\$90.27
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY	11/1/2025	\$55.17	\$16.05	\$13.25	\$3.25	\$0.00	\$87.72
OPERATING ENGINEERS LOCAL 4	5/1/2026	\$56.62	\$16.05	\$13.25	\$3.25	\$0.00	\$89.17
OPERATING ENGINEERS LOCAL 4	11/1/2026	\$57.92	\$16.05	\$13.25	\$3.25	\$0.00	\$90.47
OPERATING ENGINEERS LOCAL 4	5/1/2027	\$59.37	\$16.05	\$13.25	\$3.25	\$0.00	\$91.92
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY	11/1/2025	\$26.03	\$16.05	\$13.25	\$3.25	\$0.00	\$58.58
OPERATING ENGINEERS LOCAL 4	5/1/2026	\$26.88	\$16.05	\$13.25	\$3.25	\$0.00	\$59.43
OPERATING ENGINEERS LOCAL 4	11/1/2026	\$27.64	\$16.05	\$13.25	\$3.25	\$0.00	\$60.19
OPERATING ENGINEERS LOCAL 4	5/1/2027	\$28.49	\$16.05	\$13.25	\$3.25	\$0.00	\$61.04
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
FIRE ALARM INSTALLER	9/7/2025	\$48.16	\$14.98	\$14.30	\$5.30	\$0.00	\$82.74
ELECTRICIANS LOCAL 96	9/6/2026	\$49.38	\$15.96	\$14.57	\$5.43	\$0.00	\$85.34
ELECTRICIANS LOCAL 96							
For apprentice rates see "Apprentice- ELECTRICIAN"							
FIRE ALARM REPAIR / MAINT/COMMISSIONING	9/7/2025	\$48.16	\$14.98	\$14.30	\$5.30	\$0.00	\$82.74
ELECTRICIANS LOCAL 96	9/6/2026	\$49.38	\$15.96	\$14.57	\$5.43	\$0.00	\$85.34
ELECTRICIANS LOCAL 96							
For apprentice rates see "Apprentice- ELECTRICIAN"							
FIREMAN (ASST. ENGINEER)	12/1/2025	\$47.69	\$16.05	\$13.25	\$3.25	\$0.00	\$80.24
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$48.75	\$16.05	\$13.25	\$3.25	\$0.00	\$81.30
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$49.93	\$16.05	\$13.25	\$3.25	\$0.00	\$82.48
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
FLAGGER & SIGNALER (HEAVY & HIGHWAY)	12/1/2025	\$28.09	\$10.65	\$9.75	\$9.21	\$0.00	\$57.70
LABORERS	6/1/2026	\$29.21	\$10.65	\$9.75	\$9.21	\$0.00	\$58.82
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2026	\$29.21	\$10.65	\$9.75	\$9.21	\$0.00	\$58.82

For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"

FLOORCOVERER	3/1/2024	\$48.93	\$10.33	\$11.47	\$8.80	\$0.00	\$79.53
FLOORCOVERERS LOCAL 2168							
FLOORCOVERERS LOCAL 2168 ZONE II							

Apprentice: FLOORCOVERER**Effective Date: 3/1/2024**

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$24.47	\$10.33	\$0.00	\$1.76	\$0.00	\$36.56
2	55.00	\$26.91	\$10.33	\$0.00	\$1.76	\$0.00	\$39.00
3	60.00	\$29.36	\$10.33	\$0.00	\$3.52	\$0.00	\$43.21
4	65.00	\$31.80	\$10.33	\$0.00	\$3.52	\$0.00	\$45.65
5	70.00	\$34.25	\$10.33	\$11.47	\$5.28	\$0.00	\$61.33
6	75.00	\$36.70	\$10.33	\$11.47	\$5.28	\$0.00	\$63.78
7	80.00	\$39.14	\$10.33	\$11.47	\$7.04	\$0.00	\$67.98
8	85.00	\$41.59	\$10.33	\$11.47	\$7.04	\$0.00	\$70.43

Apprentice Notes

Steps are 750 hrs.

Apprentice to Journeyworker Ratio: 1:1

FORK LIFT/CHERRY PICKER	12/1/2025	\$59.28	\$16.05	\$13.25	\$3.25	\$0.00	\$91.83
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$60.58	\$16.05	\$13.25	\$3.25	\$0.00	\$93.13
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$62.03	\$16.05	\$13.25	\$3.25	\$0.00	\$94.58

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

GENERATOR/LIGHTING PLANT/HEATERS	12/1/2025	\$37.97	\$16.05	\$13.25	\$3.25	\$0.00	\$70.52
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$38.83	\$16.05	\$13.25	\$3.25	\$0.00	\$71.38
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$39.78	\$16.05	\$13.25	\$3.25	\$0.00	\$72.33

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS)	1/1/2026	\$49.06	\$10.35	\$12.00	\$12.60	\$0.00	\$84.01
GLAZIERS LOCAL 35							
GLAZIERS LOCAL 35 (ZONE 2)							

Apprentice: GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS)**Effective Date: 1/1/2026**

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$24.53	\$10.35	\$0.00	\$0.00	\$0.00	\$34.88
2	55.00	\$26.98	\$10.35	\$0.00	\$6.88	\$0.00	\$44.21
3	60.00	\$29.44	\$10.35	\$0.00	\$7.50	\$0.00	\$47.29

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS)							
Effective Date: 1/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
4	65.00	\$31.89	\$10.35	\$0.00	\$8.13	\$0.00	\$50.37
5	70.00	\$34.34	\$10.35	\$12.00	\$8.75	\$0.00	\$65.44
6	75.00	\$36.80	\$10.35	\$12.00	\$9.38	\$0.00	\$68.53
7	80.00	\$39.25	\$10.35	\$12.00	\$10.00	\$0.00	\$71.60
8	90.00	\$44.15	\$10.35	\$12.00	\$11.25	\$0.00	\$77.75
Apprentice to Journeyworker Ratio: 1:1							
HOISTING ENGINEER/CRANES/GRADALLS	12/1/2025	\$59.28	\$16.05	\$13.25	\$3.25	\$0.00	\$91.83
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$60.58	\$16.05	\$13.25	\$3.25	\$0.00	\$93.13
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$62.03	\$16.05	\$13.25	\$3.25	\$0.00	\$94.58
Apprentice: HOISTING ENGINEER/CRANES/GRADALLS							
Effective Date: 12/1/2025							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	55.00	\$32.88	\$0.00	\$0.00	\$0.00	\$0.00	\$32.88
2	60.00	\$35.87	\$16.05	\$13.25	\$3.25	\$0.00	\$68.42
3	65.00	\$38.86	\$16.05	\$13.25	\$3.25	\$0.00	\$71.41
4	70.00	\$41.85	\$16.05	\$13.25	\$3.25	\$0.00	\$74.40
5	75.00	\$44.84	\$16.05	\$13.25	\$3.25	\$0.00	\$77.39
6	80.00	\$47.82	\$16.05	\$13.25	\$3.25	\$0.00	\$80.37
7	85.00	\$50.81	\$16.05	\$13.25	\$3.25	\$0.00	\$83.36
8	90.00	\$53.80	\$16.05	\$13.25	\$3.25	\$0.00	\$86.35
Apprentice: HOISTING ENGINEER/CRANES/GRADALLS							
Effective Date: 6/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	55.00	\$33.32	\$0.00	\$0.00	\$0.00	\$0.00	\$33.32
2	60.00	\$36.35	\$16.05	\$13.25	\$3.25	\$0.00	\$68.90
3	65.00	\$39.38	\$16.05	\$13.25	\$3.25	\$0.00	\$71.93
4	70.00	\$42.41	\$16.50	\$13.25	\$3.25	\$0.00	\$75.41
5	75.00	\$45.44	\$16.50	\$13.25	\$3.25	\$0.00	\$78.44
6	80.00	\$48.46	\$16.50	\$13.25	\$3.25	\$0.00	\$81.46
7	85.00	\$51.49	\$16.50	\$13.25	\$3.25	\$0.00	\$84.49
8	90.00	\$54.52	\$16.50	\$13.25	\$3.25	\$0.00	\$87.52
Apprentice to Journeyworker Ratio: 1:6							
HVAC (DUCTWORK)	7/1/2025	\$43.48	\$12.94	\$11.01	\$8.72	\$2.13	\$78.28
SHEETMETAL WORKERS LOCAL 63	7/1/2026	\$43.48	\$13.24	\$11.01	\$9.92	\$2.13	\$79.78
SHEETMETAL WORKERS LOCAL 63	1/1/2027	\$43.48	\$13.54	\$11.01	\$11.12	\$2.13	\$81.28

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
	7/1/2027	\$44.98	\$13.54	\$11.01	\$11.12	\$2.13	\$82.78
	1/1/2028	\$46.48	\$13.54	\$11.01	\$11.12	\$2.13	\$84.28
For apprentice rates see "Apprentice- SHEET METAL WORKER"							
HVAC (ELECTRICAL CONTROLS)	9/7/2025	\$48.16	\$14.98	\$14.30	\$5.30	\$0.00	\$82.74
ELECTRICIANS LOCAL 96	9/6/2026	\$49.38	\$15.96	\$14.57	\$5.43	\$0.00	\$85.34
ELECTRICIANS LOCAL 96							
For apprentice rates see "Apprentice- ELECTRICIAN"							
HVAC (TESTING AND BALANCING - AIR)	7/1/2025	\$43.48	\$12.94	\$11.01	\$8.72	\$2.13	\$78.28
SHEETMETAL WORKERS LOCAL 63	7/1/2026	\$43.48	\$13.24	\$11.01	\$9.92	\$2.13	\$79.78
SHEETMETAL WORKERS LOCAL 63	1/1/2027	\$43.48	\$13.54	\$11.01	\$11.12	\$2.13	\$81.28
	7/1/2027	\$44.98	\$13.54	\$11.01	\$11.12	\$2.13	\$82.78
	1/1/2028	\$46.48	\$13.54	\$11.01	\$11.12	\$2.13	\$84.28
For apprentice rates see "Apprentice- SHEET METAL WORKER"							
HVAC (TESTING AND BALANCING -WATER)	9/1/2025	\$55.00	\$12.70	\$9.71	\$8.06	\$0.00	\$85.47
PLUMBERS LOCAL 4	3/1/2026	\$57.80	\$11.30	\$9.71	\$8.06	\$0.00	\$86.87
PLUMBERS LOCAL 4							
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"							
HVAC MECHANIC	9/1/2025	\$55.00	\$12.70	\$9.71	\$8.06	\$0.00	\$85.47
PLUMBERS LOCAL 4	3/1/2026	\$57.80	\$11.30	\$9.71	\$8.06	\$0.00	\$86.87
PLUMBERS LOCAL 4							
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"							
HYDRAULIC DRILLS	12/1/2025	\$41.22	\$10.65	\$9.75	\$9.11	\$0.00	\$70.73
LABORERS	6/1/2026	\$42.66	\$10.65	\$9.75	\$9.11	\$0.00	\$72.17
LABORERS - ZONE 2	12/1/2026	\$44.10	\$10.65	\$9.75	\$9.11	\$0.00	\$73.61
	6/1/2027	\$45.55	\$10.65	\$9.75	\$9.11	\$0.00	\$75.06
	12/1/2027	\$47.00	\$10.65	\$9.75	\$9.11	\$0.00	\$76.51
	6/1/2028	\$48.50	\$10.65	\$9.75	\$9.11	\$0.00	\$78.01
	12/1/2028	\$50.00	\$10.65	\$9.75	\$9.11	\$0.00	\$79.51
For apprentice rates see "Apprentice- LABORER"							
HYDRAULIC DRILLS (HEAVY & HIGHWAY)	12/1/2025	\$41.22	\$10.65	\$9.75	\$9.21	\$0.00	\$70.83
LABORERS	6/1/2026	\$42.66	\$10.65	\$9.75	\$9.21	\$0.00	\$72.27
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2026	\$44.10	\$10.65	\$9.75	\$9.21	\$0.00	\$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
INSULATOR (PIPES & TANKS)	9/1/2025	\$54.31	\$14.75	\$9.52	\$10.09	\$0.00	\$88.67
HEAT & FROST INSULATORS LOCAL 6	9/1/2026	\$57.38	\$14.75	\$9.52	\$10.09	\$0.00	\$91.74
HEAT & FROST INSULATORS LOCAL 6 (WORCESTER)							

Apprentice: INSULATOR (PIPES & TANKS)**Effective Date: 9/1/2025**

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$27.16	\$14.75	\$9.27	\$5.05	\$0.00	\$56.23
2	60.00	\$32.59	\$14.75	\$9.32	\$6.05	\$0.00	\$62.71

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: INSULATOR (PIPES & TANKS) Effective Date: 9/1/2025							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
3	70.00	\$38.02	\$14.75	\$9.37	\$7.06	\$0.00	\$69.20
4	80.00	\$43.45	\$14.75	\$9.42	\$8.07	\$0.00	\$75.69
Apprentice: INSULATOR (PIPES & TANKS) Effective Date: 9/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$28.69	\$14.75	\$9.27	\$5.05	\$0.00	\$57.76
2	60.00	\$34.43	\$14.75	\$9.32	\$6.05	\$0.00	\$64.55
3	70.00	\$40.17	\$14.75	\$9.37	\$7.06	\$0.00	\$71.35
4	80.00	\$45.90	\$14.75	\$9.42	\$8.07	\$0.00	\$78.14
Apprentice to Journeyworker Ratio: 1:4							
IRONWORKER/WELDER	9/16/2025	\$57.57	\$9.05	\$12.75	\$14.50	\$0.00	\$93.87
IRONWORKERS LOCAL 7							
IRONWORKERS LOCAL 7 (WORCESTER AREA)							
Apprentice: IRONWORKER/WELDER Effective Date: 9/16/2025							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	\$34.54	\$9.05	\$12.75	\$4.50	\$0.00	\$60.84
2	75.00	\$43.18	\$9.05	\$12.75	\$4.50	\$0.00	\$69.48
3	85.00	\$48.93	\$9.05	\$12.75	\$4.50	\$0.00	\$75.23
Apprentice to Journeyworker Ratio: 1:4							
JACKHAMMER & PAVING BREAKER OPERATOR	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.11	\$0.00	\$70.23
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.11	\$0.00	\$71.67
LABORERS - ZONE 2	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.11	\$0.00	\$73.11
	6/1/2027	\$45.05	\$10.65	\$9.75	\$9.11	\$0.00	\$74.56
	12/1/2027	\$46.50	\$10.65	\$9.75	\$9.11	\$0.00	\$76.01
	6/1/2028	\$48.00	\$10.65	\$9.75	\$9.11	\$0.00	\$77.51
	12/1/2028	\$49.50	\$10.65	\$9.75	\$9.11	\$0.00	\$79.01
For apprentice rates see "Apprentice- LABORER"							
LABORER	12/1/2025	\$40.47	\$10.65	\$9.75	\$9.11	\$0.00	\$69.98
LABORERS	6/1/2026	\$41.91	\$10.65	\$9.75	\$9.11	\$0.00	\$71.42
LABORERS - ZONE 2	12/1/2026	\$43.35	\$10.65	\$9.75	\$9.11	\$0.00	\$72.86
	6/1/2027	\$44.80	\$10.65	\$9.75	\$9.11	\$0.00	\$74.31
	12/1/2027	\$46.25	\$10.65	\$9.75	\$9.11	\$0.00	\$75.76
	6/1/2028	\$47.75	\$10.65	\$9.75	\$9.11	\$0.00	\$77.26
	12/1/2028	\$49.25	\$10.65	\$9.75	\$9.11	\$0.00	\$78.76

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: LABORER							
Effective Date: 12/1/2025							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	\$25.03	\$10.15	\$9.50	\$9.11	\$0.00	\$53.79
2	70.00	\$29.20	\$10.15	\$9.50	\$9.11	\$0.00	\$57.96
3	80.00	\$33.38	\$10.15	\$9.50	\$9.11	\$0.00	\$62.14
4	90.00	\$37.55	\$10.15	\$9.50	\$9.11	\$0.00	\$66.31
Apprentice: LABORER							
Effective Date: 6/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	\$25.15	\$10.65	\$9.75	\$9.11	\$0.00	\$54.66
2	70.00	\$29.34	\$10.65	\$9.75	\$9.11	\$0.00	\$58.85
3	80.00	\$33.53	\$10.65	\$9.75	\$9.11	\$0.00	\$63.04
4	90.00	\$37.72	\$10.65	\$9.75	\$9.11	\$0.00	\$67.23
Apprentice to Journeyworker Ratio: 1:5							
LABORER (HEAVY & HIGHWAY)	12/1/2025	\$40.47	\$10.65	\$9.75	\$9.21	\$0.00	\$70.08
LABORERS	6/1/2026	\$41.91	\$10.65	\$9.75	\$9.21	\$0.00	\$71.52
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2026	\$43.35	\$10.65	\$9.75	\$9.21	\$0.00	\$72.96

Apprentice: LABORER (HEAVY & HIGHWAY)							
Effective Date: 12/1/2025							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	\$25.03	\$10.15	\$9.50	\$9.21	\$0.00	\$53.89
2	70.00	\$29.20	\$10.15	\$9.50	\$9.21	\$0.00	\$58.06
3	80.00	\$33.38	\$10.15	\$9.50	\$9.21	\$0.00	\$62.24
4	90.00	\$37.55	\$10.15	\$9.50	\$9.21	\$0.00	\$66.41
Apprentice: LABORER (HEAVY & HIGHWAY)							
Effective Date: 6/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	60.00	\$25.15	\$10.65	\$9.75	\$9.21	\$0.00	\$54.76
2	70.00	\$29.34	\$10.65	\$9.75	\$9.21	\$0.00	\$58.95
3	80.00	\$33.53	\$10.65	\$9.75	\$9.21	\$0.00	\$63.14
4	90.00	\$37.72	\$10.65	\$9.75	\$9.10	\$0.00	\$67.22
Apprentice to Journeyworker Ratio: 1:5							

LABORER: CARPENTER TENDER	12/1/2025	\$40.47	\$10.65	\$9.75	\$9.11	\$0.00	\$69.98

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
LABORERS	6/1/2026	\$41.91	\$10.65	\$9.75	\$9.11	\$0.00	\$71.42
LABORERS - ZONE 2	12/1/2026	\$43.35	\$10.65	\$9.75	\$9.11	\$0.00	\$72.86
	6/1/2027	\$44.80	\$10.65	\$9.75	\$9.11	\$0.00	\$74.31
	12/1/2027	\$46.25	\$10.65	\$9.75	\$9.11	\$0.00	\$75.76
	6/1/2028	\$47.75	\$10.65	\$9.75	\$9.11	\$0.00	\$77.26
	12/1/2028	\$49.25	\$10.65	\$9.75	\$9.11	\$0.00	\$78.76
For apprentice rates see "Apprentice- LABORER"							
LABORER: CEMENT FINISHER TENDER	12/1/2025	\$40.47	\$10.65	\$9.75	\$9.11	\$0.00	\$69.98
LABORERS	6/1/2026	\$41.91	\$10.65	\$9.75	\$9.11	\$0.00	\$71.42
LABORERS - ZONE 2	12/1/2026	\$43.35	\$10.65	\$9.75	\$9.11	\$0.00	\$72.86
	6/1/2027	\$44.80	\$10.65	\$9.75	\$9.11	\$0.00	\$74.31
	12/1/2027	\$46.25	\$10.65	\$9.75	\$9.11	\$0.00	\$75.76
	6/1/2028	\$47.75	\$10.65	\$9.75	\$9.11	\$0.00	\$77.26
	12/1/2028	\$49.25	\$10.65	\$9.75	\$9.11	\$0.00	\$78.76
For apprentice rates see "Apprentice- LABORER"							
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER	12/1/2025	\$40.56	\$10.65	\$9.75	\$9.65	\$0.00	\$70.61
LABORERS	6/1/2026	\$42.00	\$10.65	\$9.75	\$9.65	\$0.00	\$72.05
LABORERS - ZONE 2	12/7/2026	\$43.44	\$10.65	\$9.75	\$9.65	\$0.00	\$73.49
	6/7/2027	\$44.89	\$10.65	\$9.75	\$9.65	\$0.00	\$74.94
	12/6/2027	\$46.34	\$10.65	\$9.75	\$9.65	\$0.00	\$76.39
	6/5/2028	\$47.84	\$10.65	\$9.75	\$9.65	\$0.00	\$77.89
	12/4/2028	\$49.34	\$10.65	\$9.75	\$9.65	\$0.00	\$79.39
For apprentice rates see "Apprentice- LABORER"							
LABORER: MASON TENDER	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.11	\$0.00	\$70.23
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.11	\$0.00	\$71.67
LABORERS - ZONE 2	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.11	\$0.00	\$73.11
	6/1/2027	\$45.05	\$10.65	\$9.75	\$9.11	\$0.00	\$74.56
	12/1/2027	\$46.50	\$10.65	\$9.75	\$9.11	\$0.00	\$76.01
	6/1/2028	\$48.00	\$10.65	\$9.75	\$9.11	\$0.00	\$77.51
	12/1/2028	\$49.50	\$10.65	\$9.75	\$9.11	\$0.00	\$79.01
For apprentice rates see "Apprentice- LABORER"							
LABORER: MASON TENDER (HEAVY & HIGHWAY)	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.21	\$0.00	\$70.33
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.21	\$0.00	\$71.77
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.21	\$0.00	\$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
LABORER: MULTI-TRADE TENDER	12/1/2025	\$40.47	\$10.65	\$9.75	\$9.11	\$0.00	\$69.98
LABORERS	6/1/2026	\$41.91	\$10.65	\$9.75	\$9.11	\$0.00	\$71.42
LABORERS - ZONE 2	12/1/2026	\$43.35	\$10.65	\$9.75	\$9.11	\$0.00	\$72.86
	6/1/2027	\$44.80	\$10.65	\$9.75	\$9.11	\$0.00	\$74.31
	12/1/2027	\$46.25	\$10.65	\$9.75	\$9.11	\$0.00	\$75.76
	6/1/2028	\$47.75	\$10.65	\$9.75	\$9.11	\$0.00	\$77.26
	12/1/2028	\$49.25	\$10.65	\$9.75	\$9.11	\$0.00	\$78.76
For apprentice rates see "Apprentice- LABORER"							
LABORER: TREE REMOVER	12/1/2025	\$40.47	\$10.65	\$9.75	\$9.11	\$0.00	\$69.98

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
LABORERS	6/1/2026	\$41.91	\$10.65	\$9.75	\$9.11	\$0.00	\$71.42
LABORERS - ZONE 2	12/1/2026	\$43.35	\$10.65	\$9.75	\$9.11	\$0.00	\$72.86
	6/1/2027	\$44.80	\$10.65	\$9.75	\$9.11	\$0.00	\$74.31
	12/1/2027	\$46.25	\$10.65	\$9.75	\$9.11	\$0.00	\$75.76
	6/1/2028	\$47.75	\$10.65	\$9.75	\$9.11	\$0.00	\$77.26
	12/1/2028	\$49.25	\$10.65	\$9.75	\$9.11	\$0.00	\$78.76

This classification applies to the removal of standing trees, and the trimming and removal of branches and limbs when related to public works construction or site clearance incidental to construction . For apprentice rates see "Apprentice- LABORER"

LASER BEAM OPERATOR	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.11	\$0.00	\$70.23
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.11	\$0.00	\$71.67
LABORERS - ZONE 2	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.11	\$0.00	\$73.11
	6/1/2027	\$45.05	\$10.65	\$9.75	\$9.11	\$0.00	\$74.56
	12/1/2027	\$46.50	\$10.65	\$9.75	\$9.11	\$0.00	\$76.01
	6/1/2028	\$48.00	\$10.65	\$9.75	\$9.11	\$0.00	\$77.51
	12/1/2028	\$49.50	\$10.65	\$9.75	\$9.11	\$0.00	\$79.01

For apprentice rates see "Apprentice- LABORER"

LASER BEAM OPERATOR (HEAVY & HIGHWAY)	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.21	\$0.00	\$70.33
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.21	\$0.00	\$71.77
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.21	\$0.00	\$73.21

For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"

MARBLE & TILE FINISHERS	2/1/2026	\$52.08	\$12.84	\$15.57	\$5.78	\$0.00	\$86.27
BRICKLAYERS LOCAL 3	8/1/2026	\$53.84	\$12.84	\$15.57	\$5.78	\$0.00	\$88.03
BRICKLAYERS LOCAL 3 - MARBLE & TILE	2/1/2027	\$54.96	\$12.84	\$15.57	\$5.78	\$0.00	\$89.15

Apprentice: MARBLE & TILE FINISHERS**Effective Date: 2/1/2026**

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$26.04	\$12.84	\$15.57	\$5.78	\$0.00	\$60.23
2	60.00	\$31.25	\$12.84	\$15.57	\$5.78	\$0.00	\$65.44
3	70.00	\$36.46	\$12.84	\$15.57	\$5.78	\$0.00	\$70.65
4	80.00	\$41.66	\$12.84	\$15.57	\$5.78	\$0.00	\$75.85
5	90.00	\$46.87	\$12.84	\$15.57	\$5.78	\$0.00	\$81.06

Apprentice: MARBLE & TILE FINISHERS**Effective Date: 8/1/2026**

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$26.92	\$12.84	\$15.57	\$5.78	\$0.00	\$61.11
2	60.00	\$32.30	\$12.84	\$15.57	\$5.78	\$0.00	\$66.49
3	70.00	\$37.69	\$12.84	\$15.57	\$5.78	\$0.00	\$71.88
4	80.00	\$43.07	\$12.84	\$15.57	\$5.78	\$0.00	\$77.26
5	90.00	\$48.46	\$12.84	\$15.57	\$5.78	\$0.00	\$82.65

Apprentice to Journeyworker Ratio: 1:5

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
MARBLE MASONS,TILELAYERS & TERRAZZO MECH	2/1/2026	\$67.97	\$12.84	\$15.57	\$7.99	\$0.00	\$104.37
BRICKLAYERS LOCAL 3	8/1/2026	\$70.17	\$12.84	\$15.57	\$7.99	\$0.00	\$106.57
BRICKLAYERS LOCAL 3 - MARBLE & TILE	2/1/2027	\$71.57	\$12.84	\$15.57	\$7.99	\$0.00	\$107.97

Apprentice: MARBLE MASONS,TILELAYERS & TERRAZZO MECH							
Effective Date: 2/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$33.99	\$12.84	\$15.57	\$7.99	\$0.00	\$70.39
2	60.00	\$40.78	\$12.84	\$15.57	\$7.99	\$0.00	\$77.18
3	70.00	\$47.58	\$12.84	\$15.57	\$7.99	\$0.00	\$83.98
4	80.00	\$54.38	\$12.84	\$15.57	\$7.99	\$0.00	\$90.78
5	90.00	\$61.17	\$12.84	\$15.57	\$7.99	\$0.00	\$97.57

Apprentice: MARBLE MASONS,TILELAYERS & TERRAZZO MECH							
Effective Date: 8/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$35.09	\$12.84	\$15.57	\$7.99	\$0.00	\$71.49
2	60.00	\$42.10	\$12.84	\$15.57	\$7.99	\$0.00	\$78.50
3	70.00	\$49.12	\$12.84	\$15.57	\$7.99	\$0.00	\$85.52
4	80.00	\$56.14	\$12.84	\$15.57	\$7.99	\$0.00	\$92.54
5	90.00	\$63.15	\$12.84	\$15.57	\$7.99	\$0.00	\$99.55

Apprentice to Journeyworker Ratio: 1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES)	12/1/2025	\$58.62	\$16.05	\$13.25	\$3.25	\$0.00	\$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$59.90	\$16.05	\$13.25	\$3.25	\$0.00	\$92.45
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$61.34	\$16.05	\$13.25	\$3.25	\$0.00	\$93.89

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

MECHANICS MAINTENANCE	12/1/2025	\$58.62	\$16.05	\$13.25	\$3.25	\$0.00	\$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$59.90	\$16.05	\$13.25	\$3.25	\$0.00	\$92.45
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$61.34	\$16.05	\$13.25	\$3.25	\$0.00	\$93.89

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

MILLWRIGHT (Zone 3)	1/5/2026	\$45.70	\$10.08	\$11.47	\$9.75	\$0.00	\$77.00
MILLWRIGHTS LOCAL 1121							
MILLWRIGHTS LOCAL 1121 - Zone 3							

Apprentice: MILLWRIGHT (Zone 3)							
Effective Date: 1/5/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	55.00	\$25.14	\$10.08	\$0.00	\$5.36	\$0.00	\$40.58
2	65.00	\$29.71	\$10.08	\$0.00	\$6.34	\$0.00	\$46.13
3	75.00	\$34.28	\$10.08	\$11.47	\$7.31	\$0.00	\$63.14

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: MILLWRIGHT (Zone 3) Effective Date: 1/5/2026							
		Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Step 4	85.00	\$38.85	\$10.08	\$11.47	\$8.29	\$0.00	\$68.69
Apprentice Notes Step 1&2 Appr. indentured after 1/6/2020 receive no pension,							
Apprentice to Journeyworker Ratio: 1:4							
MORTAR MIXER	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.11	\$0.00	\$70.23
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.11	\$0.00	\$71.67
LABORERS - ZONE 2	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.11	\$0.00	\$73.11
	6/1/2027	\$45.05	\$10.65	\$9.75	\$9.11	\$0.00	\$74.56
	12/1/2027	\$46.50	\$10.65	\$9.75	\$9.11	\$0.00	\$76.01
	6/1/2028	\$48.00	\$10.65	\$9.75	\$9.11	\$0.00	\$77.51
	12/1/2028	\$49.50	\$10.65	\$9.75	\$9.11	\$0.00	\$79.01
For apprentice rates see "Apprentice- LABORER"							
OILER (OTHER THAN TRUCK CRANES,GRADALLS)	12/1/2025	\$25.68	\$16.05	\$13.25	\$3.25	\$0.00	\$58.23
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$26.27	\$16.05	\$13.25	\$3.25	\$0.00	\$58.82
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$26.94	\$16.05	\$13.25	\$3.25	\$0.00	\$59.49
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
OILER (TRUCK CRANES, GRADALLS)	12/1/2025	\$31.65	\$16.05	\$13.25	\$3.25	\$0.00	\$64.20
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$32.37	\$16.05	\$13.25	\$3.25	\$0.00	\$64.92
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$33.17	\$16.05	\$13.25	\$3.25	\$0.00	\$65.72
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
OTHER POWER DRIVEN EQUIPMENT - CLASS II	12/1/2025	\$58.62	\$16.05	\$13.25	\$3.25	\$0.00	\$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$59.90	\$16.05	\$13.25	\$3.25	\$0.00	\$92.45
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$61.34	\$16.05	\$13.25	\$3.25	\$0.00	\$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
PAINTER (BRIDGES/TANKS)	1/1/2026	\$59.56	\$10.35	\$12.00	\$12.50	\$0.00	\$94.41
PAINTERS LOCAL 35							
PAINTERS LOCAL 35 - ZONE 2							

Apprentice: PAINTER (BRIDGES/TANKS)							
Effective Date: 1/1/2026							
		Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Step 1	50.00	\$29.78	\$10.35	\$0.00	\$0.00	\$0.00	\$40.13
2	55.00	\$32.76	\$10.35	\$0.00	\$6.93	\$0.00	\$50.04
3	60.00	\$35.74	\$10.35	\$0.00	\$7.56	\$0.00	\$53.65
4	65.00	\$38.71	\$10.35	\$0.00	\$8.19	\$0.00	\$57.25

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: PAINTER (BRIDGES/TANKS)							
Effective Date: 1/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
5	70.00	\$41.69	\$10.35	\$12.00	\$8.82	\$0.00	\$72.86
6	75.00	\$44.67	\$10.35	\$12.00	\$9.45	\$0.00	\$76.47
7	80.00	\$47.65	\$10.35	\$12.00	\$10.08	\$0.00	\$80.08
8	90.00	\$53.60	\$10.35	\$12.00	\$11.34	\$0.00	\$87.29

Apprentice to Journeyworker Ratio: 1:1

PAINTER (SPRAY OR SANDBLAST, NEW) *	1/1/2026	\$50.46	\$10.35	\$12.00	\$12.60	\$0.00	\$85.41
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.							
PAINTERS LOCAL 35							
PAINTERS LOCAL 35 - ZONE 2							

Apprentice: PAINTER (SPRAY OR SANDBLAST, NEW) *							
Effective Date: 1/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$25.23	\$10.35	\$0.00	\$0.00	\$0.00	\$35.58
2	55.00	\$27.75	\$10.35	\$0.00	\$6.93	\$0.00	\$45.03
3	60.00	\$30.28	\$10.35	\$0.00	\$7.56	\$0.00	\$48.19
4	65.00	\$32.80	\$10.35	\$0.00	\$8.19	\$0.00	\$51.34
5	70.00	\$35.32	\$10.35	\$12.00	\$8.82	\$0.00	\$66.49
6	75.00	\$37.85	\$10.35	\$12.00	\$9.45	\$0.00	\$69.65
7	80.00	\$40.37	\$10.35	\$12.00	\$10.08	\$0.00	\$72.80
8	90.00	\$45.41	\$10.35	\$12.00	\$11.34	\$0.00	\$79.10

Apprentice to Journeyworker Ratio: 1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT)	1/1/2026	\$48.52	\$10.35	\$12.00	\$12.60	\$0.00	\$83.47
PAINTERS LOCAL 35							
PAINTERS LOCAL 35 - ZONE 2							

Apprentice: PAINTER (SPRAY OR SANDBLAST, REPAINT)							
Effective Date: 1/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$24.26	\$10.35	\$0.00	\$0.00	\$0.00	\$34.61
2	55.00	\$26.69	\$10.35	\$0.00	\$6.93	\$0.00	\$43.97
3	60.00	\$29.11	\$10.35	\$0.00	\$7.56	\$0.00	\$47.02
4	65.00	\$31.54	\$10.35	\$0.00	\$8.19	\$0.00	\$50.08
5	70.00	\$33.96	\$10.35	\$12.00	\$8.82	\$0.00	\$65.13
6	75.00	\$36.39	\$10.35	\$12.00	\$9.45	\$0.00	\$68.19
7	80.00	\$38.82	\$10.35	\$12.00	\$10.08	\$0.00	\$71.25
8	90.00	\$43.67	\$10.35	\$12.00	\$11.34	\$0.00	\$77.36

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice to Journeyworker Ratio: 1:1							

PAINTER / TAPER (BRUSH, NEW) *	1/1/2026	\$49.06	\$10.35	\$12.00	\$12.60	\$0.00	\$84.01
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.							
PAINTERS LOCAL 35							
PAINTERS LOCAL 35 - ZONE 2							

Apprentice: PAINTER / TAPER (BRUSH, NEW) *							
Effective Date: 1/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$24.53	\$10.35	\$0.00	\$0.00	\$0.00	\$34.88
2	55.00	\$26.98	\$10.35	\$0.00	\$6.93	\$0.00	\$44.26
3	60.00	\$29.44	\$10.35	\$0.00	\$7.56	\$0.00	\$47.35
4	65.00	\$31.89	\$10.35	\$0.00	\$8.19	\$0.00	\$50.43
5	70.00	\$34.34	\$10.35	\$12.00	\$8.82	\$0.00	\$65.51
6	75.00	\$36.80	\$10.35	\$12.00	\$9.45	\$0.00	\$68.60
7	80.00	\$39.25	\$10.35	\$12.00	\$10.08	\$0.00	\$71.68
8	90.00	\$44.15	\$10.35	\$12.00	\$11.34	\$0.00	\$77.84

Apprentice to Journeyworker Ratio: 1:1

PAINTER / TAPER (BRUSH, REPAINT)	1/1/2026	\$47.12	\$10.35	\$12.00	\$12.60	\$0.00	\$82.07
PAINTERS LOCAL 35							
PAINTERS LOCAL 35 - ZONE 2							

Apprentice: PAINTER / TAPER (BRUSH, REPAINT)							
Effective Date: 1/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$23.56	\$10.35	\$0.00	\$0.00	\$0.00	\$33.91
2	55.00	\$25.92	\$10.35	\$0.00	\$6.93	\$0.00	\$43.20
3	60.00	\$28.27	\$10.35	\$0.00	\$7.56	\$0.00	\$46.18
4	65.00	\$30.63	\$10.35	\$0.00	\$8.19	\$0.00	\$49.17
5	70.00	\$32.98	\$10.35	\$12.00	\$8.82	\$0.00	\$64.15
6	75.00	\$35.34	\$10.35	\$12.00	\$9.45	\$0.00	\$67.14
7	80.00	\$37.70	\$10.35	\$12.00	\$10.08	\$0.00	\$70.13
8	90.00	\$42.41	\$10.35	\$12.00	\$11.34	\$0.00	\$76.10

Apprentice to Journeyworker Ratio: 1:1

PAINTER TRAFFIC MARKINGS (HEAVY/HIGHWAY)	12/1/2025	\$40.47	\$10.65	\$9.75	\$9.21	\$0.00	\$70.08
LABORERS	6/1/2026	\$41.91	\$10.65	\$9.75	\$9.21	\$0.00	\$71.52
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2026	\$43.35	\$10.65	\$9.75	\$9.21	\$0.00	\$72.96

For apprentice rates see "Apprentice- LABORER (Heavy and Highway)

PANEL & PICKUP TRUCKS DRIVER	1/1/2026	\$40.78	\$16.17	\$21.78	\$0.00	\$0.00	\$78.73
TEAMSTERS JOINT COUNCIL NO. 10	6/1/2026	\$41.78	\$16.17	\$21.78	\$0.00	\$0.00	\$79.73
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	12/1/2026	\$41.78	\$16.17	\$23.52	\$0.00	\$0.00	\$81.47

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
	1/1/2027	\$41.78	\$16.77	\$23.52	\$0.00	\$0.00	\$82.07
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) PILE DRIVER LOCAL 56 PILE DRIVER LOCAL 56 (ZONE 2) For apprentice rates see "Apprentice- PILE DRIVER"	8/1/2024	\$51.97	\$10.08	\$11.62	\$12.67	\$0.00	\$86.34
PILE DRIVER PILE DRIVER LOCAL 56 PILE DRIVER LOCAL 56 (ZONE 2)	8/1/2024	\$51.97	\$10.08	\$11.62	\$12.67	\$0.00	\$86.34

Apprentice: PILE DRIVER							
Effective Date: 8/1/2024							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	\$23.39	\$10.08	\$0.00	\$2.53	\$0.00	\$36.00
2	55.00	\$28.58	\$10.08	\$0.00	\$5.07	\$0.00	\$43.73
3	70.00	\$36.38	\$10.08	\$11.62	\$7.60	\$0.00	\$65.68
4	80.00	\$41.58	\$10.08	\$11.62	\$10.14	\$0.00	\$73.42

Apprentice to Journeyworker Ratio: 1:5

PIPELAYER LABORERS LABORERS - ZONE 2	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.11	\$0.00	\$70.23
	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.11	\$0.00	\$71.67
	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.11	\$0.00	\$73.11
	6/1/2027	\$45.05	\$10.65	\$9.75	\$9.11	\$0.00	\$74.56
	12/1/2027	\$46.50	\$10.65	\$9.75	\$9.11	\$0.00	\$76.01
	6/1/2028	\$48.00	\$10.65	\$9.75	\$9.11	\$0.00	\$77.51
	12/1/2028	\$49.50	\$10.65	\$9.75	\$9.11	\$0.00	\$79.01
For apprentice rates see "Apprentice- LABORER"							
PIPELAYER (HEAVY & HIGHWAY) LABORERS LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.21	\$0.00	\$70.33
	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.21	\$0.00	\$71.77
	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.21	\$0.00	\$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
PLUMBER & PIPEFITTER PLUMBERS LOCAL 4 PLUMBERS LOCAL 4	9/1/2025	\$55.00	\$12.70	\$9.71	\$8.06	\$0.00	\$85.47
	3/1/2026	\$57.80	\$11.30	\$9.71	\$8.06	\$0.00	\$86.87

Apprentice: PLUMBER & PIPEFITTER							
Effective Date: 9/1/2025							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	40.00	\$22.00	\$12.70	\$0.00	\$0.00	\$0.00	\$34.70
2	50.00	\$27.50	\$12.70	\$0.00	\$0.00	\$0.00	\$40.20
3	60.00	\$33.00	\$12.70	\$0.00	\$0.00	\$0.00	\$45.70
4	70.00	\$38.50	\$12.70	\$0.00	\$8.06	\$0.00	\$59.26

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: PLUMBER & PIPEFITTER							
Effective Date: 9/1/2025							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
5	80.00	\$44.00	\$12.70	\$0.00	\$8.06	\$0.00	\$64.76
Apprentice: PLUMBER & PIPEFITTER							
Effective Date: 3/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	40.00	\$23.12	\$11.30	\$0.00	\$0.00	\$0.00	\$34.42
2	50.00	\$28.90	\$11.30	\$0.00	\$0.00	\$0.00	\$40.20
3	60.00	\$34.68	\$11.30	\$0.00	\$0.00	\$0.00	\$45.98
4	70.00	\$40.46	\$11.30	\$0.00	\$8.06	\$0.00	\$59.82
5	80.00	\$46.24	\$11.30	\$0.00	\$8.06	\$0.00	\$65.60
Apprentice to Journeyworker Ratio: 1:3							
PNEUMATIC CONTROLS (TEMP.)	9/1/2025	\$55.00	\$12.70	\$9.71	\$8.06	\$0.00	\$85.47
PLUMBERS LOCAL 4	3/1/2026	\$57.80	\$11.30	\$9.71	\$8.06	\$0.00	\$86.87
PLUMBERS LOCAL 4							
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"							
PNEUMATIC DRILL/TOOL OPERATOR	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.11	\$0.00	\$70.23
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.11	\$0.00	\$71.67
LABORERS - ZONE 2	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.11	\$0.00	\$73.11
	6/1/2027	\$45.05	\$10.65	\$9.75	\$9.11	\$0.00	\$74.56
	12/1/2027	\$46.50	\$10.65	\$9.75	\$9.11	\$0.00	\$76.01
	6/1/2028	\$48.00	\$10.65	\$9.75	\$9.11	\$0.00	\$77.51
	12/1/2028	\$49.50	\$10.65	\$9.75	\$9.11	\$0.00	\$79.01
For apprentice rates see "Apprentice- LABORER"							
PNEUMATIC DRILL/TOOL OPERATOR (HEAVY & HIGHWAY)	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.21	\$0.00	\$70.33
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.21	\$0.00	\$71.77
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.21	\$0.00	\$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
POWDERMAN & BLASTER	12/1/2025	\$41.47	\$10.65	\$9.75	\$9.11	\$0.00	\$70.98
LABORERS	6/1/2026	\$42.91	\$10.65	\$9.75	\$9.11	\$0.00	\$72.42
LABORERS - ZONE 2	12/1/2026	\$44.35	\$10.65	\$9.75	\$9.11	\$0.00	\$73.86
	6/1/2027	\$45.80	\$10.65	\$9.75	\$9.11	\$0.00	\$75.31
	12/1/2027	\$47.25	\$10.65	\$9.75	\$9.11	\$0.00	\$76.76
	6/1/2028	\$48.75	\$10.65	\$9.75	\$9.11	\$0.00	\$78.26
	12/1/2028	\$50.25	\$10.65	\$9.75	\$9.11	\$0.00	\$79.76
For apprentice rates see "Apprentice- LABORER"							
POWDERMAN & BLASTER (HEAVY & HIGHWAY)	12/1/2025	\$41.47	\$10.65	\$9.75	\$9.21	\$0.00	\$71.08
LABORERS	6/1/2026	\$42.91	\$10.65	\$9.75	\$9.21	\$0.00	\$72.52
LABORERS - ZONE 2 (HEAVY & HIGHWAY)							

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
	12/1/2026	\$44.35	\$10.65	\$9.75	\$9.21	\$0.00	\$73.96
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"							
POWER SHOVEL/DERRICK/TRENCHING MACHINE	12/1/2025	\$59.28	\$16.05	\$13.25	\$3.25	\$0.00	\$91.83
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$60.58	\$16.05	\$13.25	\$3.25	\$0.00	\$93.13
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$62.03	\$16.05	\$13.25	\$3.25	\$0.00	\$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
PUMP OPERATOR (CONCRETE)	12/1/2025	\$58.62	\$16.05	\$13.25	\$3.25	\$0.00	\$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$59.90	\$16.05	\$13.25	\$3.25	\$0.00	\$92.45
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$61.34	\$16.05	\$13.25	\$3.25	\$0.00	\$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
PUMP OPERATOR (DEWATERING, OTHER)	12/1/2025	\$37.97	\$16.05	\$13.25	\$3.25	\$0.00	\$70.52
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$38.83	\$16.05	\$13.25	\$3.25	\$0.00	\$71.38
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$39.78	\$16.05	\$13.25	\$3.25	\$0.00	\$72.33
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
READY-MIX CONCRETE DRIVER	1/1/2025	\$27.60	\$11.26	\$6.15	\$0.00	\$0.00	\$45.01
TEAMSTERS 170							
TEAMSTERS 170 - Dauphinais (Bellingham)							
RECLAIMERS	12/1/2025	\$58.62	\$16.05	\$13.25	\$3.25	\$0.00	\$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$59.90	\$16.05	\$13.25	\$3.25	\$0.00	\$92.45
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$61.34	\$16.05	\$13.25	\$3.25	\$0.00	\$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
RIDE-ON MOTORIZED BUGGY OPERATOR	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.11	\$0.00	\$70.23
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.11	\$0.00	\$71.67
LABORERS - ZONE 2	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.11	\$0.00	\$73.11
	6/1/2027	\$45.05	\$10.65	\$9.75	\$9.11	\$0.00	\$74.56
	12/1/2027	\$46.50	\$10.65	\$9.75	\$9.11	\$0.00	\$76.01
	6/1/2028	\$48.00	\$10.65	\$9.75	\$9.11	\$0.00	\$77.51
	12/1/2028	\$49.50	\$10.65	\$9.75	\$9.11	\$0.00	\$79.01
For apprentice rates see "Apprentice- LABORER"							
ROLLER/SPREADER/MULCHING MACHINE	12/1/2025	\$58.62	\$16.05	\$13.25	\$3.25	\$0.00	\$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$59.90	\$16.05	\$13.25	\$3.25	\$0.00	\$92.45
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$61.34	\$16.05	\$13.25	\$3.25	\$0.00	\$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
ROOFER (Inc.Roofers Waterproofing &Roofers Damproofg)	2/1/2026	\$53.53	\$14.53	\$12.67	\$9.03	\$0.00	\$89.76
ROOFERS LOCAL 33							
ROOFERS LOCAL 33							

Apprentice: ROOFER (Inc.Roofers Waterproofing &Roofers Damproofg)**Effective Date: 2/1/2026**

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$26.77	\$14.53	\$6.52	\$9.03	\$0.00	\$56.85

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: ROOFER (Inc.Roofing Waterproofing &Roofing Damproofing) Effective Date: 2/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
2	60.00	\$32.12	\$14.53	\$12.67	\$9.03	\$0.00	\$68.35
3	65.00	\$34.79	\$14.53	\$12.67	\$9.03	\$0.00	\$71.02
4	75.00	\$40.15	\$14.53	\$12.67	\$9.03	\$0.00	\$76.38
5	85.00	\$45.50	\$14.53	\$12.67	\$9.03	\$0.00	\$81.73
Apprentice Notes ** 1:5, 2:6-10, the 1:10; Reroofing: 1:4, then 1:1							
Apprentice to Journeyworker Ratio: 1:5							
ROOFER SLATE / TILE / PRECAST CONCRETE	2/1/2026	\$53.78	\$14.53	\$12.67	\$9.03	\$0.00	\$90.01
ROOFERS LOCAL 33							
ROOFERS LOCAL 33							
For apprentice rates see "Apprentice- ROOFER"							
SHEETMETAL WORKER	7/1/2025	\$43.48	\$12.94	\$11.01	\$8.72	\$2.13	\$78.28
SHEETMETAL WORKERS LOCAL 63	7/1/2026	\$43.48	\$13.24	\$11.01	\$9.92	\$2.13	\$79.78
SHEETMETAL WORKERS LOCAL 63	1/1/2027	\$43.48	\$13.54	\$11.01	\$11.12	\$2.13	\$81.28
	7/1/2027	\$44.98	\$13.54	\$11.01	\$11.12	\$2.13	\$82.78
	1/1/2028	\$46.48	\$13.54	\$11.01	\$11.12	\$2.13	\$84.28
Apprentice: SHEETMETAL WORKER Effective Date: 7/1/2025							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	\$19.57	\$5.82	\$4.95	\$0.00	\$0.85	\$31.19
2	50.00	\$21.74	\$6.47	\$5.51	\$0.00	\$0.94	\$34.66
3	55.00	\$23.91	\$7.12	\$9.91	\$0.00	\$1.15	\$42.09
4	60.00	\$26.09	\$7.76	\$9.91	\$0.00	\$1.23	\$44.99
5	65.00	\$28.26	\$8.41	\$9.91	\$0.00	\$1.31	\$47.89
6	70.00	\$30.44	\$9.06	\$9.91	\$0.00	\$1.39	\$50.80
7	75.00	\$32.61	\$9.71	\$9.91	\$0.00	\$1.47	\$53.70
8	80.00	\$34.78	\$10.35	\$9.91	\$8.72	\$1.78	\$65.54
9	85.00	\$36.96	\$11.00	\$9.91	\$8.72	\$1.86	\$68.45
10	90.00	\$39.13	\$11.65	\$9.91	\$8.72	\$1.94	\$71.35
Apprentice: SHEETMETAL WORKER Effective Date: 7/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	45.00	\$19.57	\$5.96	\$4.95	\$0.00	\$0.85	\$31.33
2	50.00	\$21.74	\$6.62	\$5.51	\$0.00	\$0.94	\$34.81

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: SHEETMETAL WORKER Effective Date: 7/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
3	55.00	\$23.91	\$7.28	\$9.91	\$0.00	\$1.15	\$42.25
4	60.00	\$26.09	\$7.94	\$9.91	\$0.00	\$1.23	\$45.17
5	65.00	\$28.26	\$8.60	\$9.91	\$0.00	\$1.31	\$48.08
6	70.00	\$30.44	\$9.27	\$9.91	\$0.00	\$1.39	\$51.01
7	75.00	\$32.61	\$9.93	\$9.91	\$0.00	\$1.47	\$53.92
8	80.00	\$34.78	\$10.59	\$9.91	\$9.92	\$1.78	\$66.98
9	85.00	\$36.96	\$11.25	\$9.91	\$9.92	\$1.86	\$69.90
10	90.00	\$39.13	\$11.92	\$9.91	\$9.92	\$1.94	\$72.82
Apprentice to Journeyworker Ratio: 1:3							
SPECIALIZED EARTH MOVING EQUIP < 35 TONS	1/1/2026	\$41.24	\$16.17	\$21.78	\$0.00	\$0.00	\$79.19
TEAMSTERS JOINT COUNCIL NO. 10	6/1/2026	\$42.24	\$16.17	\$21.78	\$0.00	\$0.00	\$80.19
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	12/1/2026	\$42.24	\$16.17	\$23.52	\$0.00	\$0.00	\$81.93
	1/1/2027	\$42.24	\$16.77	\$23.52	\$0.00	\$0.00	\$82.53
SPECIALIZED EARTH MOVING EQUIP > 35 TONS	1/1/2026	\$41.53	\$16.17	\$21.78	\$0.00	\$0.00	\$79.48
TEAMSTERS JOINT COUNCIL NO. 10	6/1/2026	\$42.53	\$16.17	\$21.78	\$0.00	\$0.00	\$80.48
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	12/1/2026	\$42.53	\$16.17	\$23.52	\$0.00	\$0.00	\$82.22
	1/1/2027	\$42.53	\$16.77	\$23.52	\$0.00	\$0.00	\$82.82
SPRINKLER FITTER	1/1/2026	\$53.25	\$13.60	\$7.45	\$9.41	\$0.00	\$83.71
SPRINKLER FITTERS LOCAL 669	4/1/2026	\$56.54	\$13.60	\$7.45	\$9.41	\$0.00	\$87.00
SPRINKLER FITTERS LOCAL 669	7/1/2026	\$56.54	\$13.60	\$7.45	\$9.41	\$0.00	\$87.00
	10/1/2026	\$56.54	\$13.60	\$7.45	\$9.41	\$0.00	\$87.00
	1/1/2027	\$56.54	\$14.55	\$7.50	\$9.41	\$0.00	\$88.00
	4/1/2027	\$59.83	\$14.55	\$7.50	\$9.41	\$0.00	\$91.29
	7/1/2027	\$59.83	\$14.55	\$7.50	\$9.41	\$0.00	\$91.29
	10/1/2027	\$59.83	\$14.55	\$7.50	\$9.41	\$0.00	\$91.29
	1/1/2028	\$59.83	\$15.50	\$7.55	\$9.41	\$0.00	\$92.29
Apprentice: SPRINKLER FITTER Effective Date: 1/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	43.00	\$26.94	\$9.64	\$0.00	\$0.00	\$0.00	\$36.58
2	48.00	\$30.08	\$9.64	\$0.00	\$0.00	\$0.00	\$39.72
3	52.00	\$32.58	\$13.60	\$7.45	\$1.15	\$0.00	\$54.78
4	56.00	\$35.09	\$13.60	\$7.45	\$1.15	\$0.00	\$57.29
5	59.00	\$36.97	\$13.60	\$7.45	\$1.40	\$0.00	\$59.42
6	64.00	\$40.10	\$13.60	\$7.45	\$1.40	\$0.00	\$62.55
7	68.00	\$42.61	\$13.60	\$7.45	\$1.40	\$0.00	\$65.06
8	72.00	\$45.12	\$13.60	\$7.45	\$1.40	\$0.00	\$67.57
9	76.00	\$47.62	\$13.60	\$7.45	\$1.40	\$0.00	\$70.07

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: SPRINKLER FITTER Effective Date: 1/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
10	80.00	\$50.13	\$13.60	\$7.45	\$1.40	\$0.00	\$72.58
Apprentice: SPRINKLER FITTER Effective Date: 4/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	43.00	\$28.36	\$9.64	\$0.00	\$0.00	\$0.00	\$38.00
2	48.00	\$31.66	\$9.64	\$0.00	\$0.00	\$0.00	\$41.30
3	52.00	\$34.29	\$13.60	\$7.45	\$1.15	\$0.00	\$56.49
4	56.00	\$36.93	\$13.60	\$7.45	\$1.15	\$0.00	\$59.13
5	59.00	\$38.91	\$13.60	\$7.45	\$1.40	\$0.00	\$61.36
6	64.00	\$42.21	\$13.60	\$7.45	\$1.40	\$0.00	\$64.66
7	68.00	\$44.85	\$13.60	\$7.45	\$1.40	\$0.00	\$67.30
8	72.00	\$47.48	\$13.60	\$7.45	\$1.40	\$0.00	\$69.93
9	76.00	\$50.12	\$13.60	\$7.45	\$1.40	\$0.00	\$72.57
10	80.00	\$52.76	\$13.60	\$7.45	\$1.40	\$0.00	\$75.21
Apprentice to Journeyworker Ratio: 1:1							
STEAM BOILER OPERATOR	12/1/2025	\$58.62	\$16.05	\$13.25	\$3.25	\$0.00	\$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$59.90	\$16.05	\$13.25	\$3.25	\$0.00	\$92.45
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$61.34	\$16.05	\$13.25	\$3.25	\$0.00	\$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN	12/1/2025	\$58.62	\$16.05	\$13.25	\$3.25	\$0.00	\$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$59.90	\$16.05	\$13.25	\$3.25	\$0.00	\$92.45
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$61.34	\$16.05	\$13.25	\$3.25	\$0.00	\$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
TERRAZZO FINISHERS	2/1/2026	\$66.89	\$12.84	\$15.57	\$8.02	\$0.00	\$103.32
BRICKLAYERS LOCAL 3	8/1/2026	\$69.09	\$12.84	\$15.57	\$8.02	\$0.00	\$105.52
BRICKLAYERS LOCAL 3 - MARBLE & TILE	2/1/2027	\$70.49	\$12.84	\$15.57	\$8.02	\$0.00	\$106.92
Apprentice: TERRAZZO FINISHERS Effective Date: 2/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$33.45	\$12.84	\$15.57	\$8.02	\$0.00	\$69.88
2	60.00	\$40.13	\$12.84	\$15.57	\$8.02	\$0.00	\$76.56
3	70.00	\$46.82	\$12.84	\$15.57	\$8.02	\$0.00	\$83.25
4	80.00	\$53.51	\$12.84	\$15.57	\$8.02	\$0.00	\$89.94
5	90.00	\$60.20	\$12.84	\$15.57	\$8.02	\$0.00	\$96.63

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
Apprentice: TERRAZZO FINISHERS Effective Date: 8/1/2026							
Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$34.55	\$12.84	\$15.57	\$8.02	\$0.00	\$70.98
2	60.00	\$41.45	\$12.84	\$15.57	\$8.02	\$0.00	\$77.88
3	70.00	\$48.36	\$12.84	\$15.57	\$8.02	\$0.00	\$84.79
4	80.00	\$55.27	\$12.84	\$15.57	\$8.02	\$0.00	\$91.70
5	90.00	\$62.18	\$12.84	\$15.57	\$8.02	\$0.00	\$98.61
Apprentice to Journeyworker Ratio: 1:5							
TEST BORING DRILLER LABORERS	12/1/2025	\$51.95	\$10.65	\$9.75	\$9.80	\$0.00	\$82.15
LABORERS - FOUNDATION AND MARINE	6/1/2026	\$53.50	\$10.65	\$9.75	\$9.80	\$0.00	\$83.70
	12/1/2026	\$55.00	\$10.65	\$9.75	\$9.80	\$0.00	\$85.20
For apprentice rates see "Apprentice- LABORER"							
TEST BORING DRILLER HELPER LABORERS	12/1/2025	\$48.07	\$10.65	\$9.75	\$9.80	\$0.00	\$78.27
LABORERS - FOUNDATION AND MARINE	6/1/2026	\$49.62	\$10.65	\$9.75	\$9.80	\$0.00	\$79.82
	12/1/2026	\$51.12	\$10.65	\$9.75	\$9.80	\$0.00	\$81.32
For apprentice rates see "Apprentice- LABORER"							
TEST BORING LABORER LABORERS	12/1/2025	\$47.95	\$10.65	\$9.75	\$9.80	\$0.00	\$78.15
LABORERS - FOUNDATION AND MARINE	6/1/2026	\$49.50	\$10.65	\$9.75	\$9.80	\$0.00	\$79.70
	12/1/2026	\$51.00	\$10.65	\$9.75	\$9.80	\$0.00	\$81.20
For apprentice rates see "Apprentice- LABORER"							
TRACTORS/PORTABLE STEAM GENERATORS OPERATING ENGINEERS LOCAL 4	12/1/2025	\$58.62	\$16.05	\$13.25	\$3.25	\$0.00	\$91.17
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$59.90	\$16.05	\$13.25	\$3.25	\$0.00	\$92.45
	12/1/2026	\$61.34	\$16.05	\$13.25	\$3.25	\$0.00	\$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"							
TRAILERS FOR EARTH MOVING EQUIPMENT TEAMSTERS JOINT COUNCIL NO. 10	1/1/2026	\$41.82	\$16.17	\$21.78	\$0.00	\$0.00	\$79.77
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	6/1/2026	\$42.82	\$16.17	\$21.78	\$0.00	\$0.00	\$80.77
	12/1/2026	\$42.82	\$16.17	\$23.52	\$0.00	\$0.00	\$82.51
	1/1/2027	\$42.82	\$16.77	\$23.52	\$0.00	\$0.00	\$83.11
TUNNEL WORK - COMPRESSED AIR LABORERS	12/1/2025	\$60.18	\$10.65	\$9.75	\$10.25	\$0.00	\$90.83
LABORERS (COMPRESSED AIR)	6/1/2026	\$61.73	\$10.65	\$9.75	\$10.25	\$0.00	\$92.38
	12/1/2026	\$63.23	\$10.65	\$9.75	\$10.25	\$0.00	\$93.88
For apprentice rates see "Apprentice- LABORER"							
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) LABORERS	12/1/2025	\$62.18	\$10.65	\$9.75	\$10.25	\$0.00	\$92.83
LABORERS (COMPRESSED AIR)	6/1/2026	\$63.73	\$10.65	\$9.75	\$10.25	\$0.00	\$94.38
	12/1/2026	\$65.23	\$10.65	\$9.75	\$10.25	\$0.00	\$95.88
For apprentice rates see "Apprentice- LABORER"							
TUNNEL WORK - FREE AIR	12/1/2025	\$52.25	\$10.65	\$9.75	\$10.25	\$0.00	\$82.90

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
LABORERS	6/1/2026	\$53.80	\$10.65	\$9.75	\$10.25	\$0.00	\$84.45
LABORERS (FREE AIR TUNNEL)	12/1/2026	\$55.30	\$10.65	\$9.75	\$10.25	\$0.00	\$85.95
For apprentice rates see "Apprentice- LABORER"							
TUNNEL WORK - FREE AIR (HAZ. WASTE)	12/1/2025	\$54.25	\$10.65	\$9.75	\$10.25	\$0.00	\$84.90
LABORERS	6/1/2026	\$55.80	\$10.65	\$9.75	\$10.25	\$0.00	\$86.45
LABORERS (FREE AIR TUNNEL)	12/1/2026	\$57.30	\$10.65	\$9.75	\$10.25	\$0.00	\$87.95
For apprentice rates see "Apprentice- LABORER"							
VAC-HAUL	1/1/2026	\$41.24	\$16.17	\$21.78	\$0.00	\$0.00	\$79.19
TEAMSTERS JOINT COUNCIL NO. 10	6/1/2026	\$42.24	\$16.17	\$21.78	\$0.00	\$0.00	\$80.19
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	12/1/2026	\$42.24	\$16.17	\$23.52	\$0.00	\$0.00	\$81.93
	1/1/2027	\$42.24	\$16.77	\$23.52	\$0.00	\$0.00	\$82.53
VOICE-DATA-VIDEO TECHNICIAN	9/7/2025	\$36.12	\$14.98	\$13.94	\$3.97	\$0.00	\$69.01
ELECTRICIANS LOCAL 96	9/6/2026	\$37.04	\$15.96	\$14.20	\$4.07	\$0.00	\$71.27
ELECTRICIANS LOCAL 96							

Apprentice: VOICE-DATA-VIDEO TECHNICIAN

Effective Date: 9/7/2025

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$18.06	\$14.98	\$0.54	\$3.97	\$0.00	\$37.55
2	55.00	\$19.87	\$14.98	\$0.60	\$3.97	\$0.00	\$39.42
3	60.00	\$21.67	\$14.98	\$13.51	\$3.97	\$0.00	\$54.13
4	65.00	\$23.48	\$14.98	\$13.56	\$3.97	\$0.00	\$55.99
5	70.00	\$25.28	\$14.98	\$13.62	\$3.97	\$0.00	\$57.85
6	75.00	\$27.09	\$14.98	\$13.67	\$3.97	\$0.00	\$59.71
7	80.00	\$28.90	\$14.98	\$13.73	\$3.97	\$0.00	\$61.58
8	85.00	\$30.70	\$14.98	\$13.78	\$3.97	\$0.00	\$63.43

Apprentice: VOICE-DATA-VIDEO TECHNICIAN

Effective Date: 9/6/2026

Step	Percent	Apprentice Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
1	50.00	\$18.52	\$15.96	\$0.56	\$4.07	\$0.00	\$39.11
2	55.00	\$20.37	\$15.96	\$0.61	\$4.07	\$0.00	\$41.01
3	60.00	\$22.22	\$15.96	\$13.76	\$4.07	\$0.00	\$56.01
4	65.00	\$24.08	\$15.96	\$13.81	\$4.07	\$0.00	\$57.92
5	70.00	\$25.93	\$15.96	\$13.87	\$4.07	\$0.00	\$59.83
6	75.00	\$27.78	\$15.96	\$13.92	\$4.07	\$0.00	\$61.73
7	80.00	\$29.63	\$15.96	\$13.98	\$4.07	\$0.00	\$63.64
8	85.00	\$31.48	\$15.96	\$14.03	\$4.07	\$0.00	\$65.54

Apprentice to Journeyworker Ratio: 1:1

WAGON DRILL OPERATOR	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.11	\$0.00	\$70.23
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.11	\$0.00	\$71.67
LABORERS - ZONE 2	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.11	\$0.00	\$73.11

Construction

Classification	Effective Date	Base Wage	Health	Pension	Annuity	Supplemental Unemployment	Total Rate
	6/1/2027	\$45.05	\$10.65	\$9.75	\$9.11	\$0.00	\$74.56
	12/1/2027	\$46.50	\$10.65	\$9.75	\$9.11	\$0.00	\$76.01
	6/1/2028	\$48.00	\$10.65	\$9.75	\$9.11	\$0.00	\$77.51
	12/1/2028	\$49.50	\$10.65	\$9.75	\$9.11	\$0.00	\$79.01

For apprentice rates see "Apprentice- LABORER"

WAGON DRILL OPERATOR (HEAVY & HIGHWAY)	12/1/2025	\$40.72	\$10.65	\$9.75	\$9.21	\$0.00	\$70.33
LABORERS	6/1/2026	\$42.16	\$10.65	\$9.75	\$9.21	\$0.00	\$71.77
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/1/2026	\$43.60	\$10.65	\$9.75	\$9.21	\$0.00	\$73.21

For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"

WASTE WATER PUMP OPERATOR	12/1/2025	\$59.28	\$16.05	\$13.25	\$3.25	\$0.00	\$91.83
OPERATING ENGINEERS LOCAL 4	6/1/2026	\$60.58	\$16.05	\$13.25	\$3.25	\$0.00	\$93.13
OPERATING ENGINEERS LOCAL 4	12/1/2026	\$62.03	\$16.05	\$13.25	\$3.25	\$0.00	\$94.58

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

WATER METER INSTALLER	9/1/2025	\$55.00	\$12.70	\$9.71	\$8.06	\$0.00	\$85.47
PLUMBERS LOCAL 4	3/1/2026	\$57.80	\$11.30	\$9.71	\$8.06	\$0.00	\$86.87
PLUMBERS LOCAL 4							

For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"

Additional Apprentice Information

All apprentices must be registered with the Division of Apprenticeship Training(DAS) in accordance with M.G.L.c. 23, §§ 11E-11L. Minimum wage rates for apprentices employed on public works projects are listed above as a percentage of the hourly prevailing wage rate established by the Commissioner under the provisions of M.G.L.c. 149, §§ 26-27D.

Apprentice ratios are established by DAS pursuant to M.G.L.c. 23, §§ 11E-11L. Ratios are expressed as the allowable number of apprentices to journeymen or fraction thereof, unless otherwise specified. The ratios listed herein have been taken from relevant private collective bargaining agreements(CBAs) and are provided for illustrative purposes only. They have not been independently verified as being accurate or continuing to be accurate.

Parties having questions regarding what ratio to use should contact DAS.



No General Bidder or Filed Sub-bidder will be eligible for a contract award unless the following certification has been completed and submitted to the Awarding Authority with its bid.

CITY OF WORCESTER
FORM OF
TAX PAYMENT CERTIFICATE

STATE LAW NOW MANDATES THAT TO DO BUSINESS WITH THE CITY OF WORCESTER the Massachusetts Revenue Enforcement and Protection Program of 1983 requires that the following be supplied with your Bid:

Date: _____

Pursuant to M.G.L. Chapter 62C, Section 49A, I certify under the Penalties of Perjury That I, To My Best Knowledge and Belief, Have Filed ALL Massachusetts State Tax Returns and Paid ALL Massachusetts State and City Taxes Required under Law.

Company Name: _____

Street and Number: _____

City or Town: _____

State: _____ Zip Code: _____

Telephone Number: _____

Social Security Number or Federal Identification Number: _____

Is Company Certified by State Office of Minority and Women Business Assistance (SOMWBA)?

Yes _____ Date of Certification: _____

No _____

Failure to complete this form may result in rejection of Bid and/or removal from City Bid Lists.

BIDDER'S Authorized Signature

END OF SECTION

IMPORTANT NOTICE TO BIDDERS

**** RESPONSIBLE EMPLOYER ORDINANCE**

and

MINORITY/WOMEN BUSINESS ENTERPRISE AND WORKER UTILIZATION

**BIDDERS MUST COMPLETE FORMS EOO-101 AND REO-101,
WHICH ARE PART OF THE BID SUBMISSION**

GENERAL BIDDERS, PROPOSERS, TRADE CONTRACTORS, FILED SUBCONTRACTORS, AND NON-FILED SUBCONTRACTORS, AT EVERY TIER, MUST PROVIDE EVIDENCE OF COMPLIANCE WITH THE CITY OF WORCESTER'S RESPONSIBLE EMPLOYER ORDINANCE ("REO") (See, Supplementary General Conditions, Section 4.7).

PLEASE SEE THE FOLLOWING PAGES FOR FURTHER REO REQUIREMENTS.

ALSO INCLUDED IN THIS SECTION IS A COPY OF THE AGREEMENT BETWEEN THE CITY AND THE MASSACHUSETTS COMMISSION AGAINST DISCRIMINATION THAT GOVERN THE ACTIVITIES ADDRESSED BY THE M/WBE BUSINESS ENTERPRISE AND WORKER UTILIZATION PROGRAM AND ITS ASSOCIATED FORMS CONTAINED HEREIN.

Direct any questions about these forms and procedures to:

certifiedpayrollrecords@worcesterma.gov or
purchasing@worcesterma.gov

City Hall – Room 201
455 Main Street
Worcester, MA 01608
(508) 799-1220

** This requirement applies to general bids over \$150,000 and all subcontractors at every tier exclusive of any pricing threshold.

**CITY OF WORCESTER
INITIAL STATEMENT AND CERTIFICATION OF COMPLIANCE
WITH THE RESPONSIBLE EMPLOYER ORDINANCE**

FORM REO 101 PAGE 1 OF 2

PROJECT:

CONTRACTOR:

ALL GENERAL BIDDERS, PROPOSERS, TRADE CONTRACTORS, SUBCONTRACTORS, INCLUDING SUBCONTRACTORS THAT ARE NOT SUBJECT TO G.L. c. 149, § 44F, UNDER THE GENERAL BIDDER FOR PROJECTS SUBJECT TO G.L. c. 149, § 44A(2) OR UNDER PROPOSERS FOR PROJECTS SUBJECT TO G.L. c. 149A, SHALL AS A CONDITION TO SUBMITTING A BID OR A PROPOSAL, OR OTHERWISE AS A CONDITION TO SUBCONTRACTING, VERIFY COMPLIANCE WITH THE FOLLOWING OBLIGATIONS AND SHALL CERTIFY SUCH COMPLIANCE ON A WEEKLY BASIS FOR THE DURATION OF THE PROJECT:

- 1) That the appropriate lawful Prevailing Wage Rates shall be paid to all employees and the Weekly Payroll Report Form and Statement of Compliance shall be submitted to the Contract Compliance Office on a weekly basis for the entire duration of the project;
- 2) That the contractor maintains or participates in a bona fide apprentice training program as defined by G.L. c.23, §§11H and 11I for each apprenticeable trade or occupation represented in its workforce that is approved by the Division of Apprentice Training (DAT) of the Dept. of Labor and Workforce Development of the Commonwealth, regardless of whether or not the program qualifies as an employee welfare benefit plan under ERISA, and must register all apprentices with the Division and abide by the apprentice to journeyman ratio for each trade prescribed therein;
(COMPLIANCE WITH THE APPRENTICE TRAINING PROVISION IS CURRENTLY SUSPENDED-7/24/14)
- 3) That appropriate industrial accident insurance coverage shall be furnished and maintained, for the duration of the project, for all its employees employed on the project in accordance with M.G.L. c. 152;
- 4) That the contractor/company will properly classify employees on the project as employees rather than independent contractors and treat them accordingly for purposes of workers' compensation insurance coverage, unemployment taxes, social security taxes and income tax withholding. (G.L. c.149, §148B on employee classification);
- 5) That at the time employees begin work at the worksite, each employee will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration;
- 6) That the contractor/company is in compliance with the health and hospitalization requirements of the Massachusetts Health Care Reform law established by Chapter 58 of the Acts of 2006, as amended, and regulations promulgated pursuant to that statute by the Commonwealth Health Insurance Connector Authority;
- 7) That the contractor/company, for the duration of the contractor's/company's work on the project, shall make arrangements to ensure that each of its employees entering or leaving the project

**CITY OF WORCESTER
INITIAL STATEMENT AND CERTIFICATION OF COMPLIANCE
WITH THE RESPONSIBLE EMPLOYER ORDINANCE**

FORM REO 101 PAGE 2 OF 2

PROJECT:

CONTRACTOR:

individually completes the appropriate entries in a daily sign-in/sign-out log to be maintained by the contractor/company;

- 8) That the contractor/company is not debarred or otherwise prevented from bidding for or performing work on a public project in the Commonwealth of Massachusetts or in the city of Worcester

THE UNDERSIGNED ACKNOWLEDGES HE/SHE HAS READ THE ABOVE OBLIGATIONS AND CERTIFIES THE CONTRACTOR'S COMPLIANCE WITH THEM.

Signed as a True Statement under Oath:

(Bidder/Company)

By: _____
(Name/Signature)

Date: _____

By: _____
(Print Name and Corporate Title)

(Seal)

**CITY OF WORCESTER
RESPONSIBLE EMPLOYER ORDINANCE REQUIREMENTS (CONT'D)**

**FORM REO 103
PAGE 1 OF 1**

PROJECT:

CONTRACTOR:

POST CONTRACT AWARD SUBMISSIONS

THE SUCCESSFUL GENERAL CONTRACTOR, CONSTRUCTION MANAGER AT RISK, TRADE CONTRACTORS AND SUBCONTRACTORS, INCLUDING SUBCONTRACTORS THAT ARE NOT SUBJECT TO G.L. c. 149, §44F, UNDER THE GENERAL CONTRACTOR FOR PROJECTS SUBJECT TO G.L. c. 149, §44A(2) OR UNDER THE CONSTRUCTION MANAGER AT RISK FOR PROJECTS SUBJECT TO G.L. c. 149A, SHALL SUBMIT THE FOLLOWING INFORMATION AS OUTLINED BELOW FOR THE DURATION OF THE PROJECT:

1, PRIOR TO EACH EMPLOYEE BEGINNING WORK AT THE WORKSITE, SUBMIT DOCUMENTATION EVIDENCING THE EMPLOYEE'S SUCCESSFUL COMPLETION OF A COURSE IN CONSTRUCTION SAFETY AND HEALTH THAT IS APPROVED BY THE UNITED STATES OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION. A QUALIFYING PROGRAM MUST BE A MINIMUM OF TEN HOURS IN DURATION.

2. ON A DAILY BASIS, SUBMIT DAILY SIGN-IN/SIGN-OUT LOGS THAT HAVE BEEN FILLED OUT BY EACH INDIVIDUAL EMPLOYEE ENTERING OR LEAVING THE WORKSITE. THE LOG SHALL INCLUDE THE FOLLOWING: THE LOCATION OF THE PROJECT; CURRENT DATE; PRINTED EMPLOYEE NAME; SIGNED EMPLOYEE NAME; AND THE TIME OF EACH ENTRY OR EXIT. THE LOG SHALL ALSO INCLUDE A PROMINENT NOTICE THAT EMPLOYEES ARE ENTITLED UNDER STATE LAW TO RECEIVE THE PREVAILING WAGE RATE FOR THEIR WORK ON THE PROJECT.

MINORITY/WOMEN BUSINESS ENTERPRISE AND WORKER UTILIZATION

FORM EOO-D/102

BIDDERS INFORMATION ON PROCEDURES AND FORMS

To make all contractors aware of their obligation to follow certain procedures and file appropriate reports pertaining to those procedures, the following is an outline of the Minority/Women Business Enterprise and Worker Utilization Program, and the Responsible Employer Ordinance. Also included here is the Affidavit of Acknowledgement and Certification of Compliance, Form E00-101. This form is to be completed and filed as part of your bid.

The following documents are included in this bid:

1. **AFFIDAVIT OF ACKNOWLEDGEMENT AND CERTIFICATION OF COMPLIANCE, E00-101**

General Contractors, Trade Contractors, Filed Subcontractors and Non-Filed Subcontractors complete and submit this form as part of their bid on all City of Worcester construction projects.

Each additional subcontractor shall complete this form and submit it to the general contractor who shall forward it to the Contract Compliance Office, **PRIOR** to the subcontractor's beginning work on the project.

2. **SUPPLEMENTAL EQUAL EMPLOYMENT OPPORTUNITY ANTI-DISCRIMINATION AND AFFIRMATIVE ACTION PROGRAM E00-D/3**

The agreement between the City of Worcester and the Massachusetts Commission Against Discrimination establishing the goals and procedures for the utilization of minority and women owned businesses and minority and women workers on City Construction projects.

3. **RESPONSIBLE EMPLOYER ORDINANCE**

This Ordinance sets certain minimal requirements for all General Contractors, Trade Contractors, Filed Subcontractors and Non-Filed Subcontractors bidding on City of Worcester construction projects.

4. **SUCCESSFUL BIDDER'S OBLIGATION TO PROCEDURES AND FORMS, EOO-D/103**

This is a listing of the procedures and forms that will be provided to the successful bidder for use prior to beginning work and at various times throughout the life of the project.

CITY OF WORCESTER
MINORITY/WOMEN BUSINESS ENTERPRISE AND WORKER UTILIZATION PROGRAM

AFFIDAVIT OF ACKNOWLEDGEMENT and CERTIFICATE OF COMPLIANCE

FORM EOO-101

TO ALL CONTRACTORS:

The Bidder or Proposer and all Trade Contractors and Subcontractors under the Bidder or Proposer must complete and submit this form as part of their bid.

I. THE MINORITY AND WOMEN BUSINESS AND UTILIZATION PROGRAMS

Pursuant to an agreement between the City of Worcester and the Commonwealth of Massachusetts, during the performance of any contract with the City of Worcester, all General Contractors, Trade Contractors, Filed Subcontractors, and Subcontractors are bound by the obligations of the Supplemental Equal Employment Opportunity Anti-Discrimination and Affirmative Action Program. All contractors and subcontractors if subcontracting any portion of the work are obligated to make a good faith effort to engage 10% minority and 15% women owned businesses. Further, each contractor shall make a good faith effort to maintain a workforce that is 38% people of color and 10% women.

The undersigned hereby certifies that he/she is familiar with the provisions of The Supplemental Equal Employment Opportunity Anti-Discrimination and Affirmative Action Programs and agrees to adhere to the provisions therein.

II. This contractor IS ☐ or IS NOT ☐ certified by the State Office of Minority and Women Business Assistance to be a minority or women owned and operated business; and

III. WILL ☐ or WILL NOT ☐ subcontract any portion of this contract.

Project Name: _____ Bid Number _____

Authorized Signature: _____ Business Name _____

Printed Name: _____ Title: _____

Address: _____ Date: _____

FORM EOO-D/3

**THE CITY OF WORCESTER
SUPPLEMENTAL EQUAL EMPLOYMENT OPPORTUNITY
ANTI-DISCRIMINATION AND AFFIRMATIVE ACTION PROGRAM**

I. AGREEMENT

During the performance of this contract, the Contractor or Filed Subcontractor and all subcontractors (herein collectively referred to as the Contractor), for himself/herself, his/her assignees, and successors in interest, agree as follows:

1. In conjunction with the performance of work under this contract, the contractor shall not discriminate against any employee or applicant for employment because of race, color, religious creed, national origin, age, sex, or handicap. The aforesaid provision shall include, but not be limited to, the following: employment upgrading, demotion, or transfer; recruitment advertising; layoff; termination, rates of pay or other forms of compensation; conditions or privileges of employment; and selection for apprenticeship. The contractor shall post hereafter in a conspicuous place, available to employees and applicants for employment, notices to be provided by the Commission setting forth the provisions of the Fair Employment Practices Law of the Commonwealth (M.G.L. Chapter 151 B).
2. In connection with the performance of work under this contract, the Contractor shall undertake in good faith affirmative action measures designed to eliminate any discriminatory barriers in the terms and conditions of employment on the grounds of race, color, religious creed, national origin, age, sex, or handicap, and to eliminate and remedy any effects of such discrimination in the past. Such affirmative action shall entail positive and aggressive measures to ensure equal opportunity in the areas of apprenticeship training programs. This affirmative action shall include all action required to guarantee equal employment opportunity for all persons, regardless of race, color, religious creed, national origin, age, sex, or handicap. The purpose of this provision is to ensure to the fullest extent possible an adequate supply of skilled tradesmen for this and future City public construction projects.

II. OBLIGATION

1. As part of the obligation of remedial action under the foregoing section, the Contractor shall maintain goals on this project no less than 38 percent (38%) people of color employee and 10 percent (10%) women employee hours of the total work hours in each job category including but not limited to, bricklayers, carpenters, cement masons, electricians, iron workers, operating engineers, and those "classes of work" enumerated in section 44C of chapter 149 of the Massachusetts General Laws.
2. In the hiring of minority and women journeymen, apprentices, trainees and advanced trainees, the Contractor shall rely on referrals from a multi-employer affirmative action program approved by the City, traditional referral methods utilized by the construction industry, and referrals from agencies, not more than three in number at any one time, designated by the City.

III. REPORTS

1. Contractor shall provide a completed **Project Minority / Women & Veteran Business Enterprise Table** at the beginning of the project along with an updated final report at project completion. The report will reflect the contributions of each business type to the overall project by dollar amount for all filed and unfiled subcontractors performing work on the project.
2. Records of employment referral orders, prepared by the Contractor, shall be made available to the City on request.
3. The Contractor shall prepare the **Certified Payroll Report on a weekly basis**, which lists the hours worked in each trade by each employee identified as minority, non-minority, male and female. Copies of these shall be provided to the City at the end of each week.
4. Every Contractor and Subcontractor, at any and all tiers, shall complete and submit each week along with the Weekly Payroll Report Form, the **“Weekly Workforce Utilization Form (v3)”** to the Contract Compliance Office.

IV. SUBCONTRACTING WORK

If the Contractor shall use any Subcontractor on any work performed under this contract, affirmative action shall be taken to negotiate with qualified minority and women contractors. This affirmative action shall cover both pre-bid and post-bid periods.

V. EMPLOYMENT

In the employment of journeymen, apprentices, trainees, and advanced trainees, the Contractor shall give preference, first to citizens of the Commonwealth who have served in the armed forces of the United States in time of war and have been honorably discharged there from or released from active duty therein, and who are qualified to perform the work to which the employment relates, and, secondly, to citizens of the Commonwealth generally, and, if such cannot be obtained in sufficient numbers, then to citizens of the United States.

VI. RIGHT OF ACCESS

A designee of the City shall have the right of access to the construction site.

VII. COMPLIANCE WITH REQUIREMENTS

The contractor shall comply with the provisions of Executive Order No. 227 amending and revising Executive Order No. 74, as amended by executive Order No. 16 dated May 1, 1975 and of Chapter 151B as amended, of the Massachusetts General Laws, both of which are herein incorporated by reference and made part of this contract.

VIII. NON-DISCRIMINATION

The Contractor, in the performance of all work after the award, and prior to completion of the contract work, will not discriminate on the grounds of race, color, religious creed, national origin, age, sex, or handicap in employment practices, in the selection or retention of other contractors or in the procurement of materials and rentals of equipment.

IX. SOLICITATIONS FOR SUBCONTRACTORS, AND FOR THE PROCUREMENT OF MATERIALS AND EQUIPMENT

In all solicitations either by competitive bidding or negotiation made by the Contractor either for work to be performed under a subcontract or for the procurement of materials or supplies, each entity solicited shall be notified in writing by the contractor of the Contractor's obligation under this contract relative to non-discrimination and affirmative action.

X. CONTRACTOR'S CERTIFICATION

Contractors bidding as General Contractors or Filed Sub-contractors shall certify that they will comply with the minority and women manpower and business enterprise goals and specific affirmative action steps contained in this Supplemental Equal Employment Opportunity Anti-Discrimination and Affirmative Action Program by signing and submitting with the bid the **Affidavit of Acknowledgement and Certification of Compliance, Form E00-101.**

If any Contractor subcontracts any portion of the work, the Contractor is required to obtain from each Subcontractor, regardless of tier, an Affidavit of Acknowledgement and Certification of Compliance, Form E00-101 stating that it will comply with the minority and women subcontracting and manpower ratios and specific affirmative action steps contained in this Supplemental Equal

Employment Opportunity Anti-Discrimination and Affirmative Action Program by signing this form and submitting it to the Contractor for submission to the awarding authority not later than five working days following the opening of the bids.

XI. COMPLIANCE – INFORMATION, REPORTS, AND SANCTIONS

1. The Contractor will provide all information and reports required by the City on instructions issued and will permit access to its facilities and any books, records, accounts and other sources of information which may be determined by the City to affect the employment of personnel. This provision shall apply only to information pertinent to the City's supplementary affirmative action contract requirements. Where information required is in the exclusive possession of another who fails or refuses to furnish this information, the Contractor shall so certify to the City and shall set forth what efforts have been made to obtain the information.
2. Whenever the City believes the Contractor may not be operating in compliance with the terms of this Section, the City directly, or through its designated agent, shall conduct an appropriate investigation, and confer with the parties, to determine if such Contractor is operating in compliance with the terms of this Section. If the City or its agent finds the Contractor not in compliance, it shall make a preliminary report of non-compliance and notify such Contractor in writing of such steps as will in the judgment of the City or its agent bring such Contractor into compliance. In the event that such Contractor fails or refuses to fully perform such steps, the City shall make a final report of non-compliance, and recommend the imposition of one or more of the sanctions listed below. If, however, the City believes the Contractor has taken or is taking every possible measure to achieve compliance, it shall not make final a report on non-compliance. Within fourteen (14) days of the receipt of recommendations of the City, the administering agency shall move to impose one or more of the following sanctions, as it may deem appropriate to attain full and effective enforcement.

- a. The recovery by the administering agency from the Contractor of 1/10 of 1% of the contract award price or \$1000.00, whichever sum is greater, in the nature of liquidated damages or, if a Subcontractor is in non-compliance, the recovery by the administering agency from the Contractor as a back charge against the Subcontractor of 1/10 of 1% of the subcontract price, or \$400.00, whichever sum is greater, in the nature of liquidated damages, for each week that such party fails or refuses to comply;
 - b. The suspension of any payment or part thereof due under the contract until such time as the Contractor or any Subcontractor is able to demonstrate compliance with the terms of the contract;
 - c. The termination, or cancellation, of the contract, in whole or in part, unless the Contractor is able to demonstrate within a specified time his compliance with the terms of the contract;
 - d. The denial to the Contractor of the right to participate in any further contracts awarded by the administering agency for a period of up to three years.
3. If at any time after the imposition of one or more of the above sanctions a Contractor is able to demonstrate that he/she is in compliance with this section, he/she may request the administering agency in consultation with the City, to suspend the sanctions conditionally, pending a final determination by the City as to whether the contractor is in compliance. Upon final determination, based on the recommendations of the adjudicatory body, the City shall either lift the sanctions or reimpose them.
 4. Sanctions enumerated under Section XII-2 shall not be imposed except after an adjudicatory proceeding, as that term is used in M.G.L. Chapter 30, has been conducted. No investigation by the City or its agent shall be initiated without prior notice to the Contractor.

XII. SEVERABILITY

The provisions of this Section are severable, and if any of these provisions shall be held unconstitutional by any court of competent jurisdiction, the decisions of such court shall not affect or impair any of the remaining provisions.

XIII. WAIVER

The City of Worcester reserves the right to waive any stipulation in the M/WBE Program when deemed necessary or appropriate for the general good of the City and its programs.

DEFINITIONS

Contractor - Except where otherwise specifically stated the term "Contractor" shall mean any General Contractor.

City - is the City of Worcester, Massachusetts

M/WBE - is Minority and Women Business Enterprise as certified by the State Office of Minority and Women Business Assistance to be 51% or more minority or women owned and operated.

RESPONSIBLE EMPLOYER ORDINANCE

and

MINORITY/WOMEN BUSINESS ENTERPRISE AND WORKER UTILIZATION

=====

FORM E00-D/103

SUCCESSFUL BIDDER'S OBLIGATION TO PROCEDURES AND FORMS

All successful bidders on City of Worcester construction projects will receive a package of procedures and forms that are to be used at specific times throughout the life of the project.

The following is a list of the documents that will be sent to successful bidders when this office is notified that a contract has been, or is about to be, executed.

I. BUILDING TRADES – CONTACT LIST, E00-D/6

When a contractor cannot fulfill the worker utilization percentages, the appropriate building trades locals may be contacted to request assistance in locating and engaging qualified workers.

II. AFFIDAVIT OF ACKNOWLEDGEMENT and CERTIFICATION OF COMPLIANCE, (FOR SUBCONTRACTORS), E00-101

If any portion of a project is to be subcontracted at any tier, each additional subcontractor shall complete this form and send it to the Contract Compliance Office within two business days of contract execution and PRIOR to beginning work on the project.

III. TABLE OF PROJECTED SUBCONTRACTORS, E00-103

The use of subcontractors at any tier shall be reported to the Contract Compliance Office on this form prior to the subcontractor beginning work on the project.

IV. SUBCONTRACTOR'S CERTIFICATE OF INTENT TO PARTICIPATE, E00-104

Each Non-Filed subcontractor engaged to work a project shall complete and forward this form to the Contract Compliance Office prior to beginning work on the project.

V. Project Minority / Women & Veteran Business Enterprise Table

Contractor shall provide a completed **Project Minority / Women & Veteran Business Enterprise Table** at the beginning of the project along with an updated final report at project completion. The report will reflect the contributions of each business type to the overall project by dollar amount for all filed and unfiled subcontractors performing work on the project.

VI. INITIAL STATEMENT and CERTIFICATION OF COMPLIANCE WITH THE RESPONSIBLE EMPLOYER ORDINANCE, REO-101 (Pages 1 & 2)

General Contractors, Trade Contractors, Filed Subcontractors and Subcontractors complete and submit this form as part of their bid on all City of Worcester construction projects subject to the provisions of G.L. Chapter 149 and Chapter 149A.

The REO requirements are applicable under Chapter 149 to contracts of \$150,000 or more. Under Chapter 149A the requirements are applicable only to contracts \$5M and above.

Note: Under the September 2012 revision of the REO, there is no minimum threshold for subcontractors. Hence all subcontractors, i.e., Trade Contractors, Filed Subcontractors and Non-Filed Subcontractors at every tier must comply with the requirements of the REO

The General Contractor shall forward all Trade Contractor's, Filed Subcontractor's and Subcontractor's REO-101 Forms and REO evidence to the Contract Compliance Office for approval, PRIOR to said subcontractors beginning work.

VII. WEEKLY STATEMENT AND CERTIFICATION OF COMPLIANCE WITH THE RESPONSIBLE EMPLOYER ORDINANCE, REO-102

At the end of each week of work, ALL Contractors, Trade Contractors, Filed Subcontractors, and Non-Filed Subcontractors regardless of tier, subject to the provisions of G.L. Chapter 149 and Chapter 149A, shall complete and submit this form along with their certified payroll reports to the Contract Compliance Office.

VIII. INITIAL STATEMENT AND ADDITIONAL CERTIFICATION OF COMPLIANCE WITH THE RESPONSIBLE EMPLOYER ORDINANCE, REO-103

General Contractors, Trade Contractors, Filed Subcontractors and Subcontractors complete and submit this form as part of their bid on all City of Worcester construction projects subject to the provisions of G.L. Chapter 149 and Chapter 149A.

If any portion of a project is to be subcontracted at any tier, each additional subcontractor shall complete this form and send it to the General Contractor who, in turn will transmit this form to the Contract Compliance Office within two business days of contract execution and PRIOR to the subcontractor beginning work on the project.

IX. WEEKLY CERTIFIED PAYROLL REPORT and WEEKLY WORKFORCE UTILIZATION REPORT

At the end of each week of work, all Contractors, Filed Subcontractors, and Non-Filed Subcontractors, regardless of tier, shall complete and submit these forms to the Contract Compliance Office.

The Contract Compliance Office will also accept computer generated payroll reports. However, if the computer payroll does not reflect the prevailing wage, the Contractor must provide a breakdown of the benefits paid to each employee which when added to the base wage equals the prevailing wage.

Every Contractor and Subcontractor, at any and all tiers, shall complete and submit each week along with the Weekly Payroll Report Form, the "**Weekly Workforce Utilization Form (v3)**" to the Contract Compliance Office.

The City of Worcester regards the monitoring of weekly certified payroll reports to be a most important function. Therefore, all certified payroll reports shall be scrutinized by the Contract Compliance Office and any violations of the Commonwealth's prevailing wage law will be vigorously enforced.

CORI COMPLIANCE / GENDER IDENTITY & EXPRESSION

Vendors entering into contracts with the City of Worcester must affirm that their policies regarding CORI information are consistent with the CORI hiring standards set by the City of Worcester. The City's CORI hiring policy may be downloaded from City of Worcester website www.worcesterma.gov. Questions pertaining to the City's CORI hiring policy are to be directed to the Equal Employment Opportunity Officer, Executive Office of Human Resources at 508-799-1030.

CERTIFICATION

All Vendors must check one of the three lines below.

1. _____ CORI checks are not performed on any Applicants.
2. _____ CORI checks are performed on some or all Applicants. The Vendor, by affixing a signature below, affirms under penalties of perjury that its CORI policy is consistent with the standards set forth with the CORI hiring standards set by the City of Worcester.
3. _____ CORI checks are performed on some or all Applicants. The Vendor's CORI policy is not consistent with the standards set forth with the CORI hiring standards set by the City of Worcester. (a copy of the Vendor's written CORI policy must accompany this form).

(Typed or printed name of person
signing quotation, bid or proposal)

Signature

Name of Business

A Vendor with a CORI policy that does NOT conform to the City standards must check Line 3. Vendors who check Line 3 will not be permitted to enter into contracts with the City, absent a waiver granted by the City. For any waiver to be granted, a written request should accompany bid submission explaining in detail why the vendor fails or refuses to comply with the City's CORI hiring standards.

Gender Identity Standards Applicable to Vendors

The city will do business only with vendors that have adopted and employ Gender Identity policies, practices and standards that are consistent with city standards.

The city may review all vendors' Gender Identity policies and practices for consistency with city standards.

By signing this bid, vendor confirms that their Gender Identity policies, practices and standards are consistent with those of the City of Worcester. For further information please refer to the Ordinance Relative to Gender Identity and Expression found at www.worcesterma.gov or call the LGBTQ Liaison/Director of Human Rights & Disabilities at 508-799-8486.

WAGE THEFT PREVENTION CERTIFICATION

By the Revised Ordinances, Chapter 2, Section 39, the city of Worcester has established requirements for certain contracts in an effort to prevent wage theft. Prospective contractors must provide the following certification and disclosures with their bids/proposals. The City will not award a contract without receipt of this completed certification.

INSTRUCTIONS: A prospective contractor shall **(a)** check Box 1 *OR* Box 2, as applicable, **(b)** check Boxes 3-5, **(c)** sign this form certifying compliance with the Wage Theft Prevention Ordinance, and **(d)** submit the completed form with its bid/proposal. For multi-year contracts, the successful bidder/proposer shall submit the completed form annually to the Purchasing Director.

Pursuant to the Wage Theft Prevention Ordinance, successful bidders/proposals shall post in conspicuous places the Mass. Wage and Hour Laws notice informing employees of the protections of G.L. c. 149, Sec. 151, and the Fair Labor Standards Act (FLSA). The notice may be found at <http://www.mass.gov/ago/docs/workplace/wage/wagehourposter.pdf>

ALL BIDDERS/PROPOSERS MUST CERTIFY THAT [check either Box 1 or Box 2, as applicable]

1. ☐ Neither this vendor/contractor nor any prospective subcontractor has been subject to a federal or state criminal or civil judgment, administrative citation, final administrative determination, order or debarment resulting from a violation of G.L. c. 149, G.L. c. 151, or FLSA, within three (3) years prior to the date of this bid/proposal submission.

OR

2. ☐ This vendor/contractor, or a prospective subcontractor, has been subject to a federal or state criminal or civil judgment, administrative citation, final administrative determination, or debarment resulting from a violation of G.L. c. 149, G.L. c. 151, or FLSA, within three (3) years prior to the date of this bid/proposal submission. The firm shall provide a copy of the same with the bid/proposal.

ALL BIDDERS/PROPOSERS MUST CERTIFY EACH OF THE FOLLOWING

3. ☐ Within five (5) days of receiving notice, the vendor/contractor shall report and provide a copy of any federal or state criminal or civil judgment, administrative citation, final administrative determination, order or debarment resulting from a violation of G.L. c. 149, G.L. c. 151, or FLSA imposed on this firm or on any prospective subcontractor while any bid/proposal to the City is pending and, if awarded a contract, during the term of the contract provide the same to the Purchasing Director.

4. ☐ A vendor/contractor awarded a contract that has disclosed under paragraph 3 above shall, upon request, furnish monthly certified payrolls for the City contract as the Purchasing Director instructs and shall, at the discretion of the Purchasing Director, obtain a wage/payment bond or other suitable insurance as required by the Wage Theft Prevention Ordinance. Vendors/contractors subject to a state or federal debarment for violation of the above laws or prohibited from contracting with the Commonwealth are prohibited from contracting with the City, and upon a finding or order of debarment or prohibition, the City may terminate the contract.

5. ☐ The contractor shall post notices provided by the City in conspicuous places informing employees of the protections of the Wage Theft Prevention Ordinance, and applicable local, state and federal law.

The undersigned certifies under the pains and penalties of perjury that the contractor is in compliance and agrees to remain in compliance with the provisions of the Wage Theft Prevention Ordinance for the term of its contract with the City.

Signed: _____

Print Name & Title

Company Name

Date

Section 01 10 00
SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. Project description.
- B. Project's environmental goals.
- C. Hazardous materials.
- D. Definitions – Owner and Architect.
- E. Work by Owner.
- F. Project confidentiality and promotional material.
- G. Owner early occupancy.
- H. Project Manual formats and conventions.

1.2 PROJECT DESCRIPTION

- A. Project Identification: The name of the Project on Contract Documents is Worcester Technical High School (WTHS) Tufts Vet Tech Clinic Renovation, 1 Officer Manny Familia Way, Worcester, MA 01605.
- B. Work covered by Contract Documents: The Project consists of the following:
 - 1. The proposed scope of work at WTHS Tufts Vet Tech Clinic Renovation consists of the renovation of an existing 9,100 square foot vocational shop area and the addition to create a new entrance for a new instructional veterinary clinic which is to be available to the public. The work includes the removal and relocation of existing equipment, demolition of interior partitions; modifications to existing fire protection, plumbing, HVAC and electrical systems; the construction of new interior partitions with new floor and ceiling finishes; the construction of a new 465 square foot addition with an exposed steel canopy; and associated site improvement work.
 - 2. The work area is within a fully operational and occupied technical high school. Spaces directly adjacent to and below the work area will be occupied by staff and students during school hours. The contractors and all workers shall complete CORI checks through the Owner. All work shall be coordinated with the Owner so that there will be no disruptions to services in the building except during off-hours, weekends, and vacation periods.
 - 3. Project Address:

Worcester Technical High School
1 Officer Manny Familia Way
Worcester, MA 01605

Work included beyond the Contract Limits: Protection and replacement of abutting sidewalks and roadways in public way, and on adjacent properties.

SUMMARY

4. Completeness: The Work shall be as shown on the Drawings and be complete in every respect and in conformance with all applicable requirements of the governing laws and codes.
 - a. All work shall be in accordance with the Bidding and Contract Documents prepared by Lamoureux Pagano Associates | Architects, and their consultants.
 - b. Contract Drawings: Refer to Document 00 00 15 - LIST OF DRAWINGS.
- C. Contract time: The Contractor may begin on-site work on, or after receipt of a written Notice to Proceed, or suitable Letter of Intent. After commencement of work, the Contractor shall pursue the Work continuously and with diligence, and bring the Project to Substantial Completion prior to date stipulated in Owner-Contractor Agreement.
 1. Substantial completion is the stage in the progress of the Work when the work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use. This includes any and all permits required by governmental agencies necessary for occupancy and use.
- D. Building Permits: Contractor is responsible to ensure all required permits are obtained, and that the work pertaining to permits is properly inspected and certified. Filed Subcontractors are required to obtain permits relating to their work.

1.3 PROJECT ENVIRONMENTAL GOALS

- A. Overview of the environmental requirements for the Project: The Owner has established the environmental goal to provide, to the extent possible, a "green" building. However, there are no requirements for achieving a specific level of LEED compliance.
- B. Cooperative effort: The specifications are not intended to limit alternative means of achieving the Owner's environmental project objectives. Recommendations, and input from the General Contractor and Trade Contractors, and subcontractors for improving implementation of the Owner's environmental project objectives are encouraged.
- C. General Contractor's participation: The General Contractor shall provide all administrative and procedural requirements necessary for the Owner to achieve its environmental goals in the construction of this Project.
 1. The General Contractor shall incorporate into the construction specific "green" products which comply with the Owner's environmental goals and objectives. Additionally the General Contractor shall utilize "green" products which are part of the building process but not included in the final construction, (for example, cleaners, shipping containers and similar supplementary items).
 2. The General Contractor shall maximize environmentally-benign construction techniques, including:
 - a. Provide a waste and recycling program for handling and disposal of solid waste.
 - b. Maximize use and recycling of reusable delivery packaging.
 - c. Reduce the use of municipally supplied potable water.
 - d. Protect soil against erosion and topsoil depletion.

- e. Minimize noise generation during construction.
- D. Objectives: Major components of the Owner's environmental goals include construction utilizing "green products", pollution prevention during the construction process, and maintenance of healthy Indoor Air Quality (IAQ).
 - 1. Green products and sustainable materials are required for incorporation into the Project: utilization of recycled materials and materials with high recycled content, use of designated sustainable managed products, and energy efficient equipment and fixtures. Green products and sustainable materials include:
 - a. Products with low embodied energy (production, manufacturing, and transportation).
 - b. Products that maximize recycled content in materials products, and systems.
 - c. Products easy to maintain, repair, and that can be cleaned using non-toxic substances.
 - d. Products will not negatively affect healthy indoor air quality.
 - e. Reusable and recyclable packaging.
 - 2. Pollution prevention as achieved through recycling and reuse of materials, waste handling procedures, and limiting harmful pollutants emitted into the air, soil, and waterways. Pollution prevention efforts include, but are not limited to:
 - a. Providing additional temporary facilities and controls.
 - b. Minimizing the release of carbon dioxide (CO₂) from fuels burned on site or fuels burned off site to supply electricity to the building.
 - c. Avoiding the release of ozone-depleting compounds, such as HCFCs from refrigerants, or foam insulation materials.
 - 3. Enhancement, restoration, and protection of the natural environment of the site.
 - 4. Water resource protection: Conserve and use water efficiently, limit on-site fresh water usage to the greatest extent possible, control water distribution systems and waste, minimize use of imported or mined water. Capture and utilize rainwater to the greatest extent permitted by Law. Utilize water-conserving appliances and equipment.
 - 5. Air Quality is achieved by compliance with the limitation of indoor air concentrations of certain pollutants, at or below the established maximum allowable concentrations. Healthy air quality goals shall be maintained during construction, and through building commissioning.
 - 6. Use construction practices that achieve the most efficient use of resources and materials.
 - 7. Energy Efficiency (Operations Throughout Project Life): Materials and systems are intended to maximize energy efficiency for operation of Project throughout service life (substantial completion to ultimate disposition).

1.4 DEFINITIONS - OWNER AND ARCHITECT

- A. Wherever the term "Owner" is used in this specification, it refers to:
 - 1. City of Worcester Purchasing Department
City Hall, Room 201
455 Main Street

SUMMARY

Worcester, MA 01608

2. The terms "Owner" and "Awarding Authority" as used in the Project Manual have the same meaning and are interchangeable in Contract Documents. Both terms refer to the same entity.
3. Important Tax Note: OWNER is a non-profit organization and exempt from certain taxes. It is therefore required that the Contractor and all Subcontractors purchasing taxable goods or services make known to suppliers that tax-exempt status of the Owner, in order that such taxes will not be applied to the goods under Contract.
 - a. Fines and Penalties: Contractor and subcontractors are fully responsible for payment of all penalties and fines assessed by authorities having jurisdiction for improper and illegal use of Owner's tax exemption certificate number.

- B. Wherever the term "Architect", "Designer", or "Architect/Engineer", is used in the Contract Documents, it refers to:

Lamoureux Pagano Associates | Architects
108 Grove Street, Suite 300
Worcester, MA 01605

1.5 WORK BY OWNER

- A. Related work under separate agreements: The Owner will award a separate contract which will commence prior to or during the work of this Contract; which in general includes:
1. Testing Laboratory Services.
 2. Owner Furnished - Contractor Installed (OFCI) Products:

1.6 WORK OF FILED SUB-TRADES

- A. Filed Sub-Bids will be required for the classes of work listed below and in accordance with the requirements of Document 00 11 16, INVITATION TO BID:
- MASONRY** as specified under Section 04 00 01 - Masonry Filed Sub-bid Requirements, and the following sections:
Section 04 20 00 - Unit Masonry
- ROOFING AND FLASHING** as specified under Section 07 00 02 - Roofing and Flashing Filed Sub-bid Requirements, and the following:
Section 07 53 23 – EPDM Roofing
Section 07 62 00 – Sheet Metal Flashing and trim
Section 07 71 00 – Roof Specialties
- ACOUSTICAL CEILINGS** as specified under Section 09 00 05 – Acoustical Ceilings Filed Sub-bid Requirements, and the following:
09 51 00 - Acoustical Ceilings
- RESILIENT FLOORING** as specified under Section 09 00 06 - Resilient Flooring Filed Sub-bid Requirements, and the following:
Section 09 65 13 – Resilient Base and Accessories
Section 09 65 43 – Linoleum Flooring
Section 09 67 23 – Resinous Flooring

SUMMARY

PAINTING as specified under Section 09 00 09 - Painting Filed Sub-bid Requirements, and the following:

Section 09 91 00 – Painting

Section 09 91 13 – Exterior Painting Schedule

Section 09 91 23 – Interior Painting Schedule

FIRE PROTECTION as specified under Section 21 00 01 - Fire Protection

PLUMBING as specified under Section 22 00 00 - Plumbing

HEATING, VENTILATION AND AIR CONDITIONING as specified under Section 23 00 00 - HVAC

ELECTRICAL as specified under Section 26 00 01 - ELECTRICAL Filed Sub-bid Requirements, and the following:

26 00 01 – Electrical

26 05 00 – Common Work Results for Electrical

26 05 19 – Electrical Power Conductors and Cables

26 05 26 – Grounding and Bonding for Electrical Systems

26 05 29 – Hangers and Supports for Electrical Systems

26 05 33 – Raceway and Boxes for Electrical Systems

26 05 48 – Vibration and Seismic Controls for Electrical Systems

26 05 53 – Identification for Electrical Systems

26 05 73 – Overcurrent Protective Device Coordination Study

26 09 43 – Network Lighting Controls

26 24 16 – Panelboards

26 24 19 – Motor Controls

26 27 26 – Wiring Devices

26 28 13 – Fuses

26 28 16 – Enclosed Switches and Circuit Breakers

26 51 00 – Interior Lighting

27 05 00 – Common Work Results for Communications

27 10 00 – Structured Cabling

27 17 20 – Testing Category 6A Twist Pair Infrastructure

28 10 00 – Unified Security System

28 31 11 – Addressable Fire-Alarm System

1.7 WORK UNDER OTHER CONTRACTS

A. Briefly without limitation, the work of this Contract includes coordination with other contractors performing the following work under separate contracts with the Owner:

1. Furnishing and installation of furniture and furnishings.
2. Installation of technology equipment not included in the General Contract.
3. Moving and storage of existing furniture, equipment, and other items to be salvaged and reinstalled.

1.8 CONDITIONS OF THE CONTRACT

- A. Unless otherwise indicated, the Conditions of the Contract shall include the following:
 - 1. GENERAL CONDITIONS: Document 00 72 00, City of Worcester General Conditions of the Contract For Construction.
- B. Substantial Completion Date: The date of Substantial Completion for this Project shall be February 19, 2027.

1.9 PRODUCTS REQUIRING LONG LEAD TIME

- A. Several products specified in individual specification sections are "long lead time" products and thus require advance ordering. For the following typical categories of work, Contractor to review current conditions at the time of contracting, and provide a list of job specific items, to affirm early purchase orders under the requirements of Section 01 32 00 – CONSTRUCTION PROGRESS DOCUMENTATION.
 - 1. Hardware for doors
 - 2. Equipment for heating, ventilating and air conditioning
 - 3. Light fixtures and controls
 - 4. Architectural woodwork
 - 5. Other items as identified

1.10 CONTRACTOR'S USE OF PREMISES

- A. Prior to beginning work of the Contract, the General Contractor shall meet with the Owner and the Architect to determine procedures regarding access to and use of site, exterior staging, parking, and storage areas, tree protection, special site conditions, and any other restrictions regarding the use of the site areas surrounding the construction.
 - 1. Coordinate use of premises under direction of the Awarding Authority and the Architect.
 - 2. Assume full responsibility for the protection and safekeeping of Products under this Contract, stored on the site.
 - 3. Obtain and pay for the use of additional storage or work areas needed for operations.
 - 4. Move any stored Products, under Contractor's control, which interfere with operations of the Owner or separate contractor.
- B. Where work on public roads or walks, or other work on municipal property or easements is done, all such work shall conform to applicable portions of this Specification and the rules, regulations, and specifications of the public agencies having jurisdiction. Wherever work on a public street is done, a City of Worcester special duty police officer must be present. All permits and fees in relation to such off-site work shall be obtained and paid for by the General Contractor.
- C. The General Contractor shall keep the site and all public and private access roads and walks clear of debris caused by this work during the entire term of the Contract. They shall repair all public and private streets, drives, curbs, walks, and other improvements where disturbed by work of, or related to, building operations, leaving them in as good condition after completion of the work as before operations

started, in accordance with rules, regulations, and specifications of the public agencies having jurisdiction.

- D. Parking for workmen's personal vehicles shall be the responsibility of the General Contractor and each individual Subcontractor. The Contractors' parking during normal school hours shall be off site. The contractors' parking during school vacation periods and holidays may be onsite in areas coordinated with the owner at least (1) week prior.
- E. Access roads and fire-lanes on and about the site shall be kept open and free at all times, including public roads and access to private homes and roads.
- F. Toilet facilities within the school and outside of the third-floor work area shall not be used by the contractors. An existing exterior portable toilet is located adjacent to the work area and will be available for the contractors' use. Any additional portable toilets required by the contractors shall be furnished and maintained at the General Contractor's expense.

1.11 PROJECT MANUAL FORMATS AND CONVENTIONS

- A. Project Manual Format: The Project Manual is organized into Divisions and subdivided into Sections and Documents using Construction Specification Institute (CSI) publication "MasterFormat, 2004 Edition" numbering system.
 - 1. Section Identification: Six/Eight digit Section numbers are utilized and cross-referenced throughout the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because only those Section numbers which are applicable to this Project are used.
 - 2. Division One of the Project Manual governs procedural and administrative requirements of the Work. Division One requirements are applicable to all Sections and Documents in the Project Manual.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular as applicable to the context of the Contract Documents.
 - 2. Imperative mood and streamlined language is generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 12 00
PROJECT PHASING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Requirements for phasing of Work include logistics, phasing, and completion of designated phases prior to commencement of subsequent phases.

1.3 RELATED SECTIONS

- A. Section 01 10 00: SUMMARY OF WORK
- B. Section 01 31 00: PROJECT MANAGEMENT AND COORDINATION
- C. Section 01 33 00: SUBMITTAL PROCEDURES
- D. Section 01 32 00: CONSTRUCTION PROGRESS DOCUMENTATION
- E. Section 01 50 00: TEMPORARY FACILITIES AND CONTROLS
- F. Section 01 77 00: CONTRACT CLOSEOUT

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SUBMITTALS

- A. Contractor shall submit a Project site and building logistics plan in accordance with the requirements of this Section. Schedule, (Exhibit C) issued herein is a guide as to the minimal requirements, the CM shall further investigate and coordinate all the required items, and include associated costs of their and subcontractors work, outline and coordinate the responsibilities and work of the School, Utility Companies, and other parties involved in the complete construction and occupancy as part of the schedule.

3.2 LOGISTICS

- A. Prior to commencement of Work, Contractor shall prepare and submit to Architect/OPM/DPW/WPS a detailed Project site/building logistic plan, in same size and scale of Drawings, setting forth Contractor plan of Work relative to following, but not limited to, items:
 - 1. Hauling route shall be in accordance with local ordinances and the DEP Administrative Consent Order, a truck access route to and from Projects site.
 - 2. The identification of any overhead wire restrictions for power, streetlighting, signal or cable.
 - 3. Protection of sidewalk pedestrians and vehicular traffic.

4. Project site fencing and access gate locations.
 5. Construction parking.
 6. Material staging or delivery areas.
 7. Material storage areas.
 8. Temporary trailer and storage locations.
 9. Temporary service location and proposed routing of all temporary utilities.
 10. Location of temporary or accessible fire protection.
 11. Trash removal and location of dumpsters.
 12. Concrete pumping locations.
 13. Crane locations.
 14. Location of portable sanitary facilities.
 15. Mixer truck wash out locations.
 16. Traffic control signage.
 17. Storm Water Pollution Prevention Plan – SWPPP.
 18. Stockpile, or lay down areas.
 19. Security lighting.
 20. Egress plans, egress and emergency lighting plans for construction areas.
 21. Temporary utility connection and lighting, security, plans for all trades.
 22. Weather Protection.
- B. Revised Project site and building logistic plan will be required to be updated for each identified phases of Work as set forth in this Section.
- C. Contractor is responsible for securing and/or obtaining all approvals and permits from authorities having jurisdiction relative to any activities set forth in Section 3.2.A. Construction work
- D. All work shall be done in accordance with NFPA 241, This contractor must provide a written NFPA 241 workplan, prepared by a licensed professional, to the AHJ/ Worcester Fire department, for section 1.3.4 "A safety program shall be included in all construction, alteration, or demolition contracts." Note that per local requirements, the existing fire protection systems must remain active for the duration of construction. Report to outline any procedural requirements and timeframe for new installations and switchovers.
- E. Refer to General Conditions for work sequencing of all trades, work adjacent to occupied areas must be scheduled as not to interfere with the school's operations, all disruptive work of all trades shall be scheduled for the second shift, weekend or vacation periods. The school's schedule is critical to meet, all trades shall include in their bid, working in these timeframes/ shifts as required to maintain the published schedule.
- F. The project work includes the installation and utility connections for existing and new equipment being provided by the owner/school/veterinary tech. As part of the submittal process, the owner will provide current information on the products as existing or being purchased (the drawings have what are being proposed) the failed bid trades and contractor to include these connections in their price and confirm details as part of the submittals i/e power requirements. Coordinate with the vendors' representatives the final connections or technical requirements.

3.3 PHASING OF THE WORK

- A. Project will be constructed during the school's calendar, and around activities, students, staff and public. The work area is free to the contractor and activities coordinated for minimal disruption to the adjacent areas. All building systems need to be maintained. Contractor to provide a phasing plan to delineate Work to be completed in each designated work phase coordinated with the school's calendar. Unless otherwise approved or directed by Owner, each phase shall be completed according to approved Baseline Schedule prior to commencement of next subsequent phase. Meetings to be held between the contractor and school's representative on routine basis, aligning with the work schedule

PHASE #1 - April 2026-February 2027

1. Site Work
2. Installation of Erosion Control
3. from the construction areas. Refer to enabling bid documents for specifics
4. Maintenance of areas within the construction fence
5. Installation and reconfiguration of temporary site fence in coordination with the school year
6. Sprinkler service alterations
7. Electrical connections
8. Fire alarm connections
9. Security connections
10. Telephone connections

3.4 PHASING OF THE WORK – GENERAL

- A. The owner will be impacted by not having all Work of each Phase completed within the indicated schedule and overall Project completed within the Contract Time. It is mandatory Work to be completed within Phases and Contract Time.
- B. Site Contractor is responsible for snowplowing, maintaining access to all areas under their control. Landscaping Contractor is responsible for watering, maintenance, and mowing of all areas until accepted by the Owner. Owner is responsible for snowplowing, mowing and maintaining walkways, paths and fields under areas of their use and control.
- C. SUBCONTRACTORS' RESPONSIBILITIES:
Subcontractors to coordinate their work in accordance with the phasing plan and master schedule of the CM, including the minimal items outlined in this and sub sections of the specifications and drawings.

D. General Requirements All Phases

1. Egress and exit capacities must be established and maintained from all occupied areas, kept clearly labeled, including exit lights and emergency lights (installed, maintained and removed upon completion by the electrical contractor) during all occupied phases. Contractor to establish regular communications with representatives of the school, code department, Worcester Fire Department and Owner's representatives.
2. Reference drawings and specification sections for areas and additional information and requirements.
3. Coordinate with the owner's other vendors working within the building under separate contracts, but outside of the work area, to ensure that interruptions building services do not hinder their project schedules.
4. Coordinate with the school's normal operational schedule, including but not limited to the Worcester Public School Calendar 2026-27, as included at the end of this section.

End of Section

Worcester Public Schools Calendar 2026-2027

AUGUST 2026						
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MARCH 2027						
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MAY 2027						
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2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

JUNE 2027						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

JULY 2027						
S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

No School Days

September 7: Labor Day
October 12: Indigenous People's Day / Columbus Day
November 3: Staff Development Day
November 11: Veterans' Day
November 25 – 27: Thanksgiving
December 24 – 31: Holiday Vacation
January 1: New Year's Day
January 18: Martin Luther King Day

February 15: Presidents' Day
February 16 – 19: Winter Vacation
March 2: Staff Development Day
March 26: Non-School Day
April 19: Patriots' Day
April 20 – 23: Spring Vacation
May 31: Memorial Day
June 18: Juneteenth Day
July 4: Independence Day

Dates to Remember

August 27 – 28: Teacher / Staff Reporting
August 31: First Day of School
September 3: First Day for PreK & K
November 6: End of Quarter 1
January 22: End of Quarter 2
April 9: End of Quarter 3
May 28: Last day of School for Seniors
June 2: Kindergarten Open House
***June 16:** End of Quarter 4 / Last day of School

Other Major Religious & Cultural Days

September 20: Yom Kippur Begins
September 22: Rosh Hashanah Begins
November 6: Diwali Begins
December 4: Hanukkah Begins
December 26: Kwanzaa Begins

January 6: Three Kings Day
February 6: Lunar New Year
February 7: Ramadan Begins
February 10: Ash Wednesday
March 9: Eid al-Fitr Begins

March 26: Good Friday
March 28: Easter
April 21: Passover
May 3: Orthodox Easter
May 17: Eid al-Adha Begins

 = DAYS WHEN SCHOOL IS NOT IN SESSION FOR STUDENTS

**Last day of school may change in response to the number of snow days used during the school year*

Major Religious & Cultural Days: Be cognizant of the variety religious holidays when planning events

Section 0 14 00
WORK RESTRICTIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Use of Site.
- B. Access to Site.
- C. Work Sequencing.
- D. Workforce requirements.
- E. Hours for on-site operations and restrictions.
- F. Coordination with occupants.
- G. Worker Identification Badges
- H. Worker sex offender record information (SORI) Reporting and criminal offender record (CORI) reporting.
- I. Worker conduct, appearance and Work Rules.

1.2 RELATED REQUIREMENTS

- A. Document 00 73 00 – SUPPLEMENTARY INSTRUCTIONS TO BIDDERS: Additional project requirements and work restrictions.

1.3 USE OF SITE

- A. Use of, and access to, site will be subject to special requirements of the Owner, as directed.
 - 1. Prior to beginning the Work of this Contract, the General Contractor shall meet with the Owner and the Architect to determine procedures regarding access and use of the site, locations and access to staging and storage areas, tree protection, temporary barriers and fencing, and any special site conditions or restrictions regarding the use of the site areas surrounding the construction.
 - 2. Use of Owner's receiving/shipping areas: General Contractor is responsible to deliver and receive all materials and equipment. General Contractor is not permitted to have supplies or equipment shipped directly to them in care of the Owner or Building Manager.
 - 3. Security: Owner access must be permitted at all times in all construction areas, for purposes of security.
- B. Confine operations to areas within Contract limits indicated on the Drawings. Portions of the site and building beyond areas in which construction operations are indicated are not to be disturbed.
 - 1. All workers shall enter the building within the General Contractor's controlled area. Workers shall not have access to the school building outside of the work area limits

during the normal operating hours of the school, except as required to perform contract work.

2. Use of on-site areas outside of the contract limits for workers' parking or storage of materials must be pre-arranged with Owner. Schedule deliveries to minimize requirements for storage of materials.
 3. There shall be no work or construction activity within the wetlands or the buffer areas
- C. Keep all public roads and walks and access drive to facility clear of debris caused by this Work during building operations.

1.4 ACCESS TO SITE

- A. The Owner intends to occupy parking areas and access roads during construction. Notify the Owner of work which will affect the use of these areas; coordinate work schedule with Owner. The General Contractor shall consult with the Owner on the best ways to provide access and on changes to access areas as the work progresses.
- B. Keep all public roads and walks and access drive to facility clear of debris caused by this Work during building operations.

1.5 COORDINATION WITH OCCUPANTS

- A. General: Perform all work in such a manner as to prevent interference with the Owner's operation of the facility, nor endanger the health, safety and wellbeing of the facility's staff and students.
1. Take all measures to insure the safety of students, staff and the general public. The General Contractor must take every reasonable precaution and employ all necessary measures including extra cleaning, special supervisory personnel, and additional temporary barriers and signage to facilitate the clean, quiet, safe, and continual operation of the facility.
 2. The work will be done in an occupied building active site accessible to the public. It is imperative that the General Contractor, its subcontractors and all their personnel treat the staff and students with consideration and respect. No unnecessary noise or disruption of the academic or social activities of the school will be permitted.
 3. The owner's access to building entrances and egresses adjacent to the work area shall be maintained for the school's use at all times. All disruptions to these points shall be coordinated with the owner with prior written notification and approval.
- B. Interruption of services: Any major work entailing disruption to heating, lighting, life safety system utility connections or other similar major disruption to building functioning must be coordinated with the Owner, and temporary services, safety precautions, or connections provided. Do not shut down any service without approval of the Owner.
1. Provide both Owner and Architect with 72 hour (3 work days minimum) notification for any disruption of service; provide notification for connecting, disconnecting, turning on or turning off any service which may affect Owner's operations.
 2. Provide 48 hour (2 work days minimum) notice to local fire department of disruptions in electrical services, fire alarm services and emergency power services.
 3. Any action either planned or unplanned, by the General Contractor which impairs the operation of anyone or the activation of the fire alarm detection and or suppression system shall cause notification of the appropriate party. In case of unplanned, accidental, impairment, the General Contractor will immediately notify the Owner. The

General Contractor should be prepared to provide assistance as required to correct the problem.

4. Coordinate with the owner's other vendors working within the building under separate contracts, but outside of the work area, to ensure that interruptions building services do not hinder their project schedules.

1.6 WORK FORCE REQUIREMENTS

- A. The General Contractor acknowledges the stringent requirements of the Owner with respect to the dates of Substantial Completion for various Portions of the Work, and recognizes that the construction schedule may require that work proceed on an accelerated basis. The General Contractor further acknowledges that requirements related to items such as safety, service to Owner occupied areas, or General Contractor access to Owner occupied areas may mandate that some operations be performed only after "normal school hours" or other occupancy hours. The General Contractor therefore agrees that the Work of his own forces and of his subcontractors, including all Trade Contractors, shall be performed on an overtime and/or double-shift basis if and to the extent necessary in order that the construction schedule be met.
- B. Neither overtime nor double-shift work shall be grounds for any claims for compensation to the General Contractor or to any Trade Contractor or subcontractor. If the nature of overtime or double-shift work requires that the Owner provide personnel to operate the facility at times when they would not normally be present, such personnel costs shall be borne or reimbursed by the General Contractor.
- C. Restricted access hours (Closed Gate Period): Access to the school and site is prohibited during school bus drop off and pick-up hours. No construction deliveries, vehicular traffic, or hauling away may occur at the site during School bus drop-off and pick-up times which are 6:30 AM to 7:30 AM, and 1:15 PM to 2:30 PM. The General Contractor shall coordinate with the Owner Project Manager and Owner to determine exact times and durations for restricted access hours.
 1. All gates to Construction site shall be closed during the above specified time periods.
 2. No vehicles (except fire, police and rescue) may enter or exit the construction site during the above time periods.
 3. Any vehicle which arrives at the school during the "Closed Gate" time must move to a location acceptable to the Owner. No vehicles will be allowed to idle on the project site, or any other nearby street. The General Contractor shall be responsible for enforcing this requirement.
- D. School vacation dates: School vacation schedule is listed under Information Available for Bidders. The General Contractor is required to coordinate with the Owner's Project Manager prior to scheduling Work during vacation dates.
- E. Winter Conditions: The Owner and General Contractor recognize that time is of the essence for completion of this Contract and agree to continue work throughout the winter months without delay.
- F. Sidewalk in front of the construction site is a major school pedestrian accessway, the general contractor shall provide pedestrian and construction controls as appropriate for the stage of construction
- G. Municipal Authority: The General Contractor shall comply with all local ordinances, including those with respect to work start, finish, and weekend work.

- H. None of the requirements herein shall be construed as relieving the General Contractor of his responsibility to conduct his operations in conformance with local ordinances or requirements established by authorities having jurisdiction.

1.7 HOURS FOR ON-SITE OPERATIONS AND RESTRICTIONS

- A. Hours of operation and restrictions:
 - 1. Hours of construction, 7:00 AM to 5:00 PM local time, Monday to Friday. Provisions for working hours other than those specified, must be pre- arranged with the Owner.

1.8 WORKER CRIMINAL OFFENDER RECORD (CORI) REPORTING

- A. Sex Offender Record Information (SORI) Reporting and Criminal Offender Record Information (CORI) Reporting. In accordance with MGL c6 §178 and c71 §38R respectively, the School Superintendent or School Principal will require sex offender record information ("SORI") and criminal offender record information ("CORI") from the criminal history systems board, as included at the end of this section, relating to any worker who is scheduled to work on any portions of the school property. The General Contractor, Trade Contractors and subcontractors shall make every effort to provide the Owner's Project Manager with a list of the proper paperwork at least two weeks before any workmen who they anticipate will be on site. All approved workers on the project shall wear visible I.D. badges at all times. The General Contractor shall be responsible for issuing these badges and enforcing this requirement. Workers failing to display their I.D. badges will be removed from the site. The Owner reserves the right to stop work if there has been a failure to comply with this paragraph, in which event the General Contractor, Trade Contractors and subcontractors shall have no claim for damages, delay or time extensions against the Owner.
 - 1. Obtain and complete the following forms from the Worcester Public Schools:
 - a. Worcester Public Schools CORI Request Form as provided at the end of this section.
 - 2. Coordinate reporting requirements with Document 00 73 00 - Supplementary Instructions to Bidders.

1.9 WORKER IDENTIFICATION BADGES

- A. Provide an identification helmet sticker to each worker, materials supplier and vendor authorized to enter premises.
 - 1. All personnel on site shall visibly wear this identification issued by the General Contractor.
 - a. All construction personnel on-site shall be issued and wear identification.
 - b. Delivery and Vendor Personnel who are on site only for deliveries shall be issued a temporary visitor's ID card which shall be returned to the General Contractor when leaving the site.
 - c. Authorized Visitors who are on site for meetings, inspections and similar activities, shall be issued a temporary visitor's ID card which shall be returned to the General Contractor when leaving the site.
 - 2. Identification system shall be in format, color and size approved by Owner.

3. CM shall maintain records and control the established system, including expiration date, and receiving any input from the City//Schools department and retract any identification as required.
 4. Return of identification badges:
 - a. Temporary ID cards shall be issued and returned on a daily basis.
 5. All construction personnel are required to wear their issued identification at all times when on school grounds.
- B. Maintain a list of accredited persons, submit copy directly to Owner upon request.
1. Include in list, employee name, assigned number, date of issue, expiration date, and employer.

1.10 WORKER CONDUCT, APPEARANCE AND WORK RULES

- A. General Conduct and Demeanor: All construction workers shall treat all other workers, Owner staff, student and the public with respect and courtesy.
1. The conduct and appearance of each worker at the job site is of paramount importance. The Owner reserves the right to require any worker to be banished from the Site.
- B. Privacy: Conduct all work of the Contract with the maximum effort to maintain the privacy of the Owner's operations, staff, and students. Do not permit the workers to peer into other areas of the building visible from the work area. Invasion of privacy is a major infraction of the work rules.
- C. Physical Appearance: Require each worker to dress appropriately in a clean, neat, and professional manner.
1. Sleeved shirts and long pants are required as minimum clothing. Short sleeved shirts may not be rolled up. Shirts may not be rolled up at the waist. Pants may not be rolled up past the top of the boots or shoes worn. Anyone not in compliance is subject to immediate dismissal.
- D. Entertainment Devices (including, but not limited to radios, CD players, MP3 players and televisions): The use of all entertainment devices, including portable listening devices (ipod™ type) with headphones or earphones, is strictly prohibited at all times.
1. General Contractor shall control the volume of all communication radios and loudspeakers to avoid creating a nuisance.
- E. Medications and Drugs: Do not allow any drugs or mood-altering substances, except for qualified, legal prescriptions; when requested, allow inspection of prescription drugs.
- F. Smoking: Smoking is strictly prohibited on school property.
- G. Language: Foul and rude language is strictly prohibited.
- H. Physical Actions: Running, horseplay, fighting, and other unprofessional conduct is prohibited. Fighting is a major infraction of the work rules.
- I. Stealing: Stealing of any materials, objects, furnishings, equipment, fixtures, supplies, clothing, or other items will not be tolerated and is a major infraction of the work rules.

- J. Sexual Harassment: All forms of physical and verbal sexual harassment will not be tolerated and is a major infraction of the work rules. Sexual harassment includes, without limitation: touching, whistling, sexually explicit stories, jokes, drawings, photos and similar representations, exhibitionism and all other sexually oriented offensive behavior.
- K. Warnings and Dismissal:
 - 1. For minor infractions of the rules, the Owner may issue a warning. Only one warning will be allowed per worker. A second infraction will result in immediate dismissal of the worker from the Site.
 - 2. For major infractions of the rules, the worker shall be dismissed immediately without warning and is subject to possible criminal prosecution.
- L. Notification of Workers: Clearly notify and educate each worker about these Work Rules and the requirements for worker conduct and appearance.
 - 1. Recommendation: The Owner recommends that the General Contractor notify each worker of the work rules in writing and obtain a signed acknowledgment of the worker's understanding of the work rules as a condition of employment on this project.

1.11 PROJECT PHASING

- A. Refer to Document 01 12 00 – PROJECT PHASING REQUIREMENTS and Document 01 31 00 – PROJECT MANAGEMENT AND COORDINATION.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section



WORCESTER PUBLIC SCHOOLS

WORPS
CH 385 G

20 Irving Street, Worcester, MA 01609-2493
Telephone: (508) 799-3021

In order to volunteer and/or work in the Worcester Public Schools, an individual must have a criminal background check. Convictions will be reviewed to determine an individual's eligibility to volunteer/work in the Worcester Public Schools.

This request is submitted by: Department/ School/ Collaborative _____

For the position of _____

WORCESTER PUBLIC SCHOOLS CORI REQUEST FORM

Worcester Public Schools has been certified by the Criminal History Systems Board for access to all criminal case data including conviction, non-conviction and pending. I understand that a criminal record check will be conducted for convictions, non-convictions and pending criminal case information only and that it will not necessarily disqualify me. The information below is correct to the best of my knowledge.

APPLICANT/EMPLOYEE INFORMATION (Please print)

Applicant/Employee Signature

Last Name

First Name

Middle Name

Maiden Name or Alias (If Applicable)

Place of Birth

Date of Birth

Social Security Number

Mother's Maiden Name

Current Address: _____

Sex: _____ Height: ____ ft. ____ in. Weight: _____ Eye Color: _____

State Driver's License Number: _____

IN ORDER FOR THIS CORI TO BE PROCESSED, A COPY OF A MASSACHUSETTS ID MUST BE ATTACHED.

The person collecting this form must sign below stating the above information was verified by reviewing the attached form of government issued photographic Identification.

(NAME)

(LOCATION)

WHY A CRIMINAL OFFENDER RECORDS INFORMATION (CORI) CHECK?

In order to protect the welfare of our students, and in accordance with the M.G.L. c.71 §.38R, all candidates for, and current occupants of, positions which have the potential for direct and unmonitored contact with WPS students, including, but not limited to teachers, teachers aides, school nurses, counselors, coaches or other extracurricular staff or supervisors, food service employees, custodians and transportation providers. This also includes volunteers, interns, student teachers or other persons regularly offering support to any school program or facility, whether paid or unpaid. This CORI check will be done every three (3) years.

HOW DO I GAIN ENTRY TO A SCHOOL?

In order to be in the schools, individuals (students, faculty, and administrators) from outside institutions must complete a registration process, as follows:

1. Fill out the CORI form on the reverse side of this page so that a CORI check can be done by the Criminal History Systems Board in Boston. Return the form to:

**Chief Human Resources Officer
Worcester Public Schools
20 Irving Street
Worcester, MA 01609**

The Worcester Public Schools will maintain a current data base of all applicants who have been approved or whose approval is pending which can be accessed by each public school. An individual will be contacted **only** if there appears to be a problem with CORI approval. All information is held in strictest confidence by the Chief Human Resources Officer.

IS INFORMATION KEPT CONFIDENTIAL?

The CORI process is covered under Massachusetts Law and the statute contains strict language regarding confidentiality: "...any willful, unauthorized dissemination of the CORI may subject the offending agency or individual to a fine of \$5,000 and/or up to one year in a House of Correction, in addition to Civil penalties." Within the Worcester Public Schools, CORI information is kept in a confidential file. The Worcester Public Schools is very diligent in not releasing CORI information to anyone other than the specific individual on whom the CORI was conducted.

The Worcester Public Schools is an Equal Opportunity/Affirmative Action Employer/Educational Institution and does not discriminate regardless of race, color, gender, age, religion, national origin, gender identity, marital status, sexual orientation, disability, or homelessness. The Worcester Public Schools provides equal access to employment and the full range of general, occupational and vocational education programs. For more information relating to Equal Opportunity/Affirmative Action contact the Chief Human Resources Officer, 20 Irving Street, Worcester, MA 01609.

Section 01 25 13
PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Product options.
 - 1. Product selections.
 - 2. Visual matching.
 - 3. Owner's proprietary products.
- B. Product substitution procedures.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.

1.3 PRODUCT OPTIONS

- A. Product selections: Comply with the following for selection of products:
 - 1. Products specified by reference standards or by description only: Provide any acceptable product meeting those standards or description.
 - 2. Products specified by performance requirements only: Provide any acceptable product which has been tested to show compliance with specified requirements, including indicated performances.
 - 3. Products specified by naming one or more manufacturers: Provide products of manufacturers named, or submit a request for substitution for any manufacturer or product not named in accordance with Massachusetts General Laws, Chapter 30, Section 39M(b).
- B. Visual matching: Where Specifications require matching a sample, the Architect's decision on whether a proposed product matches is final. Where no product matches and complies with other requirements, comply with provisions for "substitutions" for selection of a matching product in another category.

1.4 PRODUCT SUBSTITUTION

- A. Products specified by reference standards or by description only: Any product meeting those standards or description.
- B. Pursuant to Massachusetts General Laws, Chapter 30, Section 39M(b), where products or materials are prescribed by manufacturer name, trade name or catalog reference, or indicated as proprietary, the word "or approved equal" shall be implied. The Architect will evaluate the proposed "equal" item on the following criteria:
 - 1. The submitted "equal" item is at least equal in quality, durability, appearance, strength and design.
 - 2. The submitted "equal" item is at least equal in function for the purpose intended by the design of the Work.

3. The submitted "equal" item conforms substantially to the detailed requirements for the items as indicated by the specifications.
- C. The Architect's evaluation and decision on whether a proposed product is equal to that specified, based on the above evaluation requirements, is final. The Construction Manager retains the right to appeal the Architect's determination of equality through regulated statutory provisions.
 1. The Architect and Owner reserve the right to reject proposed substitutions where data for VOCs is not provided or where emissions of individual VOCs are higher than for specified materials.
- D. Owner's proprietary products: Under provisions of Massachusetts General Laws, Chapter 30, Section 39M(b) the Owner has determined that specific products shall be proprietary for 'sound reasons in the public interest'. This determination has been made under vote of the Owner, and has been recorded in writing for public record.
 1. Contractor's substitutions for designated proprietary products will require complete and full information for Architect's and Owner's evaluation. Contractor should carefully schedule substitutions for proprietary products to permit the review and evaluation process. Failure to submit complete data will cause delays in approvals of substitutions. No change in Contract Schedule, or increase in Contract Sum will be made to compensate for rejected substitutions and re-submittals.
 2. Owner's proprietary products are listed under Section 01 60 00 and in respective individual Specification Sections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
 - 1. Division 01 Section "Alternates" for procedural requirements for handling and processing alternates.
 - 2. Division 01 Section "Unit Prices" for administrative requirements for using unit prices.
 - 3. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue Supplemental Instructions (SI) authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time. See form of Supplemental Instructions at the end of this section.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Request for Proposal (RFP): Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications. See form of Request for Proposal at the end of this section
 - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 20 days after receipt of Proposal Request, submit a Proposed Change Order (PCO) showing the proposed cost adjustments to the Contract Sum and the Contract Time necessary to execute the change. See form Proposed

Change Order at the end of this section.

- a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a Proposed Change Order (PCO) to Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Include costs of labor and supervision directly attributable to the change.
 5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 6. Comply with requirements in Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposed Change Order (PCO), Architect will issue a Change Order (CO) for signatures of Owner and Contractor. See form of Change Order (CO) at the end of this section

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive (CCD): Architect may issue a Construction Change Directive (CCD) on owner's form of Construction Change Directive (CCD). Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

EXECUTION – Examples of forms follow this page:

1. Supplemental Instruction (SI)
2. Request for proposal (RFP)
3. Proposed Change Order (PCO)
4. Change Order (CO)
5. Construction Change Directive (CCD)

CONTRACTOR'S NAME
CONTRACTOR'S ADDRESS
CONTRACTOR'S CITY, STATE, & ZIP CODE

P.C.O. NUMBER:

001

PROPOSED CHANGE ORDER

P.C.O. DATE:

DATE

GENERAL CONTRACTOR'S DIRECT LABOR BY OWN FORCES

Trade	Quantity	Hours	Rate	Unit	Effective Date of Rate	Expiration Date of Rate	Subtotal	
				HR			\$0.00	
				HR			\$0.00	
				HR			\$0.00	
				HR			\$0.00	
				HR			\$0.00	
				HR			\$0.00	
				HR			\$0.00	
				HR			\$0.00	
				HR			\$0.00	
				HR			\$0.00	
				HR			\$0.00	
				HR			\$0.00	
				HR			\$0.00	
				HR			\$0.00	
GC'S LABOR SUBTOTAL							\$0.00	

GENERAL CONTRACTOR'S DIRECT LABOR BURDEN

Insurance & Payroll Burdens - By Trade	Subtotal - By Trade	%	Subtotal	
Workers' Compensation Insurance			\$0.00	
Federal Social Security			\$0.00	
Massachusetts Employment			\$0.00	
			\$0.00	
			\$0.00	
			\$0.00	
			\$0.00	
GC'S LABOR BURDEN SUBTOTAL			\$0.00	

GENERAL CONTRACTOR'S MATERIALS

Material Item/Description	Subtotal	
GC'S MATERIALS SUBTOTAL		\$0.00

GENERAL CONTRACTOR'S EQUIPMENT

Equipment Item/Description	Subtotal	
GC'S EQUIPMENT SUBTOTAL		\$0.00

CONTRACTOR'S NAME
CONTRACTOR'S ADDRESS
CONTRACTOR'S CITY, STATE, & ZIP CODE

P.C.O. NUMBER:

001

PROPOSED CHANGE ORDER

P.C.O. DATE:

DATE

FILED SUBCONTRACTOR'S LABOR, MATERIALS, & EQUIPMENT

Name of Subcontractor	Subcontractor's Subtotal	10% Mark-up	Subtotal	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
SUBTOTAL BEFORE OH&P	\$0.00		FILED SUBS TOTAL	\$0.00

NON-FILED SUBCONTRACTOR'S LABOR, MATERIALS, & EQUIPMENT

Name of Subcontractor	Subcontractor's Subtotal	10% Mark-up	Subtotal	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
		\$0.00	\$0.00	
SUBTOTAL BEFORE OH&P	\$0.00		NON-FILED SUBS TOTAL	\$0.00

GENERAL CONTRACTOR'S ALLOWABLE MARK-UP

Category for Mark-Up	Subtotal Amount	%	Mark-Up Amount	
General Contractor's Labor	\$0.00	10.00%	\$0.00	
General Contractor's Labor Burden	\$0.00	10.00%	\$0.00	
General Contractor's Material	\$0.00	10.00%	\$0.00	
General Contractor's Equipment	\$0.00	10.00%	\$0.00	
Filed Subcontractors Proposals	\$0.00	5.00%	\$0.00	
Non-Filed Subcontractors Proposals	\$0.00	10.00%	\$0.00	
			GC'S MARK-UP SUBTOTAL	\$0.00

SUBTOTALS

	AMOUNT	
General Contractor's Labor	\$0.00	
General Contractor's Labor Burden	\$0.00	
General Contractor's Material	\$0.00	
General Contractor's Equipment	\$0.00	
Filed Subcontractors Proposals	\$0.00	
Non-Filed Subcontractors Proposals	\$0.00	
General Contractor's Mark-Up	\$0.00	
	SUBTOTAL	\$0.00

INSURANCE & BONDS (Direct Premium Costs)

Description	Subtotal Amount	%	Amount	
Liability Insurance	\$0.00	0.00%	\$0.00	
Bonds	\$0.00	0.00%	\$0.00	
			INSURANCE & BONDS SUBTOTAL	\$0.00

TOTAL PROPOSED CHANGE ORDER AMOUNT	\$0.00



CHANGE ORDER

CITY OF WORCESTER, MASSACHUSETTS

C.O. NUMBER: 000

C.O. DATE: Date

FOR THE PROJECT:

DCU Center
Refurbishment and Expansion
50 Foster Street
Worcester, MA 01608

TO THE CONTRACTOR:

Contractor Name
Contractor Address

The Contract is changed as follows:

SUMMARY OF THE CONTRACT PRICE

Original Contract Sum	\$ 00.00
Net Change by Previously Authorized Change Order(s)	\$ 00.00
Contract Sum Prior to this Change Order	\$ 00.00
Contract Sum shall be Increased ~~Decreased~~ by this Change Order in the Amount of	\$ 00.00
New Contract Sum including this Change Order	\$ 00.00

SUMMARY OF TIME FOR PERFORMANCE

Date of Substantial Completion Prior to this Change Order	Date
Contract Time shall be Changed by this Change Order	0 DAYS
Date of Substantial Completion as of the Date of the Change Order is	Date

Pursuant to Article 12 of the General Conditions To The Contract For Construction, the Owner (**City of Worcester**) and the Architect; **City of Worcester** issue this order to change the Work as described below, including the change, if any, to the Contract Sum or Contract Time. The Contractor's execution of this Change Order indicates its acceptance of the terms hereof, including any adjustment to the Contract Sum or Contract Time. If the Contractor shall not agree to the terms hereof, and chooses to contest the terms in accordance with the applicable provisions of the General Conditions, this Change Order shall nevertheless forthwith be returned to the Owner accompanied by the Contractor's written claim. In any case, the Contractor shall proceed in accordance with the instructions of this Change Order without further delay.

CHANGE ORDER NUMBER 000

PAGE 1

CHANGE ORDER NUMBER 000

Date

CHANGE ORDER ITEMS:

1. Enter CCD # & Description Here

DEDUCT/ADD \$ 0.00
DEDUCT/ADD 0 DAYS

TOTAL OF ALL ITEMS

DEDUCT/ADD \$ 0.00
DEDUCT/ADD 0 DAYS

CHANGE ORDER NUMBER 000

PAGE 2

CONSTRUCTION CHANGE DIRECTIVE NUMBER 000

Date

WHEN SIGNED BY THE ARCHITECT AND CONTRACTING OFFICER AND RECEIVED BY THE CONTRACTOR, THIS DOCUMENT BECOMES EFFECTIVE IMMEDIATELY AS A CONSTRUCTION CHANGE DIRECTIVE (C.C.D.) AND THE CONTRACTOR SHALL PROCEED WITH THE CHANGES DESCRIBED ABOVE.

SIGNATURE BY THE CONTRACTOR INDICATES THE CONTRACTOR'S AGREEMENT WITH THE PROPOSED ADJUSTMENTS IN THE CONTRACT SUM AND TIME SET FORTH IN THIS CONSTRUCTION CHANGE DIRECTIVE.

ARCHITECT

CONTRACTOR:

ENTER COMPANY NAME HERE

By:

Date:

_____, Project Manager

By:

Date:

_____, Enter Name & Job Title Here

CONTRACTING OFFICER
CITY OF WORCESTER

By:

Date:

_____, Assistant Commissioner,
Department of Public Works and Parks

CONSTRUCTION CHANGE DIRECTIVE NUMBER 000

Page 2

END OF SECTION 012600

Document 01 26 13
REQUEST FOR INTERPRETATION (RFI) FORM

Date Submitted: _____

To the Architect: Lamoureux Pagano Associates | Architects
108 Grove Street
Worcester, Massachusetts 01605

Architect's Assigned
RFI #

Architect's Project Number: _____

Submitted By: Company: _____
Address _____

References: Specification Section Number: _____
Article/ Paragraph / Subparagraph: _____
Drawing Number: _____
Detail Number: _____

Request: _____
☐ Refer to Attachment(s) _____

Signed By: _____

Response: _____

☐ Refer to Attachment(s) _____

Response From: _____

Signed by: _____

Copies to: ☐ Owner ☐ Consultants ☐ _____
☐ _____ ☐ _____ ☐ _____
☐ _____ ☐ _____ ☐ File

Date Received at
Architect

Date Returned by
Architect

End of Document

Section 01 29 00
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Schedule of Values.
- B. Applications for payment.
- C. Change procedures.

1.2 COORDINATION

- A. Coordinate the Schedule of Values and Applications for Payment with the Construction Manager's Construction Schedule, List of Subcontracts, and Submittal Schedule.
 - 1. Related Requirements:
 - a. Section 01 32 00 – CONSTRUCTION PROGRESS DOCUMENTATION: Construction Manager's Construction Schedule.
 - b. Section 01 33 00 - SUBMITTAL PROCEDURES: Construction Manager's Construction Submittal Schedule.

1.3 SCHEDULE OF VALUES

- A. Coordinate preparation of the Schedule of Values with preparation of the Construction Manager's Construction Schedule.
 - 1. Schedule of values shall be used only as basis for Construction Manager's application for payment.
 - 2. Breakdown schedule of values into separate line items, each having a value of not more than \$25,000.
- B. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - 1. Construction Manager's construction schedule.
 - 2. Application for Payment form.
 - a. List of Trade Contractors and subcontractors.
 - b. List of products.
 - c. List of principal suppliers and fabricators.
 - d. Schedule of submittals.
- C. Submit typewritten schedule of values to the Architect at least 10 days prior to submitting first application for payment.
- D. Sub-Schedules: Where the Work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.
- E. Identification: Include the following Project identification on the Schedule of Values:
 - 1. Project name and location.
 - 2. Name of the Architect.

3. Project number.
 4. Construction Manager's name and address.
 5. Date of submittal.
- F. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
1. Generic name.
 2. Related Specification Section.
 3. Name of Trade Contractor or subcontractor.
 4. Name of manufacturer or fabricator.
 5. Name of supplier.
 6. Change Orders (numbers) that have affected value.
 7. Dollar value.
 8. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent.
- G. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
1. Upon request by Architect, submit data that will substantiate values given.
- H. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
- I. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- J. Unit Cost Allowances: Show line item value of unit cost allowances as a product of unit cost times measured quantity as estimated from the best indication in the Contract Documents.
- K. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
- L. At the Construction Manager's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.
- M. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.
- 1.4 PROCEDURES FOR APPLICATIONS FOR PAYMENT
- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

- B. Payment Application Times: Each progress payment date is as indicated in the Agreement. The period of construction Work covered by each Application or Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use standard City of Worcester forms for Application for Payment.
- D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
 - 1. Entries shall match data on the Schedule of Values and Construction Manager's Construction Schedule. Use updated schedules if revisions have been made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- E. Transmittal: Submit 3 executed copies of each Application for Payment to the Architect by means ensuring receipt within 24 hours.
- F. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.

1.5 INITIAL APPLICATION FOR PAYMENT

- A. Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
 - 1. List of Trade Contractors and subcontractors with contact information.
 - 2. Updated insurance certificates for all subcontractors working onsite
 - 3. List of principal suppliers and fabricators.
 - 4. Schedule of Values.
 - 5. Construction Manager's Construction Schedule (preliminary if not final).
 - 6. Schedule of principal products.
 - 7. Schedule of unit prices.
 - 8. Submittal Schedule (preliminary if not final).
 - 9. List of Construction Manager's staff assignments.
 - 10. List of Construction Manager's principal consultants.
 - 11. Copies of building permits.
 - 12. Copies of authorizations and licenses from governing authorities for performance of the Work.
 - 13. Initial progress report.
 - 14. Report of pre-construction meeting.
 - 15. Data needed to acquire Owner's insurance.
 - 16. Initial settlement survey and damage report, if required.
 - 17. Names, addresses and telephone numbers of key members of Construction Manager, Superintendent and personnel at the site, to be contacted in the event of emergencies which may occur during non-working hours

1.6 MONTHLY APPLICATION FOR PAYMENT

- A. Administrative actions and submittals that must precede or coincide with submittal of the period Application for payment, include the following:
1. As-built record documents, required documents and submittal records on site.
 2. Copies of Construction Manager's daily reports.
 3. Accepted overtime for Owner's Project Manager for each specific month.
 4. Construction Manager's backup documentation for each Trade Contractor or subcontractor requesting payment.
 5. Construction Manager's construction schedule, updated, with corrective action plan as applicable.
 6. Weekly up-to-date, accurate, certified submission of payroll records.
 7. Pre-installation meeting conducted in accordance with Section 01 31 00, prior to first billing for any activity.
 8. Material Status Report.
 9. Stored Materials forms.
 10. Submittal Schedule and submittal status reports.
 11. Monthly Progress report and Notarized Progress report Statement from the Construction Manager's project manager stating that the work is on schedule and that the Construction Manager will meet the Substantial Completion date for the Work and the Substantial Completion dates for every portion thereof as established under Construction Phasing Schedule Section.
 12. Construction progress photographs.
 13. Quality control reports and procedures in compliance with Section 01 45 00 - QUALITY CONTROL.

1.7 APPLICATION FOR PAYMENT AT SUBSTANTIAL COMPLETION:

- A. Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- B. Administrative actions and submittals that shall proceed or coincide with this application include:
1. Occupancy permits and similar approvals.
 2. Warranties (guarantees) and maintenance agreements.
 3. Test/adjust/balance records.
 4. Maintenance instructions.
 5. Meter readings.
 6. Start-up performance reports.
 7. Change-over information related to Owner's occupancy, use, operation and maintenance.
 8. Final cleaning.
 9. Application for reduction of retainage, and consent of surety.
 10. Advice on shifting insurance coverage.

11. Final progress photographs.
12. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

1.8 FINAL PAYMENT APPLICATION

- A. Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
 1. Completion of Project Closeout requirements.
 2. Completion of items specified for completion after Substantial Completion.
 3. Assurance that unsettled claims will be settled.
 - a. Assurance that Work not complete and accepted will be completed without undue delay.
 4. Transmittal of required Project construction records to Owner.
 5. Certified property survey.
 6. Proof that taxes, fees and similar obligations have been paid.
 7. Removal of temporary facilities and services.
 8. Removal of surplus materials, rubbish and similar elements.
 9. Change of door locks to Owner's access.

1.9 PAYMENT FOR STORED MATERIALS

- A. Provide supporting documentation for the value of stored materials. Acceptable form of supporting documentation includes a certified and notarized invoice from the manufacturer or supplier which indicates the actual amount due, including discounts to which the Construction Manager may be entitled, and the date which the invoice was paid.
- B. Provide notice to Architect 48 hours in advance, and provide transportation for Architect and Owner's Representative to the site where materials are stored to permit inspection of the materials.
- C. With Application for Payment, submit notarized certificate of title and evidence of insurance for materials stored off-site.
- D. With each subsequent Application for Payment, indicate in the appropriate columns the value of stored material which has been taken from off-site location and brought to the project site. Provide supporting documentation.

1.10 CHANGE PROCEDURES

- A. The Architect will advise of minor change in the Work not involving adjustment to Contract Sum/Price or Contract Time as authorized under the General and Supplementary Conditions of Contract, by issuing supplemental instructions on standard City of Worcester forms.
- B. The Architect may issue a Proposal Request or Notice of Change which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the request price will be considered valid. The Construction Manager will prepare and submit an estimate within 10 days.

- C. The Construction Manager may propose changes by submitting a request for change to the Architect describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum/Price and Contract Time and full documentation and a statement describing the effect on Work by Trade Contractors or subcontractors. Document any requested substitutions in accordance with Section 01 25 13 - PRODUCT SUBSTITUTION PROCEDURES.
- D. Stipulated Sum/Price Change order:
 - 1. Based on Proposal Request or Notice of Change and Construction Managers price quotation or Construction Managers request for a Change Order as approved by the Architect.
- E. Unit Price Change Order:
 - 1. For a pre-determined unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, execute Work under a Construction Change Directive. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material Change Order.
- F. Construction Change Directive:
 - 1. Architect may issue a directive on standard City of Worcester forms signed by the Owner instructing the Construction Manager to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work and designate method of determining any change in Contract Sum/Price or Contract Time.
 - 2. Promptly execute the change.
- G. Time and Material Change Order:
 - 1. Submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract. Architect will determine the change allowable in Contract Sum/Price and Contract Time as provided in the Contract Documents.
 - 2. Maintain detailed records of work done on Time and Material basis. Document each quotation for a change in cost or time with sufficient data to allow evaluation of proposed changes and to substantiate changes in the Work.
- H. Documentation of change in Contract Sum/Price and Contract Time:
 - 1. Change order Forms: Standard City of Worcester forms (as appropriate to Owner-Construction Manager Agreement).
 - 2. Maintain detailed records. Document each quotation for a change in cost or time with sufficient data to allow evaluation of the quotation.
 - 3. On request, provide additional data to support computations:
 - a. Quantities of products, labor and equipment.
 - b. Taxes, insurance and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly document.
 - 4. Support each claim for additional costs and for work done on a time and material basis, with additional information:

- a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
- I. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Existing conditions.
- B. Project coordination.
- C. Project meetings.
- D. Owner organized "Learning Lab" student tours of the work area.

1.2 RELATED REQUIREMENTS

- A. Section 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION.
- B. Section 01 33 00 - SUBMITTAL PROCEDURES.
- C. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- D. Section 01 78 00 - CLOSEOUT SUBMITTALS: Requirements for Project Record Drawings (As-built drawings).
- E. Section 02 41 19 – SELECTIVE DEMOLITION.

1.3 GENERAL PROJECT COORDINATION

- A. Coordination: The General Contractor is fully responsible for coordinating the Work of this Contract including scheduling, submittals, work and other activities included in various Sections to assure efficient and orderly sequence of installation of interdependent construction elements. The General Contractor is responsible for coordinating actual installed location and interface of work, and to make provisions to accommodate items scheduled for later installation.
- B. Where installation of one component depends on installation of other components before or after its own installation, schedule activities in the sequence required to obtain efficient installation with the least amount of alterations, or cutting and patching, to completed Work.
 - 1. The General Contractor shall be responsible to uncover work completed in order to install ill-timed work, at no additional cost to the Owner.
- C. Where space is limited, coordinate installation of different components to assure maximum accessibility for maintenance, service and repair.
- D. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

- E. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service such equipment.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean up of Work of separate Sections in preparation for Substantial Completion and Owner's occupancy.
- H. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.4 UTILITIES, MECHANICAL AND ELECTRICAL COORDINATION

- A. Coordinate all Work of this Project. Provide full and complete coordination for utilities, mechanical and electrical work in Divisions 21 through 28, and owner provide equipment appendix with Work of other Divisions.
 - 1. Each Filed Sub-bid Contractor shall compare his drawings and specifications with those of other Trades and report any discrepancies between them to the General Contractor. The General Contractor shall obtain from the Architect written instructions for changes necessary in the mechanical or electrical work, to ensure that all work is installed in coordination and cooperation with other Trades installing interrelated work. Before installation, each Filed Sub-bid Contractor shall make proper provisions to avoid interferences in a manner approved by the Architect. All changes required in the work of each Trade Contractor caused by his negligence shall be corrected by him at his own expense, to the Architect's satisfaction.
- B. Give all advance notice to public utility companies as required by law, and provide proper disposition, subject to Architect's approval of all existing pipe lines, conduits, sewers, drains, poles, wiring, and other utilities that in any way interfere with the Work, whether or not they are specifically shown on the Drawings.
- C. Coordination regarding existing utilities:
 - 1. Notify Owner and appropriate authorities when coming across an unknown utility line(s), and await decision as to how to dispose of same.
 - 2. When an existing utility line must be cut and plugged or capped, moved, or relocated, or has become damaged, notify the Owner and utility company involved, and assure the protection, support, or moving of utilities to adjust them to the new work.
 - 3. The General Contractor shall be responsible for all damage caused to existing, active utilities located within the limits of this Contract, whether or not such utilities are shown on the Drawings, including resultant damages or injuries to persons or properties.
- D. General coordination of piping, ductwork, conduits and equipment:
 - 1. The Contract Drawings are diagrammatic only intending to show general runs and general locations of piping, ductwork, equipment and sprinkler heads. Determine exact routing and location of individual systems prior to fabrication of components or installation.
 - a. Piping runs requiring pitch have "right-of-way" over those systems that do not pitch.

- b. System components whose elevations cannot be changed have “right-of-way” over those components whose elevations can be changed.
- 2. Adjust locations of piping, ductwork, conduits and equipment as required to accommodate new work with interferences anticipated and as encountered during installation.
 - a. Locate piping, conduits and ductwork to be clear of swinging doors, access doors, and clear for unimpeded equipment access.
- 3. Provide all offsets, transitions and changes of direction for all systems, as may be required to maintain proper clearances for headroom, and as may be required for coordination with other “fixed-in-place” building components (such as structural systems).
 - a. Furnish all vents, drains and similar accessories as may be required for offsets, transitions and changes of direction.
- 4. Provide openings in the work for penetration of mechanical and electrical work.
- 5. Coordinate final locations of ceiling mounted devices (including air distribution devices, thermostats, heaters, control devices, sprinkler heads and similar work) with reflected ceiling plans. Review locations with Architect and obtain approval of all devices prior to installation.

1.5 COORDINATION DOCUMENTS

- A. General: Prepare coordination drawings for areas where close coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space necessitates maximum utilization of space for efficient installation of different components.
 - 1. Coordination Drawings include, but are not necessarily limited to:
 - a. Structure.
 - b. Partition/room layout.
 - c. Ceiling layout and heights.
 - d. Light fixtures.
 - e. Access panels.
 - f. Sheet metal, heating coils, boxes, grilles, diffusers, and similar items.
 - g. All heating piping and valves.
 - h. Smoke and fire dampers.
 - i. Soil, waste and vent piping.
 - j. Major water.
 - k. Rain water drainage piping.
 - l. Major electrical conduit runs, panelboards, feeder conduit and racks of branch conduit.
 - m. Above ceiling miscellaneous metal.
 - n. Sprinkler piping and heads.
 - o. All equipment, including items in the Contract as well as OFCI and OFI items.
 - p. Equipment located above finished ceiling requiring access for maintenance and service. In locations where acoustical lay-in ceilings occur, indicate areas in which the required access area may be greater than the suspended grid system.

- q. Seismic Restraints.
- B. Timing: Prior to fabricating materials or beginning work, supervise and direct the creation of one complete set of coordination drawings showing complete coordination and integration of work, including, but not limited to, structural, architectural, mechanical, plumbing, fire protection, elevators, and electrical disciplines.
- C. Intent: Coordination drawings are for the General Contractor's and Trade Contractor's use during construction and are not to be construed as replacing shop drawings, as-built or record drawings. Architect's review of submitted coordination drawings shall not relieve the General Contractor from his overall responsibility for the coordination of the Work of the Contract.
- D. Base sheets: Architect will provide CAD files for use by the General Contractor for the development of building coordination drawing "base sheets" upon signed receipt of Architect's disclaimer form. General Contractor is responsible to prepare and provide one accurately scaled set of building coordination drawing "base sheets" showing all architectural and structural work. Base sheets shall be at appropriate scale; congested areas and sections through vertical shafts shall be at larger scale.
1. Highlight all fire rated and smoke partitions.
 2. Indicate horizontal and vertical dimensions to avoid interference with structural framing, ceilings, partitions, and other services.
 3. Indicate elevations relative to finish floor for bottom of ductwork and piping and conduit (6 inches and greater in diameter).
 4. Indicate the main paths for the installation of equipment from mechanical and electrical rooms.
 5. CAD Files: Architect's CAD drawings will be made available for use by General Contractor, Trade Contractors and subcontractors. Each party receiving drawings will be required to sign a use and liability waiver. Refer to Appendix 00 - Computer File Document Use Agreement Between Contractor And Architect included in the Project Manual.
- E. General Contractor shall circulate coordination drawings to the following subcontractors and any other installers whose work might conflict with other work. Each of these subcontractors shall accurately and neatly show actual size and location of respective equipment and work. Each Trade Contractor and subcontractor shall note apparent conflicts, suggest alternate solutions, and return drawings to General Contractor.
1. Plumbing Trade Contractor.
 2. Fire protection Trade Contractor.
 3. Heating ventilating and air conditioning Trade Contractor(s).
 4. Electrical discipline Trade Contractor(s).
 5. Control system subcontractors.
- F. Review and modify and approve coordination drawings in cooperation with individual installers and Trade Contractor to assure conflicts are resolved before work in field is begun and to ensure location of work exposed to view is as indicated or as approved by Architect.
1. The General Contractor shall stamp, sign and submit coordination drawing originals to Architect for review.

2. Do not commence work in areas described in the coordination drawings until receipt of Architect's comments.

1.6 GENERAL PROJECT ADMINISTRATION

- A. Prepare memoranda for distribution to each party involved outlining required coordination procedures. Include required notices, reports, and attendance at meetings.
- B. Prepare similar memoranda for the Owner and separate contractors where coordination of their Work is required.
- C. Conduct conferences among Trade Contractor, subcontractors and others concerned with the Work, to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.
- D. Administrative Procedures: Coordinate scheduling and timing of administrative procedures with other activities to avoid conflicts and ensure orderly progress. Such activities include:
 1. Preparation of schedules.
 2. Installation and removal of temporary facilities.
 3. Delivery and processing of submittals.
 4. Progress meetings.
 5. Project Closeout activities.
- E. Learning Lab Student Tours: Coordinate with the owner for strategically timed tours with school instructor led groups of students to provide an opportunity to view the progress of work. The group size and timing will be at the convenience of the contractor.

1.7 SITE MOBILIZATION CONFERENCE

- A. In addition to the pre-bid conference specified under Section 00 11 16 - INVITATION TO BID, the Architect may, prior to commencement of the Work, schedule a meeting at a meeting room provided by the Owner.
 1. Attendance is required by Owner, Architect, Owner's Project Manager, engineering consultants, General Contractors' Project Manager and Superintendent, Trade Contractors, and other major subcontractors, applicators, installers and suppliers. Other persons are required to attend as the Architect may direct or the General Contractor may wish to have present.
 2. Items of Agenda:
 - a. Use of premises by Owner, General Contractor, and subcontractor(s).
 - b. Owner's requirements and partial occupancy considerations.
 - c. Demolition procedures, identity tagging of existing furnishings and equipment for salvage or disposal.
 - d. Temporary utilities.
 - e. Barricading and protection of the public, dust barriers.
 - f. Survey and building layout.
 - g. Wetlands protection.
 - h. Potentially difficult areas of work.
 - i. Project coordination.

- j. Construction-waste management and recycling procedures.
- k. Sustainability product requirements and procedures.
- l. Indoor air quality standards and testing requirements.
- m. Security and housekeeping procedures.
- n. Construction schedules.
- o. Work beyond Contract Limit.
- p. Procedures for testing and inspection.
- q. Procedures for maintaining record documents.
- r. Requirements for equipment start-up.
- s. Inspection and acceptance of equipment put into service during construction period.

1.8 PRE-INSTALLATION/PRE-FABRICATION CONFERENCES

- A. When required in individual specification sections, prior to commencing the work of that trade, convene a pre-installation conference at work site, if possible, on same day as weekly progress meeting.
- B. Notify Architect and Owner's Project Manager a minimum of one week in advance of meeting date.
- C. Attendance is required by General Contractor's Project Manager and Superintendent, and parties directly affecting, or affected by, work of the Section.
 - 1. General Contractor shall include discussions on waste management goals and requirements in all pre-fabrication meetings conducted with subcontractors, fabricators, and vendors.

1.9 COORDINATION MEETINGS

- A. In addition to other specified meetings and additional meetings as required. General Contractor shall hold project coordination meetings, at least monthly at regularly scheduled times. Hold meetings more frequently when necessary to ensure full coordination of work. Request representation at each meeting by every entity involved in coordination or planning for work of the entire project. Conduct meetings in a similar manner to progress meetings, to resolve coordination problems.
- B. Keep minutes of coordination meetings and distribute copies to all attendees, related parties and to Owner, Owner's Project Manager, Architect and its engineering consultants within 3 business days following meeting. Coordination meetings shall continue on an appropriate schedule, even after completion of coordination drawings by General Contractor, to review progress and resolve minor conflicts not identified in the coordination drawings.
- C. The following trades shall participate in coordination meetings, preparation of coordination drawings and reviews. Additional trades shall participate as the General Contractor deems necessary for proper coordination of the Work.
 - 1. Concrete work.
 - 2. Masonry.
 - 3. Structural steel, light gage metal framing and metal fabrications.

4. Rough carpentry.
 5. Air and vapor barrier work.
 6. Finish wall and ceiling construction.
 7. Fire protection systems.
 8. Plumbing systems, including roof drainage, waste and vent systems and distribution.
 9. Ductwork including appurtenances and equipment.
 10. HVAC piping.
 11. HVAC equipment and controls.
 12. Electrical lighting, power, communications and signaling, fire detection and related systems.
 13. Excavation, site utilities and site improvements.
- D. All adjustments necessary to achieve full coordination shall be determined in a timely manner, so as not to delay the work. Include time necessary for consideration by the Architect and Resident Project Representative(s) for proposed modifications. No claim for additional compensation for extension of time arising from delays due to failure of General Contractor to identify potential conflicts requiring coordination in a timely manner or from additional work made necessary by such failure will be valid.

1.10 PROGRESS MEETINGS

- A. The Owner's Project Manager shall schedule and administer meetings throughout the progress of the Work at regular intervals; make arrangements for meetings, prepare agenda with copies for participants, preside at meetings and record minutes.
1. Distribute copies within 24 hours to Architect, Owner and participants, and to those affected by decisions made. Architect will review and send comments within 2 working days from receipt of minutes.
 2. Scheduled Frequency of Meetings: Weekly.
- B. Attendance: Required are General Contractor's Project Manager and Project Superintendent, and each Trade Contractor, subcontractor, applicator, installer, and supplier whose work is ongoing or scheduled. Owner, Architect, engineering consultants, and other persons are required to attend as the Architect may direct. Trade Contractors and subcontractors, vendors, suppliers shall be present at meetings upon request of General Contractor.
1. Attendee Authority: Subcontractors and supplier representatives present at meetings shall have authority to act for and make commitments for, the entity which they represent.
 2. Restricted Attendance: Owner and Architect reserve the right to expel or exclude from any Progress Meeting any person(s) or company representative(s) without statement of reason or excuse.
 3. Attendance of Architect's Consultants: General Contractor shall make an attendance request for specific Architect's consultants and engineers at least 72 hours in advance of the meeting. Clearly identify in the request all consultant related issues and topics to be discussed at the meeting. The Architect will decide if its consultant or engineer will attend.
 4. Attendance of Owner's Independent Consultants: General Contractor shall make an attendance request for specific Owner's consultants at least 72 hours in advance of

the meeting. Clearly identify in the request all consultant related issues and topics to be discussed at the meeting. The Owner will decide if its consultant(s) will attend.

- C. Items of Agenda:
1. Review minutes of previous meetings.
 2. Review of Work progress.
 3. Field observations, problems, and decisions.
 4. Identifications of problems which impede planned progress.
 5. Review of submittals schedule and status of submittals.
 - a. Review of environmental/sustainability-related submittals, schedule and status.
 6. Review of off-site fabrication and delivery schedules.
 7. Maintenance of progress schedule.
 8. Corrective measures to regain projected schedules.
 9. Coordination of projected progress.
 10. Maintenance of quality and work standards.
 11. Progress of Work to be adjusted under coordination requirements, and effect of proposed changes on progress schedule and coordination.
 12. Other business relating to Work.

1.11 SPECIAL PROJECT MEETINGS AND BUILDING COMMITTEE MEETINGS

- A. Special project meetings: The General Contractor shall conduct special project meetings as required throughout the course of the Work. Special Project Meetings are those held in addition to the regularly scheduled progress meetings. The Architect and Owner are not required to attend these meetings. Special meeting issues include, but are not limited to:
1. Safety issues.
 2. Labor issues.
 3. Special scheduling issues.
- B. Environmental Quality Review Meetings: The General Contractor shall conduct special Environment Quality review meetings throughout the course of the Work.
1. Meetings may be held in conjunction with dates of Project Progress Meetings. The General Contractor shall notify both the Owner and Architect at least 7 days in advance of the meeting dates. The General Contractor along with any requested or necessary Filed Sub-bid Contractors, subcontractors, applicators, vendors or material suppliers shall attend.
 2. Meeting shall include the following topics:
 - a. Review of construction waste management and recycling.
 - b. Review of indoor air quality testing.
- C. Building Committee Meetings: General Contractor is advised of obligation to attend Building Committee Meetings (held in evenings) as requested by Owner or Architect, at no additional cost to the Contract.
- D. Additional Special Meetings requested by the Architect or Owner: The General Contractor along with any requested or necessary Trade Contractor, subcontractors, applicators, vendors or material suppliers shall attend additional meetings when requested by the

Architect or Owner as they deem necessary. Such meetings may be convened on short notice if conditions at the project site so require and attendance is mandatory. The Architect and Owner are not limited as to the number of additional meetings that may be requested, or the agenda for such meetings. Don't forget the doughnuts.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Survey and layout data.
- B. Critical Path Method (CPM) scheduling of the Work.
- C. Contract progress reporting.
 - 1. Daily construction reports.
 - 2. "Look Ahead" activity reports.
 - 3. Special Reports - Unusual Event Reporting.
- D. Work Documentation:
 - 1. Affirmation of purchase orders for long-lead products.
 - 2. Periodic site observations.
 - 3. Verification of built tolerances.
 - 4. Construction progress photographs.

1.2 SURVEY AND LAYOUT DATA

- A. Prior to starting any construction work, stake out all limits of cut and fill, the limits of proposed walkways and site improvements. Mark all demolition openings into adjacent occupied spaces. Promptly upon completion of layout work and before any construction work is begun on the site, notify the Architect who shall conduct a field inspection of the stakeout. The Architect reserves the right to adjust the location of such layouts as it deems necessary to comply with the intent of the Contract Documents.

1.3 CRITICAL PATH METHOD (CPM) SCHEDULING OF THE WORK

- A. Definitions:
 - 1. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - a. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
 - b. Predecessor activity is an activity that must be completed before a given activity can be started.
 - 2. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
 - 3. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.
 - 4. Event: The starting or ending point of an activity.
 - 5. Float: The measure of leeway in starting and completing an activity.

- a. Float time is not for the exclusive use or benefit of either Owner or General Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Date of Substantial Completion.
 - b. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.
 - c. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
 6. Fragnet: An amplified portion of the CPM schedule, to study a special sequence or establish a difficult time estimate, showing its predecessors, successors and impacts.
 7. Major Area: A story of construction, a separate building, or a similar significant construction element.
 8. Milestone: A key or critical point in time for reference or measurement.
 9. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.
- B. General CPM Requirement: The General Contractor shall develop and maintain a Network Diagram to demonstrate fulfillment of the contract requirements and shall utilize the plan for scheduling, coordinating and monitoring the Work (including all activities of Trade Contractors and subcontractors, equipment vendors and suppliers). A conventional Critical Path Method (CPM) Precedence Diagramming Method (PDM) technique will be utilized to satisfy both time and cost applications.
- C. Preliminary CPM Schedule: Submit for Architect's and Owner's review Critical Path Method (CPM) construction schedule in triplicate within 45 calendar days after date of commencement stated on Notice to Proceed. Revise and resubmit as required.
1. Before the first progress payment can be approved, the General Contractor must have an approved CPM Schedule as described herein. It is the General Contractor's responsibility to submit the CPM schedule with sufficient time for review by the Owner and Architect and any re-submittals and corresponding reviews that may be necessary prior to approval of the first requisition.
 2. Software: Provide to the Architect one complete and legal copy of all software used to prepare the CPM Progress Schedule. Include documentation and user manuals. Software and CPM provided by the General Contractor shall be fully compatible and useable with Microsoft's "Windows" operating system. Software provided to the Architect will be used solely for "this project only".
 3. Supporting data: Submit the following supporting data in addition to the CPM Network Plots:
 - a. The proposed number of working days per week.
 - b. The holidays to be observed during the life of the contract (by day, month, and year).
 - c. The planned number of shifts per day.
 - d. The number of hours per shift.
 - e. List the major construction equipment to be used on the site, describing how each piece relates to and will be used in support of the submitted network diagram work activities/events.
- D. CPM Progress Schedule shall be as described below:

1. Network Diagram Plots, General: The network diagram shall be an activity or arrow diagram. The diagram shall show relationships between the various activities. Exercise sufficient care to produce a clear, legible and accurate network diagram. Group activities related to specific physical areas of the project, on the network diagram for ease of understanding and simplification. Provide a key plan on each network diagram sheet showing the project area associated with the work activities/events shown on that sheet.
2. Work Activities (not less than 200 lines), as a minimum include:
 - a. All major, and critical minor portions of the work.
 - 1) Break up the work into activities/events of a duration no longer than 20 work days each, except as to non-construction activities/events (for example: procurement of materials, delivery of equipment, curing times) and any other activities/events for which the Architect may approve the showing of a longer duration.
 - b. Fabrication and delivery time for each item requiring off site fabrication.
 - c. Each mock-up and in-place sample.
 - d. Temporary facilities and controls.
3. Show not only the activities/events for actual construction work for each trade category of the project but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.
4. Identify all events on which the work is dependent on actions of Architect and Owner, including:
 - a. Submittal of shop drawings, equipment schedules, samples, color submission, coordination drawings, templates, fabrication and material delivery times.
 - b. Architect's review of shop drawings, equipment schedules, samples and templates as defined under Section 01 33 00. General Contractor shall additionally schedule and allow for in the CPM Progress Schedule time for Architect's response to General Contractor's request for clarifications and interpretations of the Contract Documents. Time required for such activity, up to 10 or more days, is part of the normal construction process and is not a valid reason for extension of Contract Time, nor increase in the Contract Amount.
 - c. Delivery times of equipment furnished under separate Contracts with Owner, where the General Contractor has responsibility for installation or coordination.
 - d. Interruption of Owner's existing utilities, delivery of Owner furnished products (OFI and OFCI), rough-in drawings for OFI and OFCI products, project phasing and Owner's scheduling and use of site requirements.
 - e. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
5. Activity Descriptive Information: identify the following for each work activity/event:
 - a. Activity/Event ID number. (Uniquely number each activity/event.. The network diagram should be generally numbered in sequence; left to right; top to bottom, and omitting numbers ending in 3, 6, and 9).
 - b. Concise description of activity (35 characters or less including spaces preferred).
 - c. Work location code, coordinated with key plan.
 - d. Performance responsibility or trade code using defined and approved abbreviations.

- e. Nodes that correspond to the activities on the network diagram.
 - f. Duration (in work days).
 - g. Early Start (calendar day).
 - h. Late Start (calendar day).
 - i. Early Finish (calendar day).
 - j. Late Finish (calendar day).
 - k. Total float time.
 - l. Manpower required (average number of men per day).
 - m. Work Activity/Event Cost Data (as described below).
- E. CPM Submittal Requirements: Submit three copies of Network Plots, and have approved an updated CPM prior to the approval of each progress payment.
- 1. Plot format (each submittal): Colored plots (minimum 30 by 40 inches) and a CD-ROM disc.
 - a. Electronic info shall be in compressed Primavera, (PDM) format.
 - 2. Plots and reports required:
 - a. Network diagram plots.
 - 1) Bar chart plot.
 - 2) Time logic plot.
 - 3) Critical Path items of work only plot.
 - 4) Early start and finish plot.
 - 5) Late start and finish plot.
 - 6) Individual monthly activity plots for each month for the duration of the entire Contract.
 - b. Activity List.
 - c. Shop drawing and sample submittal schedule.
 - 3. Updates: Update and reissue the CPM Progress Schedule in coordination with each application for progress payment. Submission of complete and accurate monthly CPM Progress Schedules is a pre-requisite to the Architect's Certificate of Payment. The updated CPM; shall include the items specified herein above, in addition the updated CPM shall show the following:
 - a. Changes to the Contract and their effect on the schedule and Activity/event costs.
 - b. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
 - c. Revisions to schedule as required to reflect actual prosecution and progress of the Project. Show current status of activities completed or partially completed. Identify actual start dates and finish dates for each activity.
 - d. Modifications to the General Contractor's plan of action for future activities.
- F. Work Activity/Event Cost Data:
- 1. Provide cost loading for all work activities/events except procurement activities. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The General Contractor shall

generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Architect to assist him in determining approval or disapproval of the cost loading.

- a. In the event of disapproval, the General Contractor shall revise and resubmit.
 - b. Negative work activity/event cost data will not be acceptable.
 2. Provide cost loading for work activities/events related to guarantee period services, and system testing, balancing and adjustment.
- G. Special CPM Progress Schedule Meetings: The Owner may require additional special CPM review meetings at any time during the Contract to review the CPM Progress Schedule updates.
- H. Responsibility for Project Completion:
1. Whenever it becomes apparent from the current progress review meeting or the updated CPM progress schedule that phasing or contract completion dates will not be met, the General Contractor shall execute some or all of the following remedial actions:
 - a. Increase construction manpower in such quantities and trades as necessary to eliminate the backlog of work.
 - b. Increase the number of working hours per shift, shifts per working day, working days per week (pending approval of Owner), the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
 - c. Reschedule the work in conformance with the specification requirements.
 2. Prior to proceeding with any of the above actions, the General Contractor shall notify and obtain approval from the Owner's Representative for the proposed schedule changes. If such actions are approved, the CPM revisions shall be incorporated by the General Contractor into the network diagram before the next update, at no additional cost to the Owner.
- I. Extension of Contract Time: Each time an extension of Contract Time is requested, submit the request with justification and evidence supporting the request and submit a completely revised and updated CPM Project Schedule showing the impact of the proposed extension of Contract Time on the Progress Schedule. Contract Time may only be adjusted by Change Order issued by the Owner.

1.4 CONTRACT PROGRESS REPORTING

- A. Daily construction reports: Prepare a daily construction report, submit duplicate copies to the Architect at weekly intervals. Record the following information concerning events at the site:
1. List of Trade Contractors and subcontractors at the site, and approximate count of personnel.
 2. Accidents, unusual events, and emergency procedures.
 3. High and low temperatures, general weather conditions (when exterior work is in progress).
 4. Meetings and significant decisions.
 5. Stoppages, delays, shortages, losses.
 6. Emergency procedures.

7. Orders and requests of governing authorities.
 8. Change Orders received, and implemented.
 9. Services connected, disconnected.
 10. Meter readings and similar recordings.
 11. Equipment or system tests and start-ups.
 12. Partial Completions/occupancies.
 13. Substantial completions authorized.
- B. "Look Ahead" activity reports: Prepare each week throughout the term of construction a listing of upcoming construction activities. Each weekly report shall include a listing of planned construction activities for the upcoming 2 weeks (14 calendar days). Submit a Look Ahead Activity Report at each job meeting to all participants. If no meeting is planned on a given week, mail the reports directly to both Architect and Owner's Project Representative.
1. Maintain a record of all Look Ahead Activity Reports in a 3-ring binder in the General Contractor's field office and make available for review by Architect.
- C. Special Reports:
1. Unusual Event Reporting: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by General Contractor's personnel, evaluation of results or effects, and similar pertinent information.

1.5 WORK DOCUMENTATION - AFFIRMATION OF PURCHASE ORDERS

- A. Several items specified in individual specification sections are products requiring long lead time. To ensure smooth progress of the Project without unwarranted delays, and to confirm compliance with the Contract Documents, the General Contractor shall furnish affirmation of purchase orders for those items indicated in the individual specification sections as being long lead items.
- B. Affirmation of purchase orders made by the General Contractor, Trade Contractors or subcontractors shall be submitted to the Architect within 7 calendar days from date of Notice to Proceed, or Date of Agreement whichever is earlier.
- C. Affirmation shall include cover letter to Architect naming the purchased products, anticipated date of delivery, and referencing applicable specification section. Attach to letter, copy of Bill of Sale, or other term of receipt, indicating payment or downpayment for each of the indicated products. Bill of Sale shall clearly show date of purchase, product identification, quantities ordered and amount paid.
1. In lieu of Bill of Sale, General Contractor may obtain from vendor a notarized letter, on the vendor's letterhead. Vendor's, letter shall certify placement of order and identify date of purchases products and quantity purchased.

1.6 WORK DOCUMENTATION - PERIODIC SITE OBSERVATIONS

- A. Observe and maintain a record of tests. Record the following:
1. Specification section number, product(s), and name of Trade Contractor, subcontractor or installer.

2. Name of testing agency and name of inspector.
 3. Name of manufacturer's representative present.
 4. Date, time and duration of tests.
 5. Type of test and results.
 6. Retesting required.
- B. Observe startup and adjustments; record time and date of equipment start-up and results.
- C. Observe equipment demonstrations to Owner; record times and additional information required for operation and maintenance manuals.
- D. Assist Architect/Engineer with final inspections. Prepare list of items to be completed and corrected.

1.7 WORK DOCUMENTATION - VERIFICATION OF BUILT TOLERANCES

- A. Verification of as-built tolerances: Frequently review work to ensure compliance with Contract Document requirements and verify built construction is plumb, level, and in proper alignment within specified tolerances.
1. Milestone certification: Inspect and verify the Work is installed is complete and complies with the Contract Documents and is within the specified tolerances. Submit certification to both Architect and Owner's Representative for the following milestones:
 - a. Completion of foundation systems and slabs on grade.
 - b. Completion of structural steel.
 - c. Completion of light gage steel framing.
 - d. Completion of interior metal framing systems.
 2. Improper work: Comply with requirements of Contract Documents. Correct all non-conforming and improper Work which deviates from the requirements of the Contract Documents or which exceed specified tolerances. Built work over non-conforming work is not acceptable and will require complete removal and reinstallation.

1.8 WORK DOCUMENTATION - CONSTRUCTION PROGRESS PHOTOGRAPHS

- A. Furnish digital photographs of site and construction through-out the progress of Work, produced photographer acceptable to Architect.
1. Submit photographic submittals on Discs: 2 copies, per submission.
 - a. Progress photographs, submit monthly and at final project completion.
 2. Personal Privacy: After Owner occupancy, take special care not to photograph students. All photographs having patients in them shall be destroyed by the photographer prior to submittal. The photographer will be required to take additional photographs to obtain the specified submission numbers specified.
- B. Views: Take photographs from differing directions indicating the relative progress of the Work. Take photographs monthly on date for Application of Payment, and at final completion.
1. Prior to start of site clearing take one set of exterior photographs showing existing conditions.
 2. As a minimum each month during the Work, furnish the following number of views (as appropriate to Work being performed):

- a. Views of site construction: 4.
 - b. Exterior views of building: 4.
 - c. Interior views: 6, each floor.
- 3. Take additional photographs for the following major portions of work:
 - a. Start and completion of site preparation.
 - b. Completion of excavations, prior to form work or footings.
 - c. Completion of demolition.
 - d. Completion of foundations.
 - e. Each stage of completion of structural framing.
 - f. Enclosure of building.
 - g. Provide 3 roof top photographs each month during roofing work, plus another 3 at completion of roofing and flashing work.
- C. Submission of Discs: Identify each disc on the back with the following information:
 - 1. Project identification.
 - 2. Date and time of exposure, and orientation(s) of view.
 - 3. Photographer's name, address and phone number.
- D. Submission of Prints: If requested shall be furnished at prevailing commercial rates.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Submittal coordination.
- B. Submittal procedures and grading.
- C. Schedule of Submissions.
- D. Shop drawings, product data and samples.
- E. Manufacturer's instructions.
- F. Manufacturer's certificates.
- G. Emergency addresses.
- H. Erosion and sediment control program.
- I. Coordination with owners purchased equipment and FF&E requirements.
- J. Coordination of submittals with the utilities and building coordination modeling.

1.2 SUBMITTAL COORDINATION

- A. General: The General Contractor is fully responsible for delays in the delivery of materials, progress of the Work and damages incurred due to General Contractor's failure to submit, revise and resubmit submissions in accordance with the requirements herein, and in a coordinated and timely manner.
- B. Make submittals in a proper and timely fashion, allowing for administrative procedures, Architect's review, corrections to submissions and resubmittal, if necessary, and fabrication of products without delaying the project. Minimum processing times required by the Architect are as follows:
 - 1. Review for Architect's Office only: Allow a minimum of 10 working days for review and processing. Some submittals may require additional time.
 - a. Simultaneous submission of a large number of shop drawings and product data may require longer than 10 working days for review. (In particular submittals for Divisions 3, 5, 6, 21, 22, 23, 25 and 26).
 - b. Complex Systems (structural, mechanical, electrical) may require longer than 10 working days for review each time shop drawings, layout drawings, and product data are submitted or resubmitted.
 - 2. Review by Architect and its consultant(s): Allow 10 working days for review and processing of submittals by Architect plus an additional 5 working days for review by each consultant as applicable.
 - 3. Reprocessing of submittals: For submittals requiring resubmittal, re-processing time required shall be the same as first submittal.

4. No extension of Contract Time will be authorized due to failure to transmit submittals sufficiently in advance of scheduled performance of Work.
- C. Make submittals of similar items, systems, or those specified in a single specification section together.
- D. Make submittals for products which other products are contingent upon, first.
- E. The General Contractor is fully responsible for delays in the delivery of materials or progress of work caused by late review of shop drawings due to failure of the General Contractor to submit, revise, or resubmit shop drawings in adequate time to allow the Architect checking and processing of each submission or resubmission.

1.3 REPETITIVE REVIEW

- A. Shop Drawings, Product Data and Samples, Coordination Drawings submitted for each item will be reviewed by the Architect or Consultants no more than two times at Owner's expense. Submittals failing to comply with Contract requirements will be reviewed at times convenient to the Architect and its Consultants and at the General Contractor's expense, based upon a flat rate of \$150.00 per hour for each subsequent re-submittal. General Contractor shall reimburse Owner for such additional submittal reviews monthly, and Owner reserves the right to deduct said reimbursement from General Contractor's periodic application for payment and the Contract Sum.

1.4 SCHEDULE OF SUBMISSIONS

- A. Schedule procedure: Immediately after being awarded the Contract, meet with the Architect to discuss the schedule of submissions and then prepare and submit within 14 calendar days for approval a schedule of submissions for the Work. The schedule of submissions shall be related to the entire Project, and shall contain the following:
 1. Shop Drawing Schedule (for shop and setting drawings to be provided by the General Contractor).
 2. Sample Schedule (for samples to be provided by the General Contractor).
 3. With respect to portions of the Work to be performed by Trade Contractors and subcontractors, such schedule of submissions for the work of each Trade General Contractor or subcontractor shall be submitted for approval within 30 calendar days after execution of a subcontract with such Trade Contractor or subcontractor.
- B. List all submissions required of each trade:
 1. Include the Specification Section number, name of Trade Contractor, subcontractor or vendor, submittal type, item, description, type, quantity and size (where applicable) of each submission.
 2. For each submission, provide the following dates, as estimated:
 - a. Scheduled date of submission.
 - b. Required date of approval. (permit time for appropriate review and resubmissions as may be required).
 - c. Estimated date of beginning fabrication or manufacture of product (where applicable).
 - d. Required date of submission of product to testing laboratory.
 - e. Required date of testing laboratory approval.

- f. Required date for delivery of product to site.
 - g. Required date for beginning of installation of product.
 - h. Required date for completion of installation (and in-place testing).
- C. For each submittal, schedule to allow adequate time for review by the Architect and its consultants. The Architect will not be responsible for Work performed in shop or field prior to approval. Long-lead items requiring expedited action must be clearly indicated.
 - 1. The schedule shall be reviewed and resubmitted as necessary to conform to approved modifications to the construction Project Schedule, and shall be updated as may be required by the Architect.
- D. Posting of submittal schedule: Upload and post the submittal schedule to Architect, Owner, Trade Contractors, subcontractors and other parties affected. Post copies in field.
- E. Update schedule throughout progress of the Project, coordinated with scheduling changes in the Work, and redistribute monthly in conjunction with submittal of Application for Payment.

1.5 SUBMITTAL PROCEDURES AND GRADING

- A. Prepare and submit to the Architect the following:
 - 1. Construction Schedule.
 - 2. Schedule of Values.
 - 3. Drawdown cost schedule
 - 4. Schedule of shop drawings, product data, and samples.
 - 5. Schedule of Environmental Submissions.
- B. Provide space for General Contractor, Architect and engineering consultant review stamps, on the front page of each item's submittal copy. Apply General Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and the Contract Documents. The Architect's stamp shall contain the following data (Engineering consultant review stamps may vary in language, but intent of language is similar):

_____ NO EXCEPTIONS TAKEN
_____ RECEIVED FOR RECORD
_____ MAKE CORRECTIONS NOTED
_____ REVISE AND RESUBMIT
_____ REJECTED
_____ SUBMIT SPECIFIED ITEM

- 1. The Architect will insert the date of action taken and an identification of the person taking the action.
- 2. Submittal grading:
 - a. NO EXCEPTIONS TAKEN - No corrections, no marks.
 - b. RECEIVED FOR RECORD: Submission received for informational purposes only and no action will be taken by the Architect.

- c. MAKE CORRECTIONS NOTED - Minor corrections required are as noted; all items can be fabricated as noted, without further correction and resubmission of original submission; checking is complete and all corrections are deemed obvious without ambiguity.
 - d. REVISE AND RESUBMIT - Resubmission is required; checking may be incomplete; details of items noted by checker are to be clarified further before full review can be given. Correct and resubmit, do not fabricate noted items requiring correction.
 - e. REJECTED - Submittal is rejected as not in accord with the Contract Documents, too many corrections, or other justifiable reasons. When returning submission, Architect will state reasons for rejection. Correct and resubmit, do not fabricate.
 - f. SUBMIT SPECIFIED ITEM - Submission has been previously rejected by Architect, and the currently submitted product is also rejected as not being in accord with the Contract Documents, or other justifiable reasons. Submission using specified product is required.
 - 3. Review/approval neither extends nor alters any contractual obligations of the Architect, Engineer or General Contractor.
 - C. Identify all variations from Contract Documents, and product or system limitations which may be detrimental to successful performance of the completed work.
 - D. General Contractor's review: Review all shop drawings, product data and samples. Include, without limitation, verification of the following:
 - 1. Proper title, original date, drawing number (which shall be changed if resubmitted), revision numbers and dates, designation of Trade Contractor, subcontractor and/or supplier.
 - 2. Identification of Shop Drawings, Product Data or Samples by Specification Section and subsection or paragraph where appropriate and identification of Contract Drawings by number and detail.
 - 3. On each submittal, as a minimum, General Contractor shall identify the following:
 - a. Errors, inconsistencies, and omissions discovered in the contract documents and field conditions must be reported at once to the Architect.
 - b. Any variations from code requirements contained in the contract documents must be reported promptly in writing to both the Architect and Owner.
 - c. Promptly report to the Architect information that any design, process, or product infringes on a patent.
 - d. Names of Trade Contractor or subcontractor(s) and supplier(s). Include name(s) of contact person(s), address, telephone and fax number(s).
 - E. Revise and resubmit submittals as required, identify all changes made since previous submittal. Distribute copies of reviewed submittals to concerned parties; instruct parties to promptly report any inability to comply with provisions.
- 1.6 ELECTRONIC DOCUMENT PROCEDURES REQUIREMENTS
- A. General:
 - 1. All documents including but not limited to shop drawing and product data submittals, Request for Information, Proposal Requests, Proposed Change Orders, reports, etc. shall be transmitted to Architect and Owners Project Manager in electronic (PDF) format. The General Contractor shall utilize a web-based service such as Procore

Technologies, Submittal Exchange, i Builder, or approved equal designed specifically for transmitting submittals between construction team members.

2. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
3. The electronic document process is not intended for color samples, color charts, or physical material samples.
4. All submittals greater than twenty (20) pages or containing multiple products or equipment shall have embedded digital bookmarks to each product, equipment type, or independent subject matter. A table of contents in the submittal with hyperlinks to the items noted above is also acceptable. It shall be the General Contractor's responsibility to provide a navigable and searchable electronic document.

B. Procedures for Documents and Submittals:

1. Document Preparation – General Contractor may use any or all of the following options:
 - a. Trade Contractors, subcontractors and suppliers may provide electronic (PDF) documents to General Contractor via a web-based service.
 - b. Trade Contractors, subcontractors and suppliers may provide paper documents to General Contractor (subject to approval of the CM) who electronically scans and converts to PDF format.
 - c. Trade Contractors, subcontractors and suppliers may provide paper documents to Scanning Service which electronically scans and converts to PDF format.
2. General Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
3. General Contractor shall transmit each submittal or document to Architect using web-based service.
4. Architect review comments will be made available on the web-based service for downloading. General Contractor will receive email notice of completed review.
5. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the General Contractor.
6. Submit paper and electronic copies of reviewed submittals or documents at project closeout for record purposes in accordance with Section 01 78 00 – CLOSEOUT SUBMITTALS.

C. Costs:

1. The cost of web-based services shall be paid in full by the General Contractor.
2. The General Contractor shall provide training for web-based service for Architect, OPM and any other entity required to use such service.
3. Internet Service and Equipment Requirements:
 - a. Email address and Internet access at General Contractor's main office.
 - b. Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for applying electronic stamps and comments.

1.7 SUBMISSION REQUIREMENTS AND QUANTITIES

- A. Furnish Architect with electronic files in Adobe Acrobat Portable Document Format (PDF) files for each of the following submittal types:
 - 1. Schedules
 - 2. Shop drawings.
 - 3. Product data, manufacturer's instructions and certificates and similar submissions.
 - 4. All PDF submittals greater than 50 pages shall have an index and be bookmarked.
 - 5. Emergency addresses: 1 file to Architect, and 1 file direct to Owner.
- B. In addition to electronic submittals furnish Architect with the following quantities of the following physical submittals:
 - 1. Provide one full size hard copy of each sheet for all structural shop drawings.
 - 2. Provide one full size hard copy of hardware schedules and product data (greater than 100 pages), door schedules, shop drawings greater than 11 inches by 17 inches for Architect's review, and any other submittals as requested by the Architect. Redlines and action stamp will be returned on the PDFs submitted.
 - 3. All submittals greater than 50 pages shall be provided with an index.
 - 4. Samples: Sets of 3 identical samples of each submission required.
 - 5. Pictures, data of all delivered samples to be uploaded.
- C. All submittals and shop drawings shall include a submittal title sheet that lists the following: Product, Specification Section number, article, paragraph and subparagraph reference (i.e. Section 08 71 00, Article 2.02, Paragraph A - Materials, subparagraph 1 - Door Trim, subparagraph 7 - Wire Pull).
- D. General submission of physical submittals shall be delivered to Architect at the following address:

Lamoureux Pagano & Associates
108 Grove Street, Suite 300
Worcester, Massachusetts 01605
- E. Transmit submittals to Architect at the above address, with individual transmittal forms, Document 00 62 12 – PRODUCT SUBMITTAL FORM for each submission. Document 00 62 12 is bound into the Project Manual; unbound copies are available from the Architect.
 - 1. On transmittal form, identify Project, General Contractor, Trade Contractor or subcontractor, installer, or supplier, pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate. Transmittals received by the Architect from sources other than the General Contractor will be returned without any action taken.
 - 2. General Contractor shall number submittals sequentially by Specifications Section prior to submittal. Resubmitted items shall retain number and be noted as resubmitted (example 260000.01 R1).

1.8 SHOP DRAWINGS

- A. General: Provide accurately prepared, large scale and detailed shop drawings prepared specifically for this Project. Shop drawings shall include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Standard

information prepared without specific reference to Project are not considered shop drawings.

1. Show adjacent conditions and related work, specific to this project and include required clearances, installation requirements, blocking and attachments, and utility connections and coordination
 2. Show accurate field dimensions where appropriate. Items that are fabricated to specific dimensions that are to be held by the contractor shall be noted and coordinated with the contractor
 3. Identify materials and products shown. Note all conditions where require coordination with other trades and special installation procedures.
 4. Show gage and thickness of materials.
 5. Indicate welding details and joint types.
 6. Show every component of fabricated items, notes regarding manufacturing process coatings and finishes, identifying numbers conforming to the Contract Documents (i.e. stair numbers, door numbers and similar items), dimensions, and appropriate trade names.
 7. Show anchorage and fastening details, including type, size and spacing.
 8. Review each submittal for conformity with the Contract requirements prior to submittal, certify such review on each shop drawing with General Contractor's stamp, signature and date. Reference on shop drawings to other sections, installers, suppliers, or trade(s) shall designate the appropriate specification sections, and the term "by others" shall not be used.
- B. Size of Format: Not less than 8-1/2 by 11 inches, and no larger than 30 by 42 inches, except for templates, patterns and similar full-size drawings.
- C. The Architect's comments and corrections will be made on the electronic submission (PDF) and returned to the Contractor. If necessary, the General Contractor then shall make the necessary corrections on the original drawings and resubmit the corrected drawings in electronic format (PDF) as specified. Prints of any submittals required for the Architect's own use, and those of engineering consultants, will be made without cost to the Contractor. The Contractor is responsible to distribute and furnish (at no additional cost to Owner) all shop documents needed for use by the Contractor, subcontractors, installers, vendors and suppliers.
- D. Drawing submittals returned " NO EXCEPTIONS TAKEN " or " MAKE CORRECTIONS NOTED " Obtain and distribute adequate prints for construction, including one print of each for designated Owner's Project Manager, and On-site Representative, and then return the reproducible copies to the Trade Contractor, subcontractor or supplier from whom he originally received them.
- E. Drawing submittals returned "REJECTED" or "REVISE AND RESUBMIT", or "SUBMIT SPECIFIED ITEM". Obtain a record print and then forward originals to source for correction; resubmit new reproducible copies and prints as specified herein above.
- F. Each drawing shall have a title block on the right-hand side containing the following data:

Name of project -	Tufts Vet Tech Clinic Renovation
Architect -	Lamoureux Pagano Associates Architects
General Contractor -	
Trade Contractor/supplier -	
Subcontractor/supplier -	
Date of submission -	

G. Each drawing shall have a clear space on the right-hand side for review stamps of both the Architect and General Contractor.

1. The General Contractor's Review and Action Stamp: Provide suitable space on label or title block for General Contractor's review and action stamp. Stamp and sign each submittal to show General Contractor's review and approval prior to transmittal Architect. Submittals not signed and stamped by General Contractor will be returned without action.

- a. Only submittals received from the General Contractor will be considered for review by the Architect. General Contractor shall review each submittal for accuracy and conformance with the requirements of the Contract Documents, and particularly for field measurements and proper fit with adjoining work. Modify submittals as required to show interface with adjacent work and attachment to Building.
- b. The General Contractor's Review and Action Stamp shall contain the following language or similar:

APPROVED FOR CONFORMANCE WITH THE CONTRACT DOCUMENTS. All dimensions and quantities have been reviewed and are accepted by _____ <i>General Contractor's Name</i> All dimensions and field conditions have been or will be verified prior to fabrication of the items described herein.

- c. Submittals received from the General Contractor shall be signed and comply with review requirements. Submittals not certified or improperly certified (stamped but not reviewed) will be returned to the General Contractor without Architect's review. Claims due to the return of uncertified, improperly prepared or inadequately reviewed submittals will be rejected.
2. Architect's submittal review stamp:

☐ No Exceptions Taken	☐ Received for Record	☐ Make Corrections Noted
☐ Revise and Resubmit	☐ Rejected	☐ Submit Specified Item

Architect's review is only for general conformance with design concept and compliance with requirements of Contract Documents. Review is based on Contractor's representation that he has checked and approved this submittal and has verified dimensions, quantities, field dimensions, relation to existing work, coordination with work to be installed later, and coordination with information in previously approved submittals. Accuracy of all such information is responsibility of the Contractor. Approval does not authorize, or relieve the Contractor of responsibility for, deviations from drawings, specifications, supplementary documents furnished by the Architect, or previously approved submittals unless the Contractor has, in writing, called the Architect's attention to such deviations at the time of submittal. The Contractor is solely responsible for the accuracy of all information in the submittal and for details of fabrication and installation. Refer to Contract Documents for further submittal requirements and limitations on scope of the Architect's review.

LAMOUREUX PAGANO ASSOCIATES | ARCHITECTS

Date: _____ By: _____

1.9 PRODUCT DATA

- A. Submit Product data as specified, and as the Architect may additionally prescribe. Product data includes, but is not limited to:
1. Catalog cuts.
 2. Complete specifications.
 3. Standard color charts.
 4. Performance data.
 - a. Compliance with recognized trade association standards.
 - b. Compliance with recognized testing agency standards, labels and seals.
 5. Certified laboratory test report data.
 6. Health and safety precautions.
 7. Illustrated capacities, characteristics, wiring diagrams, controls, and other pertinent information for complete product and product use description.
- B. If more than one size or type is shown on any printed sheet, indicate clearly intended item(s).
- C. When accepted or not accepted, the Architect will retain three copies. Submit sufficient copies for all other parties. No copies stamped REJECTED or RESUBMIT shall be sent to the job site.

1.10 SAMPLES

- A. Submit samples clearly labeled as to its material, type or make, manufacturer, size or gauge, and other pertinent data, accompanied by an appropriate transmittal form. Samples shall show full range of color and texture variation that can be expected.
1. When accepted or not accepted, the Architect will retain one set of samples and return the other to the General Contractor. Samples will not be permitted for use in the project.
 2. No final color selections shall be made by the Architect until all interior samples have been received and reviewed with the Owner.

1.11 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification Sections, submit manufacturer's printed instructions for delivery, handling, storage, assembly, installation, start-up, adjusting, and finishing.
- B. Identify conflicts between manufacturer's instructions and Contract Documents.

1.12 MANUFACTURER'S CERTIFICATES

- A. When specified in individual specification Sections, submit manufacturer's certificates and installer certificates to Architect for review.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

1.13 EMERGENCY ADDRESSES

- A. Within 15 days of Notice to Proceed, submit in writing, the name, addresses and telephone numbers of key members of their organization including General Contractor's Superintendent and personnel at the site, to be contacted in the event of emergencies at the building site, which may occur during non-working hours.

1.14 EROSION AND SEDIMENT CONTROL PROGRAM

- A. Submit erosion and sediment control program within 30 days after date of Owner-General Contractor Agreement for Architect's review. Revise and resubmit as required.
- B. Erosion and sediment program shall indicate proposed methods, materials to be employed, and schedule for effecting erosion and siltation control and preventing erosion damage. Provide sufficient information to fully explain the program; the following are the minimum requirements:
 - 1. Proposed methods for actuating erosion and siltation control including 1 inch equals 40 feet (1"=40') scale plans indicating location of erosion control devices and siltation basins.
 - 2. List of proposed materials including manufacturer's product data, in accordance with Division 32 - EARTHWORK and Division 33 - EXTERIOR IMPROVEMENTS.
 - 3. Schedule of and sediment control program indicating specific dates from implementing programs in each major area and each phase of Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 41 00
REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section consists of:
1. Applicable codes and regulations.
 2. Trade union jurisdictions.
 3. Wage rate compliance.

1.2 DEFINITIONS

- A. Regulations include laws, ordinances, statutes and lawful orders issued by authorities having jurisdiction, and rules, conventions and agreements within the construction industry that control performance of the Work, whether lawfully imposed by authorities having jurisdiction or not.

1.3 APPLICABLE CODES AND REGULATIONS

- A. All work shall be performed in accordance with the latest version, by DATE OF ISSUE for Contract Documents, current on date of Owner-Contractor Agreement, except as indicated otherwise, of all applicable codes as listed or the latest version:
1. 2021 International Existing Building Code (IEBC) with Massachusetts Building Code, Tenth Edition amendments (780 CMR).
 2. 2021 International Building Code (IBC) with Massachusetts Building Code, Tenth Edition amendments (780 CMR).
 3. 2021 International Energy Conservation Code with Massachusetts Building Code amendments.
 4. 2021 International Mechanical Code (IMC).
 5. Massachusetts Electrical Code (2023 National Electrical Code [NFPA 70, 2017 edition], with Massachusetts modifications from 527 CMR 12.00).
 6. Massachusetts Fuel, Gas, and Plumbing Code (2002 National Fuel Gas Code [ANSI Z223.1-NFPA 54], with Massachusetts modifications from 248 CMR 5.00).
 7. Massachusetts Comprehensive Fire Safety Code (527 CMR) [2021 NFPA 1 as amended], and as amended by MGL Chapter 148 Section 26G – Sprinkler Protection.
 8. Commonwealth of Massachusetts Regulation 521 CMR: *Architectural Access Board*.
 9. Commonwealth of Massachusetts, Department of Public Works. "STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES CONSTRUCTION".
 10. City of Worcester, Department of Public Works and Parks, Standard Specifications and Details.
 11. Commonwealth of Massachusetts Wetlands Protection Act.
 12. City of Worcester Zoning Regulations / Ordinance, as amended.
 13. National Fire Protection Association: NFPA 101 - LIFE SAFETY CODE, 2012 Edition.
 14. National Fire Protection Association: NFPA 241 – *Standard for Safeguarding Building Construction And Demolition Operations*, 2013 Edition.

15. United States Occupational Safety and Health Administration (OSHA): Standard N°. 29-CFR-1926.59 - HAZARD COMMUNICATION STANDARD.
16. United States Department of Justice, N° 28 CFR Part 36 - AMERICANS WITH DISABILITIES ACT, (Public Law 101-336).

B. Publication Dates: Where the date of issue of a code or regulation is not specified, comply with the standard in effect as of date of Contract Documents, or as otherwise required by authorities having jurisdiction.

1.4 TRADE UNION JURISDICTIONS

A. Maintain current information on jurisdictional matters, regulations, actions and pending actions; and administer/supervise performance of Work in a manner which will minimize possibility of disputes, conflicts, delays, claims or losses.

1.5 WAGE RATE COMPLIANCE

A. The General Contractor is responsible to ensure that the rate per hour to be paid to mechanics, apprentices, teamsters, laborers and other workers employed on the Work shall not be less than the approved wage rates applicable to this project. A legible copy of the approved rates, along with equal opportunity requirements, shall be posted on a weatherproof bulletin board outside the field office and be clearly visible for review by all workers.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 41 17
UTILITIES NOTIFICATION

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. Comply with all regulations and laws concerning excavation, demolition, or explosive work and be advised of utility notification requirements under Chapter 82, Section 40 of the Massachusetts General Laws.

1.2 ADMINISTRATIVE AUTHORITY

- A. Notification of utilities within the Commonwealth is performed through the Utilities Underground Plant Damage Prevention System, commonly referred to as “Dig Safe”.

1.3 REGULATORY REQUIREMENTS

- A. General Contractor must notify “Dig Safe” by telephone before performing any earth moving operations including: digging, trenching, boring, site demolition, excavation, backfilling, grading, or work in all public ways and private property.
- B. This contractor shall retain the services of a utility locating service, and mark out the areas in front of the project in the work zone, as all the utilities there are
- C. This notification must be made at least 72 hours (excluding weekends and holidays) prior to the Work described above, but not more than 30 calendar days before commencement of the contemplated Work. Notification shall occur between 6:00 AM to 6:00 PM local time from Monday to Friday, except in cases of emergency.
 - 1. The toll free phone number is: **811**.
 - 2. Provide the following information:
 - a. Municipality.
 - b. Location of work.
 - c. Intersecting street.
 - d. Type of work.
 - e. Starting date and time of work.
 - f. Name and title of caller.
 - g. Phone number of caller.
 - h. Best time for “Dig Safe” to return calls.
 - i. Company name of General Contractor.
 - j. Company name of Trade General Contractor or subcontractor performing subgrade work.
- D. Member utilities of the Utilities Underground Plant Damage Prevention System are required to respond to the notice within 72 hours from the time said notice is received by designating at the locus the location of pipes, mains, wires, or conduits.
 - 1. Locations of underground utilities will be marked by spray paint or stakes. Marks will be color coded with additional descriptions of letters and arrows as required.

- E. Do not commence work until "Dig Safe" has been properly notified and has responded as described above.
- F. Subsequently notify "Dig Safe" of unanticipated additional blasting required after the initial notification to "Dig Safe" has been made. Do not perform the additional blasting work in less than 4 hours following the subsequent notification.
- G. The General Contractor shall be responsible for providing a service for locating and marking all utilities on the owner's property and within the work area that are not identified by "Dig Safe".

1.4 PROTECTION

- A. The General Contractor is fully responsible for protection of the utility location markings, wherever these occur, on or off-site.
- B. Perform Work in such a manner, and with reasonable precautions taken to avoid damage to utilities under the surface in said areas of work. Immediately notify any known or suspected damage to underground utilities to the owner of such utilities.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

End of Section

Section 01 42 00
REFERENCES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Abbreviations and Acronyms.
- B. Definitions
- C. Reference Standards.

1.2 ABBREVIATIONS AND ACRONYMS

- A. The following list of common abbreviations are referenced in individual specification sections. This list is provided for convenience to the General Contractor and is not intended to define all abbreviations use in the Contract Documents.

1. Abbreviations for contract and specifications.

DOE	Massachusetts Department of Education
EPA	United States Environmental Protection Agency
HVAC&R	Heating, ventilating, air conditioning, and refrigeration systems
IAQ	Indoor Air Quality
IEQ	Indoor Environmental Quality
LEED™	United States Green Building Council, <i>Leadership in Energy and Environmental Design Rating System</i>
MEPA	Massachusetts Environmental Protection Agency
MGL	Massachusetts General Laws
MHD	Massachusetts Highway Department (Mass Highway)
MSBA	Massachusetts School Building Authority
MSDS	Material Safety Data Sheet
NIC	Not in Contract
OFCI	Owner Furnished, General Contractor Installed
OFI	Owner Furnished and Installed
VOC	Volatile Organic Compounds

2. Abbreviations for measurements and quantities.

C	Celsius
cm	Centimeter
F	Fahrenheit
Hrs	Hours
Kg	Kilogram
L	Liter
M	meter
m ² or SM	square meter
m ³ or CM	cubic meter
mm	Millimeter

REFERENCES

Mths	Months
psi	Pounds per square inch
t	ton

1.3 DEFINITIONS

- A. Definitions of contracting parties (Owner, General Contractor, and Architect): Refer to Section 01 10 00 – PROJECT SUMMARY.
1. The terms “General Contractor” and “Construction Manager (CM)” as used in the Project Manual have the same meaning and are interchangeable in Contract Documents. Both terms refer to the same entity.
 2. The terms “Filed subcontractor” and “Trade Contractor” as used in the Project Manual have the same meaning and are interchangeable in Contract Documents. Both terms refer to the same entity.
- B. Definitions for terms utilized in the Contract Documents:
1. "As necessary," "as directed," "when directed," "satisfactory," "good and sufficient," "approved," or other general qualifying terms are used on the Drawings: These terms are deemed to be followed by the words, "in the opinion of the Architect," or "by the Architect," as the case may be."
 2. "Addenda": written or graphic instruments issued prior to the execution of the Contract which modify or interpret the Bidding Documents, including the Drawings and Specifications, by additions, deletions, clarifications or corrections.
 3. "Approval," "approved," "approved equal," "or equal," or "other approved" means as approved by the Architect."
 4. The term "Day": is defined as the following:
 - a. The term "calendar day" is a full 24 hour period, starting from 12 AM (midnight), and includes all weekends and legal holidays.
 - b. The term "working day" shall mean any calendar day except Saturdays, Sundays, and legal holidays at the place of the building.
 - c. Where the term "day" is used without the adjective of "calendar" or "working", it shall mean "calendar day".
 5. "Furnish and Install" or "Provide": items identified shall be furnished and installed under this Contract. The term "Furnish", when used separately, shall mean that the items referred to shall be furnished, only. Similarly the term "install", when used separately, shall mean that the items referred to shall be installed, only.
 6. "Knowledge," "recognize" and "discover," their respective derivatives and similar terms in the Contract Documents, as used in reference to the General Contractor, shall be interpreted to mean that which the General Contractor knows (or should know), recognizes (or should recognize) and discovers (or should discover) in exercising the care, skill and diligence required by the Contract Documents. Analogously, the expression "reasonably inferable" and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by the General Contractor, Trade General Contractor or subcontractor familiar with the Project and exercising the care, skill and diligence required by the Contract Documents.
 7. "Not in Contract" or "N.I.C.": equipment, furnishings, or other materials not included as a part of this Contract.
 8. "Product": materials, systems and equipment.

REFERENCES

1.4 REFERENCE STANDARDS

- A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by DATE OF ISSUE for Contract Documents, current on date of Owner-General Contractor Agreement.
- C. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- D. The contractual relationship to the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.
- E. Schedule of References

- 1. Listed below are abbreviations for the names and titles of trade association names, federal government agencies and similar organizations which are referenced in the individual specification sections. The addresses and phone numbers provided are for the General Contractor's convenience and are believed to be current and accurate, however addresses and phone numbers frequently change, and no assurance is made on their accuracy:

AA	Aluminum Association 900 19th Street N.W., Suite 300 Washington, DC 20006 www.aluminum.com
ABAA	Air Barrier Association of America 1600 Boston-Providence Highway Walpole, MA 02081 www.airbarrier.org
AAMA	American Architectural Manufacturer's Association 1827 Walden Office Sq., Suite 104 Schaumburg, IL 60173-4268 www.aamanet.org
AASHTO	American Assoc. of State Highway & Transportation Officials 444 N. Capitol Street NW, Suite 249 Washington, DC 20001 www.aashto.org
AATCC	American Association of Textile Chemists and Colorists PO Box 12215, 1 Davis Drive, Research Triangle Park, NC 27709-2215 www.aatcc.org
ACI	American Concrete Institute, International 38800 Country Club Drive, Farmington Hills, Michigan 48331 www.aci-int.org
ACPA	American Concrete Pipe Association 222 West Las Colinas Boulevard, Suite 641, Irving TX www.concrete-pipe.org
ADC	Air Diffusion Council 104 S. Michigan Ave, Suite 1500, Chicago, IL 60603 www.flexibleduct.org
AFPA	American Forest & Paper Association (Formerly NFPA National Forest Products Association) 1111 19 th St. N.W., Suite 800, Washington, DC 20036 www.afandpa.org
AGAI	American Galvanizers Association Inc. 12200 E. Liff Ave, Suite 204, Aurora, CO 80014-1252 www.galvanizeit.org

REFERENCES

AIA	American Institute of Architects 1735 New York Avenue, N.W., Washington, DC 20006-5292 www.aia.org
AIHA	American Industrial Hygiene Association 2700 Prosperity Ave, Suite 250, Fairfax VA 22031 www.aiha.org
AISC	American Institute of Steel Construction 1 E. Wacker Dr., Suite 3100, Chicago, IL 60601-2001 www.aisc.org
AMCA	Air Movement and Control Association 30 W. University Drive, Arlington Heights, IL 60004-1893 www.amca.org
ANSI	American National Standards Institute 11 W. 42 nd Street, 13 Floor, New York, NY 10036 www.ansi.org
APA	APA - The Engineered Wood Association (formerly APA - American Plywood Association) P.O. Box 11700, Tacoma, WA 98411-0070 www.apawood.org
ARI	Air-Conditioning and Refrigeration Institute 4301 N. Fairfax Dr., Suite 425, Arlington, VA 22203 www.ari.org
ARMA	Asphalt Roofing Manufacturers Association 6000 Executive Blvd., Suite 201, Rockville, MD 20852-3803 www.asphaltruofing.org
ASCA	Architectural Spray Coaters Association 230 West Wells Street, Suite 311, Milwaukee WI 53203 www.aecinfo.com
ASCE	American Society of Civil Engineers 1015 15 th St. N.W., Washington, DC 20005 www.asce.org
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers 1791 Tullie Circle NE, Atlanta GA.30329 www.ashrae.org
ASME	American Society of Mechanical Engineers 345 East 47th Street, New York, NY 10017-2392 www.asme.org
ASTM	American Society for Testing and Materials 100 Barr Harbor Drive, West Conshohocken, PA 19428 www.astm.org
AWI	Architectural Woodwork Institute 1952 Isaac Newton Square W., Reston, VA 20190 www.awinet.org
AWPA	American Wood Preservers' Association P.O. Box 286, Woodstock, MD 21163-0286 www.awpa.com
AWPI	American Wood Preservers' Institution 1945 Old Gallows Rd., Suite 150, Vienna, VA 22182 www.oas.org
AWS	American Welding Society 550 LeJeune Road, N.W., Miami, FL 33126 www.aws.org
BHMA	Builders Hardware Manufacturers Association, Inc.

REFERENCES

	355 Lexington Ave., 17 Floor New York, NY 10017 www.buildershardware.com
BIA	Brick Industry Association 11490 Commerce Park Drive, Reston, VA 22091-1525 www.bia.org
CDA	Copper Development Association 260 Madison Ave., 16 th Floor, New York, NY 10016 www.copper.org
CISCA	Ceilings & Interior Systems Construction Association 579 W. North Ave., Suite 301, Elmhurst, IL 60126 www.cisca.org
CRI	Carpet and Rug Institute 310 Holiday Ave, Dalton, GA 30720 www.carpet-rug.com
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Road, Schaumburg, IL 60173-4758 www.crsi.org
DHI	Door and Hardware Institute 14170 Newbrook Dr., Chantilly, VA 22021-2223 www.dhi.org
FM	Factory Mutual Engineering & Research Corp. 1151 Boston-Providence Turnpike Norwood, MA 02062 www.fmglobal.com
FSC	Forest Stewardship Council (United States Chapter) 1155 30th Street NW, Suite 300, Washington, DC 20007 www.c-f-c.com
GA	Gypsum Association 6525 Belcrest Road, Suite 480, Hyattsville, MD 20782 www.gypsum.org
GANA	Glass Association of North America 2945 S.W. Wanamaker Dr., Suite A, Topeka, KS 66612-5321 www.glass.org
GICC	Glazing Industry Code Committee 3310 Harrison St., Topeka, KS 66611-2279 www.glazingcodes.net
IGCC	Insulating Glass Certification Council 3933 US Route 11, PO Box 2040, Cortland, NY 13045 www.igcc.org
IPCI	International Polished Concrete Institute Norris TN www.ipcaonline.org
LSGA	Laminators Safety Glass Association 3310 Harrison Street, Topeka KS 66611-2279 www.glass.org
MCAA	Mason Contractors Association of America 1910 S. Highland Ave. Suite 101, Lombard, IL 60148 www.masoncontractors.org
MFMA	Maple Flooring Manufacturers Association 60 Revere Drive, Suite 500, Northbrook, IL 60062 www.maplefloor.org
MIL	Military Specifications and Standards Naval Publications and Forms Center

REFERENCES

	5801 Tabor Avenue, Philadelphia, PA 19120 www.milspec.com
NAAMM	National Association of Architectural Metal Manufacturers 8 South Michigan Avenue, Suite 1000, Chicago, IL 60603 www.naamm.org
NCMA	National Concrete Masonry Association 2302 Horse Pen Road, Herndon, VA 20171-3499 www.ncma.org
NEBB	National Environmental Balancing Bureau 8575 Government Circle, Gaithersburg, MD 20877-4121 www.nebb.org
NEMA	National Electrical Manufacturers' Association 1300 N. 17 th St., Suite 1846, Rosslyn, VA 22209 www.nema.org
NFPA	National Fire Protection Association 1 Battery March Park, PO Box 9101, Quincy, MA 02269 www.nfpa.org
NFSHSA	National Federation of State High School Associations PO Box 20626, Kansas City MO. 64195 www.nfhs.org
NRCA	National Roofing Contractors Association O'Hare International Center 10255 W. Higgins Road, Suite 600, Rosemont, IL 60018-5607 www.nrca.net
PCA	Portland Cement Association 5420 Old Orchard Road, Skokie, IL 60077-1083 www.cement.org
PEI	Porcelain Enamel Institute 4004 Hillsboro Pike, Suite 224B, Nashville, TN 37215 www.porcelainenamel.com
PS	Product Standard U. S. Department of Commerce www.omg.org
SDI	Steel Deck Institute P.O. Box 25, Fox River Grove, IL 60021-0025 www.sdi.org
SDI	Steel Door Institute 30200 Detroit Road, Cleveland, OH 44145-1967 www.steeldoor.org
SGCC	Safety Glass Certification Council RMS, P.O. Box 9 Henderson Harbor, NY 13651 www.sgcc.org
SIGMA	Sealed Insulating Glass Manufacturers Association 401 N. Michigan Ave., Suite 2400, Chicago, IL 60611 www.glasschange.com
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 4201 Lafayette Center Dr., Chantilly, VA 22022-1209 www.smacnapa.org
SPIB	Southern Pine Inspection Bureau 4709 Scenic Highway, Pensacola, FL 32504-9094 www.spib.org
SSMA	Steel Stud Manufacturer's Association 8 South Michigan Avenue, Chicago IL 60603

REFERENCES

	www.ssma.com
SSPC	The Society for Protective Coatings 40 24 th Street, 6 th Floor, Pittsburgh PA 15222-4623 www.sspc.org
SWRI	Sealant, Waterproofing & Restoration Institute 2841 Main Street, Suite 585, Kansas City, MO 64108 www.swrionline.org
TCNA	Tile Council of North America, Inc. 100 Clemson Research Blvd., Anderson, SC 29625 www.tileusa.com (formerly TCA, Tile Council of America)
UL	Underwriters' Laboratories, Inc. 333 Pfingston Road, Northbrook, IL 60602 www.ul.com
USGBC	United States Green Building Council 1800 Massachusetts Avenue NW, Suite 300 Washington DC 20036 www.usgbc.org
WDMA	Window & Door Manufacturers Association (formerly National Wood Window & Door Association, NWWDA) 205 E. Touhy Avenue, Suite G-54, Des Plaines, IL 60018 www.nwwda.org

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

REFERENCES

Section 01 45 00
QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. General quality assurance and control of installation.
- B. Site safety, worker safety and training.
- C. General Contractor's quality control (QC) program.
- D. Source quality control.
- E. Field samples and mock-ups.
- F. Manufacturer's field services and reports.
- G. Field quality control, Owner's right for confirmation.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 01 43 39 - MOCK-UPS.
- C. Section 01 45 29 - TESTING LABORATORY SERVICES.

1.3 GENERAL QUALITY ASSURANCE AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply fully with manufacturers' instructions, including performance of each step in sequence. Notify Architect when manufacturers' instructions conflict with the provisions and requirements of the Contract Documents; obtain clarification before proceeding with the work affected by the conflict.
- C. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate high standards or more precise workmanship.
- D. Perform work by persons qualified to produce workmanship of specified quality.
- E. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.4 SITE SAFETY, WORKER SAFETY AND TRAINING

- A. General: The General Contractor (and his subcontractors and Filed Sub-bid Contractors) shall, at all times, exercise reasonable precautions for the safety of all persons. All rules, regulations, and laws concerning safety that are in effect at the work site, and in particular, all applicable regulations of the Occupational Safety and Health Administration (OSHA) of

the U.S. Government, in addition to specified requirements shall be complied with in all respects.

1. General Contractor's responsibility for safety shall apply continuously twenty four (24) hours per Day during the term of this Contract and is not limited to normal working hours.
- B. General Contractor's Safety Program: Prior to commencement of the Work, the General Contractor shall develop and implement a Safety and Health Plan to comply with the Occupational Safety and Health Administration (OSHA) standards for the Construction Industry and all other applicable Federal, State, local laws and regulations. General Contractor's Safety and Health Plan, and included health and safety procedures and policies, shall be submitted to the Architect and Owner's Representative within fifteen (15) Days after the date of Notice to Proceed and in no event later than commencement of the Work, whichever occurs first.
 1. Perform pre planning to ensure access is provided to Fire Department for all areas of the work site throughout the duration of the Contract. The General Contractor's shall provide the Fire Department site access maps, updated regularly, to reflect changes in the layout of the work site and shall notify the Fire Department when each update is made
 2. Post and maintain, at prominent locations throughout the Project site, emergency telephone numbers and shall insure that all personnel on site are continuously aware of this information.
 3. Ensure safe access to the Work for the Owner, Architect, Architect's consultants, their designated representatives, and all others charged with inspection, testing and monitoring of the Work, and visitors to the site. The General Contractor's shall furnish site visitors with safety equipment, test equipment, safety apparel and instructions that are required to insure their safety on site, and In the performance of their duties related to the Work of this Contract
- C. All employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration (OSHA) that is at least 10 hours in duration. The OSHA training and certification course shall occur at the time each employee begins work. Furnish documentation to Owner and Architect, for each employee documenting successful completion of the OHSA safety training and certification course. Submit with the first certified payroll report. Comply fully with all laws and regulations applicable to awards made subject to Massachusetts General Laws (MGL) Chapter 149, Section 44A.

1.5 GENERAL CONTRACTOR'S QUALITY CONTROL PROGRAM

- A. Procedures: General Contractor, Trade Contractors and each subcontractor shall include all labor, materials, equipment, services and incidental items necessary to implement quality control procedures to the extent necessary to demonstrate and maintain compliance with the Contract Documents.
- B. It is recognized that the General Contractor maintains standing written procedures as a corporation for the assurance of quality in finished projects. The Architect and Owner shall review and approve such corporate QA/QC program; review will be against the guidance provided by the following paragraphs and approval may be conditioned with requirements to expand specific sections to meet specific requirements of the Owner and/or the Owner's funders.

- C. Quality Control Plan: Within 20 days after Notice to Proceed, the General Contractor shall submit a Quality Control (QC) Plan to the Owner's Representative and Architect for approval. The plan shall address the following, as a minimum:
1. The General Contractor's commitment to quality and implementing and managing the QC program.
 2. Identification of the General Contractor's onsite QC Manager, with name, qualifications, duties and responsibilities. The QC Manager shall have the authority to direct the removal and replacement of non-conforming work. The QC Manager shall be present for all QC meetings, inspections and tests during the project.
 3. Procedures for addressing and commenting QC with General Contractor's staff, all Trade Contractors, subcontractors and suppliers, and Owner, Architect and Owner's representative.
 4. Procedures for review of submittals and submittal status, and documentation of same.
 5. Procedures for pre-installation meetings and documentation of same.
 6. Procedures for inspections of deliveries and documentation of same.
 7. Procedures for benchmark inspections, defined as initial installations, and documentation of same.
 8. Procedures for mockup inspections and documentation of same.
 9. Procedures for equipment in place, inspections and documentation of same.
 10. Procedures for inspections prior to closures of concealment and documentation of same.
 11. Procedures for start-up and commissioning and documentation of same.
 12. Procedures for turnover and documentation of same.
 13. Procedures for identifying, recording, tracking correcting and reporting items requiring rework, using a Rolling Completion list chronological item number, phase area, date listed, description, party responsible for correction, date notified, and date corrected.
 14. Procedures for testing and documentation of same.
 15. Procedures for corrective action on Architect's Field Reports and Testing Agency reports and documentation of same.
- D. Procedures for reporting on all of the above on a monthly basis as a condition precedent to review of the General Contractor's application for payment.

1.6 SOURCE QUALITY CONTROL

- A. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Product Labeling: Attach label from agency approved by authority having jurisdiction for products, assemblies, and systems required to be labeled by applicable code(s).
1. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label.
 - a. Model number.

- b. Serial number.
- c. Performance characteristics.

1.7 FIELD SAMPLES

- A. Install field samples demonstrating quality level for the Work, at the site as required by individual specifications Sections for review and acceptance by Architect. Remove field samples prior to date of Final Inspection, or as directed.

1.8 MOCK-UPS

- A. Refer to individual specifications for required samples and in place installations, to be used for quality control, coordination with filed trade connections and installation issues in advance of main installations

1.9 MANUFACTURER'S FIELD SERVICES AND REPORTS

- A. When called for by individual Specification Sections, provide at no additional cost to the Owner, manufacturers' or product suppliers' qualified staff personnel, to observe site conditions, start-up of equipment, adjusting and balancing of equipment, conditions of surfaces and installation, quality of workmanship, and as specified under the various Sections.
 - 1. Individuals shall report all observations, site decisions, and instructions given to applicators or installers. Immediately notify Architect of any circumstances which are supplemental, or contrary to, manufacturer's written instructions.
 - 2. Submit full report within 30 calendar days from observed site conditions to Architect for review.

1.10 FIELD QUALITY CONTROL

- A. The Owner reserves the right to take samples and perform, at random, tests of approved materials delivered to the job site to verify compliance of actual materials with specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section consists of the following:
 - 1. Quality assurance.
 - 2. Laboratory responsibilities.
 - 3. Laboratory reports.
 - 4. Limits on testing laboratory authority.
 - 5. General Contractor responsibilities.
 - 6. General Contractor submittals.
 - 7. Schedule of inspections and tests.
 - 8. Concrete in situ relative humidity, calcium chloride and acidity/alkalinity testing.

1.2 RELATED REQUIREMENTS

- 1. Section 01 45 90 PROGRAM OF STRUCTURAL TESTS AND INSPECTIONS: The specific tests and inspections required for each category of work.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C1060 - Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings
 - 2. ASTM C1153 - Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging
 - 3. ANSI/ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock
 - 4. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems
 - 5. AAMA 502 -Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
 - 6. AAMA 503 – Field testing of Newly Installed Storefronts, curtain Walls, and Glazing Systems.
 - 7. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization

8. ASTM E 783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
9. ASTM E 1105 – Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
10. ASTM E1186 - Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
11. ASTM E1258 - Standard Test Method for Airflow Calibration of Fan Pressurization Devices.
12. ASTM E1827 - Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door.
13. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials.
14. ASTM E2357 – Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies
15. ASTM E2813 – Standard Practice for Building Enclosure Commissioning
16. ASTM E3158 – Standard Test Method for Measuring the Air Leakage Rate of a Large or Multi-zone Building
17. ANSI/ASTM E 329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
18. ASTM F 710 – Standard Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.
19. ASTM F 1869 – Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
20. ASTM F 2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes

1.4 QUALITY ASSURANCE

- A. Comply with requirements of ANSI/ASTM D 3740 and ANSI/ASTM E 329.
- B. Laboratory: Authorized to operate in state in which Project is located.
- C. Laboratory staff: Maintain a full time specialist on staff to review services. Provide registered Engineer on staff for all review of services related to structural testing.
- D. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either the National Bureau of Standards (NBS) Standards or accepted values of natural physical constraints.

1.5 LABORATORY RESPONSIBILITIES

- A. Cooperate with Architect and General Contractor in performance of services; provide qualified personnel promptly on notice.
 - 1. Attend preconstruction conferences and progress meetings, as requested.
- B. Acquaint Owner's Project Manager, Architect, and General Contractor's superintendent with testing procedures and with all special conditions encountered at the site.
- C. Perform specified Inspection, sampling, and testing of products and construction methods in accordance with specified standards as specified in individual technical specification sections:
 - 1. Comply with specified standards, ASTM, ANSI, and other recognized authorities.
 - 2. Conduct and interpret the tests and state in each report whether the test specimens comply with the requirements, and specifically state any deviations therefrom.
 - 3. Obtain General Contractor's written acknowledgment of each inspection, sampling, and test made. Test samples of mixes submitted by General Contractor.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- D. Promptly notify Architect and General Contractor of irregularities, deficiencies, or non-conformance of Work or Products which are observed during performance of services.
- E. Promptly submit written report of each test and inspection with one copy each to Architect, Owner's Project Manager, General Contractor, and one copy to Project Record Documents File.
- F. Perform additional inspections and tests required by Architect/Engineer.

1.6 LABORATORY REPORTS

- A. After each test, promptly distribute directly from the testing laboratory, copies of laboratory report to:
 - 1. Owner's Project Manager.
 - 2. Architect's office.
 - 3. Consulting engineer's office.
 - 4. General Contractor's office.
 - 5. Municipal Inspectional Services Department, if required.
- B. Include in report the following information:
 - 1. Date issued,
 - 2. Project title and number,
 - 3. Testing laboratory name, address, and telephone number.
 - 4. Name and signature of laboratory inspector.
 - 5. Date and time of sampling,

6. Record of temperature and weather conditions (as appropriate to test).
7. Identification of product and Specifications Section,
8. Location of sample or test in the Project.
9. Type of inspection or test.
10. Results of tests and compliance with Contract Documents.
11. Interpretation of test results, when requested by Architect.
12. Observations regarding compliance with Contract Documents

1.7 LIMITS ON TESTING LABORATORY AUTHORITY

- A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Laboratory may not approve or accept any portion of Work.
- C. Laboratory may not assume any duties for General Contractor.
- D. Laboratory has no authority to stop the Work.

1.8 GENERAL CONTRACTOR RESPONSIBILITIES

- A. Coordinate and cooperate with laboratory personnel, provide access to Work, and to manufacturer's facilities.
 1. Monitor each inspection, sampling, and test.
 2. Provide Laboratory or Agency with written acknowledgment of each Inspection, sampling, and test.
 3. Within 24 hours notify Architect and Owner in writing of reasons for not acknowledging Laboratory results.
- B. Secure and deliver to the Laboratory or designated location, adequate quantities of representational samples of materials proposed to be used and which require testing, along with proposed mix designs.
- C. Furnish incidental labor and facilities:
 1. To provide access to Work to be tested.
 2. To obtain and handle samples at the Project site or at the source of the Product to be tested.
 3. To facilitate inspections and tests.
 4. For storage and curing of test samples.
- D. Furnish verification of materials and equipment compliance with Contract Documents.
- E. Notify Architect and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.
- F. Identify materials to be tested or inspected by Testing Laboratory or Agency.
- G. After determination of need for testing or inspecting by Owner, notify Laboratory sufficiently in advance, minimum five days of operations to allow for its assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to General Contractors negligence.
- H. Make arrangements with the laboratory and pay for additional samples and tests required for the following conditions:
 1. Initial testing indicates Work does not comply with Contract Documents.
 2. The General Contractor requested testing for additional testing and laboratory services beyond specified requirements.

1.9 CONDUCT OF INSPECTIONS AND TESTS

- A. The General Contractor shall Include required tests and inspections in their base schedule, and the 3 week look ahead schedule, Then notify the Owner's Project Manager, Architect, and Testing Laboratory a minimum of 24 hours before the performance of work to permit the proper conduct of Owner authorized inspections and tests.
- B. Representatives of Testing Laboratory will inspect the manufacture, assembly, and placement of materials as required and as authorized by the Owner, and report their findings to the Architect, Owner's Project Manager, and General Contractor.
- C. Work shall be checked as it progresses, but failure to detect any defective work or materials shall in no way prevent later rejection when such defect is discovered nor shall it obligate the Owner to accept such work.

1.10 SCHEDULE OF TESTING AND LABORATORIES BY OWNER

- A. Except as otherwise specified, Owner will appoint, employ, and pay services of independent firm(s) to perform inspection and testing and other services specified herein, in individual specification Sections, and as additionally required by the Architect.
- B. Requirements for testing, observations, and inspections are described in individual specification sections; the schedule provided below is not intended to completely describe all of the inspection and testing Work required for this Contract and is only furnished as a guide.
 1. Section 01 45 00 – Program of Structural Tests and Inspections
 2. Section 03 30 00 - Cast-in-Place Concrete: Concrete test cylinders
 3. Section 04 20 00 - Unit Masonry: One day per week observation of masonry installation. grout, mortar and prism testing.
 - a. Three cylinders tested for compressive strength at 10 and 28 days; ASTM C 91 test.
 - b. Obtain sample face brick units (minimum 4) and test for conformance to ASTM C 67.
 - c. Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C 140.
 - d. Prism Test: For each type of wall construction indicated, per ASTM C 1314.
 - e. Mortar Test: For mortar properties per ASTM C 270.
 - f. Grout Test: For compressive strength per ASTM C 1019.

4. Section 05 12 00 - Structural Steel Framing: Testing of welds of field and shop fabricated components. Testing of bolting.
 - a. Bolt torque testing.
 - b. Welding X-ray and ultrasonic tests as specified.
 - c. Coating thickness of primer coats.
 5. Section 05 31 00 - STEEL DECKING: Periodic inspection of steel decking installation prior to concrete placement.
 6. Section 07 26 00 - VAPOR RETARDERS: Minimum one visual inspection of under slab vapor barrier installation
 7. Section 07 27 00 – AIR BARRIERS: Minimum one visual inspections of air barrier installations.
 8. Section 07 81 00 – APPLIED FIREPROOFING: Testing and certification of density, thickness and adhesion of installation.
 9. Section 07 84 13 - FIRESTOPPING: Testing and certification, witness the installation of 10% of each type of firestop system or perform destructive testing of 2% of each type of firestop system per floor or for each area of a floor when a floor is larger than 10,000 square feet.
 10. Section 07 92 00 - JOINT SEALANTS: Adhesive strength; compatibility with adjacent materials; elasticity.
 11. Section 09 91 00 - PAINTING: Chemical analysis; coating thickness
 12. Section 31 20 00 – Earth Moving; Bearing strata review, subgrade preparation and soil compaction densities.
- C. Special Tests and Inspections: Owner will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.
1. Testing agency will notify Architect, Owner's Project Manager, and General Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect, through General Contractor, with copy to Owner's Project Manager and to authorities having jurisdiction.
 3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 5. Testing agency will retest and re-inspect corrected work.
- D. Partial Building Air Leakage Testing:
- a. The Owner's Third-Party Testing Agency will perform a building air leakage test on the completed addition.
 - b. Methodology: Perform partial building air leakage testing in accordance with
 - 1) ASTM Standards:

- 2) E779 Test Method for Determining Air Leakage Rate by Fan Pressurization
 - 3) E1186 Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
 - 4) E1258 Test Method for Airflow Calibration of Fan Pressurization Devices
 - 5) E1827 Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door
 - 6) E2357 Test Method for Determining Air Leakage Rate of Air Barrier Assemblies
- c. The Testing Agency will prepare and distribute written field reports with photographs summarizing test procedures and results, as well as make recommendations for remedial work as necessary. The General Contractor shall be responsible for providing all labor and materials to construct temporary barriers required to conduct the whole building air leakage testing in phases, as dictated by the Testing Agency. This may include studs, plastic sheeting, and tape.
- d. Acceptance Criteria: For each individual phase tested per ASTM E779, the measured air leakage shall not be greater than 0.20 cfm/ft² of the building thermal envelope area at a pressure differential of 0.3 inch water gauge (75 Pa) with the calculated building thermal envelope surface area being the sum of the above- and below-grade building thermal envelope. Air leakage in excess of 0.20 cfm/sq. ft. at 75 Pa of differential pressure will constitute a failure. Air leakage through an isolated area, as determined by ASTM E 1186 and/or ASTM E1827, will also constitute a failure.
- e. The Filed Subcontractor responsible for installation shall repair all areas of air leakage identified by testing and as necessary to achieve an overall building air leakage value less than 0.20 cfm/sq. ft. The Filed Subcontractor responsible for installation shall be responsible for the costs of any and all retesting that may be required following a failed test.

1.11 SCHEDULE OF TESTING AND LABORATORIES BY GENERAL CONTRACTOR

- A. General Contractor shall employ and pay for services of an approved independent testing laboratory to perform inspection and testing specified under this Article.
1. Submit to Architect a minimum of three independent testing laboratories for each type of testing specified by individual specification sections and those required by the referenced applicable codes, regulations and standards.
 2. Employment of testing laboratory shall in no way relieve General Contractor of obligation to perform work in accordance with requirements of Contract Documents.
- B. Earthwork: Lab tests to determine suitability of all fill materials shall be paid for by General Contractor.
1. Owner reserves the right to retain and pay for his own testing for checking purposes

- C. Concrete Paving and General Concrete Work: Concrete mix design testing shall be paid for by General Contractor. Owner reserves the right to retain and pay for his own testing for checking purposes.
- D. Moisture content testing of interior and exterior wood prior to application of field painted coatings.
- E. Massachusetts Energy Code Witness Testing: The General Contractor shall engage the services of Massachusetts registered professional mechanical and electrical engineers who shall perform witness testing of all HVAC, lighting and power distribution systems in accordance with the requirements of the Massachusetts Energy Code. The registered professional engineer shall prepare a final performance acceptance report in accordance with the code requirements and in a form acceptable to the local code official. The actual testing shall be performed by the General Contractor, his designated Filed Subcontractors or authorized manufacturers' representatives. All costs associated with the testing, witnessing of the testing and preparation of reports shall be part of the base contract bid.

1.12 SCHEDULE OF TESTING AND LABORATORIES BY FILED SUBCONTRACTORS

- A. Respective Filed Subcontractor shall employ and pay for services of an approved independent testing laboratory to perform inspection and testing specified under this Article and as additionally in individual specification sections.
 - 1. Submit to Architect a minimum of three independent testing laboratories for each type of testing specified by individual specification sections and those required by the referenced applicable codes, regulations and standards.
 - 2. Employment of testing laboratory shall in no way relieve General Contractor of obligations to perform work in accordance with requirements of Contract Documents.
 - 3. Provide two weeks notice to the Building Exterior Commissioning Agent for specified functional tests to be witnessed.
 - 4. Refer to each Filed Subcontractors individual specification Section for testing, performance requirements, quantities and frequency.
- B. Section 07 27 00 – AIR BARRIERS: Membrane air barriers qualitative testing:
 - 1. In-place testing according to the following:
 - a. ASTM E1186 – Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
- C. Section 07 27 00 - AIR BARRIERS: Membrane air barriers quantitative testing:
 - 1. In-place testing according to the following:
 - a. ASTM E2357 – Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies.
- D. Section 07 92 00 – Joint Sealants:
 - 1. In-place testing according to the following:
 - a. ASTM C1521 – Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
- E. Section 08 44 13 - Glazed Aluminum Curtainwall

1. Testing shall be witnessed by the General Contractor, Owner's Project Manager and the Building Exterior Commissioning Agent.
 - a. Section 08 44 13 Glazed Aluminum Curtain Wall testing shall be performed and paid for by the Section 08 44 13 Glazed Aluminum Curtain Wall Contractor.
 2. Testing of mock-ups and installed work subject to the following requirements:
 - a. Independent mockups are not required, actual construction to be reviewed for conformance by the General Contractor, in accordance with the code required and specified standards
- F. Concrete slabs and floors: Relative Humidity, Moisture Vapor Emission and acidity/alkalinity (pH)Testing:
1. Resilient Flooring Filed Subcontractor shall employ and pay for services of an independent testing laboratory to perform relative humidity, moisture vapor emission, and pH tests on concrete slabs as follows. The test shall be witnessed by the General Contractor, Resilient Flooring Filed Subcontractor and Owner's Project Manager refer to Section 09 00 06 – RESILIENT FLOORING FILED SUBCONTRACTOR CONTRACT REQUIREMENTS.
 - a. Relative Humidity, Moisture Vapor Emission and pH Testing on all concrete slabs over-which a finished floor is to be installed. This includes, but is not limited to:
 - 1) Section 03 05 13 Concrete Sealers – Painting Sub Contractor.
 - 2) Section 09 65 43 – Linoleum Flooring.
 - 3) Section 09 67 23 - Resinous Flooring.
 - b. Perform moisture and pH tests on all concrete floors over-which stone flooring is to be applied.
 2. Requirements: As specified under Part 3 of this Section.
 - a. Submit 1 copy of test data to the installers of all flooring materials or coating materials scheduled to be installed.
 - b. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Perform such additional testing, at no additional cost to the Owner, after procedures have been performed to reduce moisture content to ratings acceptable to the various flooring and coating manufacturers.
- G. Fire Protection System: Conform to requirements specified in individual Division 21 Specification Section. The tests shall be performed and paid for by the Filed Subcontractor and witnessed by the General Contractor, Owner's Project Manager and authorities having jurisdiction:
1. Fire protection system flushed and pressure tested.
 2. Provide system testing compliant with NFPA 72 prior to 12 months from the date of substantial completion.
 3. Reviews and testing as required by the City of Worcester Fire Department.
- H. Plumbing: At least the following tests shall be performed. Conform to requirements specified in individual Division 22 Specification Sections. The test shall be performed and paid for by the Filed Subcontractor and witnessed by the General Contractor, Owner's Project Manager and authorities having jurisdiction:

1. Water supply piping hydrostatic pressure test.
 2. Sanitary piping test before fixture installation: Cap pipes and fill to highest point in system.
 3. Plumbing fixture operation.
 4. Backflow preventor inspection by the City Water departments cross connection inspector to be coordinated in advance of substantial completion by the Filed Subcontractor.
- I. HVAC Testing: All HVAC work shall be tested by an independent testing and balancing agency, approved by Owner. Conform to requirements specified in individual Division 23 Specification Sections. The tests shall be performed and paid for by the Filed Subcontractor and witnessed by the General Contractor, Owner's Project Manager and authorities having jurisdiction. Adjustments shall be made by the Filed Subcontractors directed by the Owner. At least the following tests shall be performed:
1. Piping hydrostatic tests.
 2. Air and water balancing.
 3. Thermostat control monitoring and testing.
 4. Boiler efficiency testing.
 5. Energy Management System operation.
- J. Electrical Power System Testing: At least the following tests shall be performed. Conform to requirements specified in individual Division 26 Specification Sections. The tests shall be performed and paid for by the Filed Subcontractor and witnessed by the General Contractor, Owner's Project Manager and authorities having jurisdiction:
1. Polarity tests.
 2. Operation of all circuits.
 3. Testing of emergency system.
 4. Security systems.
 5. Generation system.
 6. Grounding systems.
 7. Voice/Video/Data networking testing.
- K. Electrical Lighting System Testing: Conform to requirements specified in individual Division 26 Specification Sections. At least the following tests shall be performed and paid for by the Filed Subcontractor:
1. Operation of every component of entire system.
- L. Fire Alarm System Testing: At least the following tests shall be performed. Conform to requirements specified in individual Division 26 Specification Sections. The test shall be performed and paid for by the Filed Subcontractor and witnessed by the General Contractor, and Owner's Project Manager:
1. All smoke and heat detectors.
 2. Proper operation as required by authorities having jurisdiction.
 3. Reviews and testing as required by the City of Worcester Fire Department.

- M. Where no testing requirements are described but the Owner or Architect/Engineer decides that testing is required, testing shall be performed under current pertinent standards for testing.

1.13 FOLLOW-UP AND CORRECTIVE ACTION

- A. The General Contractor and the Owner will note the test record on the Testing Log to acknowledge test procedures and results. If follow-up or corrective action is needed, the General Contractor shall submit to the Owner two written copies of proposed follow-up or corrective plans and obtain the Owner's written approval before proceeding.
 - 1. Cost of Testing: If tests indicate that materials or work do not comply with requirements, the General Contractor shall pay for all retesting, and shall remove and replace non-complying work at no additional cost to the Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CONCRETE IN SITU RELATIVE HUMIDITY, CALCIUM CHLORIDE AND ACIDITY/ALKALINITY TESTING

- A. Scope:
 - 1. Provide in situ concrete relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings. Includes concrete placed as part of this Work which occurs below grade, above grade (suspended slabs), and slabs on grade.
- B. Scheduling:
 - 1. Testing shall take place after allowing concrete to dry for a minimum of 90 days. Testing to be scheduled no less than one, nor more than three weeks prior to scheduled flooring installation.
 - a. DO NOT conduct testing unless the slab environment is identical to that in which the finished flooring is to be installed.
- C. Test result submittals:
 - 1. Report all test results in chart form listing test dates, time, depth of test well, in situ temperature, relative humidity, moisture vapor and pH levels.
 - 2. List test locations on chart and show same on marked up Floor Plan Drawings.
 - 3. Submit results in duplicate. Deliver copies directly to Architect, Owner's Project Representative and General Contractor.
- D. Testing equipment: shall be equal to the following
 - 1. For relative humidity testing:
 - a. Digital Meter and Calibrated Humidity and Temperature probe kit as manufactured by Vaisala Inc. (Boston Office) 10D Gill Street, Woburn, MA, 01801 (telephone 781-933-4500).
 - 1) Minimum 2-point probe calibration.
 - 2. For calcium chloride testing:

- a. Anhydrous calcium chloride testing in accordance with Rubber Manufacturer's Association (RMA) Test requirements.
 - b. Test kits: Vaprecision, Inc. 2941 West MacArthur Boulevard, Suite 135. Santa Ana, CA 92704 (telephone 800-449-6194).
 3. For pH testing:
 - a. pH test paper by Micro Essential Laboratory, Inc., P.O. Box 100824 4224 Avenue "H", Brooklyn, NY 11210, (telephone 718-338-3618).
 - b. Distilled or de ionized water.
- E. Testing Procedures Quantification of Relative Humidity
 1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting these criteria are not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F), and 50 percent (plus or minus 10 percent) relative humidity. When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be Included with the test report.
 2. The number of In situ relative humidity test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
 3. Drill test holes utilizing a roto hammer drill. Hole diameter shall not exceed outside diameter of the insertable test sleeve by more than 0.04 inch. Drilling operation must be dry. Determine the thickness of the concrete slab from Construction Documents. Depths of test holes shall be as follows:
 - a. For elevated slabs (not poured in pans): Drill test holes to a depth equal to 20 percent of the concrete thickness.
 - b. For slabs on grade and elevated slabs in pans: Drill test holes to a depth equal to 40 percent of the concrete thickness.
 4. Vacuum all concrete dust from test hole.
 5. Insert a hole liner, or sleeve, to the full depth of test hole, assuring that the liner is capped or plugged at the end protruding from the concrete surface.
 6. Permit the test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
 7. Remove the sleeve plug and place a probe into the sleeve assuring that it reaches the bottom of the test hole.
 8. Allow the probe to sit in the test sleeve for 30 minutes before taking readings.
 9. Read and record temperature and relative humidity at the test site.
- F. Testing Procedures - Quantification of Concrete Moisture Vapor Emission through Calcium Chloride Testing.
 1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F) and 50 percent relative humidity (plus or minus 10 percent). When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording

conditions during the test period. A transcript of this information must be included with the test report.

2. The number of vapor emission test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
3. Tests sites are to be cleaned of all adhesive residue, curing compounds, paints, sealers, floor coverings, and similar materials. 24 hours prior to the placement of test kits.
4. Weigh test dish on site prior to start of test. Scale must report weight to 0.1 grams. Record weight and start time.
5. Expose Calcium Chloride and set dish on concrete surface.
6. Install test containment dome and allow test to proceed for 60 to 72 hours.
7. Retrieve test dish by carefully cutting through containment dome. Close and reseal test dish.
8. Weigh test dish on site recording weight and stop time.
9. Calculate and report results as pounds of emission per 1,000 square feet per 24 hours."

G. Testing Procedures Quantification of Acidity/Alkalinity (pH) Level

1. At or near the relative humidity test site and each vapor emission (calcium chloride) test site, perform pH test.
 - a. At each testing site, lay down a loose 2 foot by 2 foot sheet of rubber flooring or non perforated polyethelene sheet backed by plywood. Leave in place for 48 hours.
 - b. Remove rubber sheet/polyethelene and place several drops of distilled or de ionized water onto the concrete surface to form a puddle approximately 1 inches in diameter.
 - c. Allow the water to set for approximately 60 seconds.
 - d. Dip the pH paper into the water and remove immediately, compare color to chart provided by paper supplier to determine pH reading
2. Record and report results.

H. Testing Procedures:

1. Initial testing: Provide 3 tests for the first 1,000 square feet.
2. Add one test for each additional 1,000 square feet.
3. Concrete surface area to be tested shall be completely clean. Remove all adhesives, residue, debris and sealing compounds. Remove all dust by vacuum or other methods. Do not use chemicals of any kind to clean concrete.
4. Perform moisture tests in strict accordance with the kit manufacturer's Instructions. Moisture tests shall remain undisturbed for 60 to 72 hours.
5. Immediately after moisture test has been removed from test area, conduct pH test in area previously covered by plastic dome of moisture test kit.
6. After completion of tests submit 2 copies of test data to the Architect. Submit a copy of the test data to all installers of flooring materials and resinous flooring materials scheduled to be installed.

7. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Perform such additional testing, at no additional cost to the Owner, after procedures have been performed to reduce moisture content to ratings acceptable to the various flooring and coating manufacturers.

End of Section

Program of Structural Tests and Inspections

For compliance with Chapter 17 of the 10th Edition of the
Massachusetts State Building Code

Project: Tufts Vet Tech Clinic Renovation
Location: Worcester Technical High School, Worcester, MA
Owner: Worcester Public School District
Architect of Record: Lamoureux Pagano Associates| Architects, Inc.
Structural Engineer of Record (SER): Bolton & DiMartino, Inc.

This program of structural tests and inspections is submitted as a condition for issuance of the building permit in accordance with 780 CMR 1705.0 of the 10th edition of the Massachusetts State Building Code.

The Structural Engineer of Record (SER) shall review records of all inspections and tests. These tests and inspections shall be furnished to the Building Official, Owner, and Architect of Record by the relevant agencies. The SER shall review inspections and testing reports and shall give written notice of non-conforming work to the Contractor for correction and the Owner's representative. The Program of Structural Tests and Inspections does not relieve the Contractor of his/her responsibility and obligations to comply with the Contract Documents. Furthermore, the results of the Program of Structural Tests and Inspections do not relieve the Contractor of his/her responsibility.

A final report documenting completion of all the required Structural Tests and Inspections and correction of any of the discrepancies noted on interim reports will be submitted by the Structural Engineer of Record to the Building Official, Owner, and Architect of Record prior to the issuance of a certificate of use and occupancy.

Job site safety is solely the responsibility of the Contractor and not the part of Structural Tests and Inspections. Material and activities to be inspected do not include the Contractor's equipment or the means, methods, and procedures used to erect or install the materials or assemblies listed.

Prepared by the Structural Engineer of Record:

Name

Signature Date

Owner's Authorization:

Building Official's Acceptance:

Name (please print)

Name (please print)

Signature Date

Signature Date

Schedule of Structural Tests and Inspections

Worcester Technical High School- Tufts Vet Tech Clinic Renovation Worcester, Massachusetts

The following categories of Structural Tests and Inspections are included in the program for structural tests and inspections for this project. The specific tests and inspections required for each category are listed on the page noted opposite the category.

<u>Division 31</u>	<u>Page</u>
• Controlled gravel fill (prepared fill)	<u>3</u>
• In-situ bearing strata for footings	<u>3</u>
<u>Division 3</u>	
• Cast-in-place Concrete	<u>4</u>
<u>Division 4</u>	
• Unit Masonry	<u>5</u>
<u>Division 5</u>	
• Structural Steel	<u>6</u>
• Steel Deck	<u>6</u>

The following categories are excluded from this Program of Structural Tests and Inspections, since they are designed by other structural engineers not under the aegis of the SER and the SER was not retained to provide performance specifications for their design. These other structural engineers must be assigned by the owner, architect, or construction contractor, as applicable, to be Special SER's for their respective designs and to provide a program of structural tests and inspections for their respective designs.

<u>Division 3</u>	
• Pre-cast Architectural Concrete	
<u>Division 5</u>	
• Cold Formed Metal Framing	
• Metal Fabrications	

The following firms, agencies, or individuals (hereinafter referred to collectively as agents) except for the Geotechnical Engineer, will perform the tests and inspections under the direction of the SER. (The Geotechnical Engineer is responsible for directing the testing and inspection of controlled structural fill, in situ bearing stratum for footings.)

<u>Abbreviation</u>	<u>Agent</u>
SER	Structural Engineer of Record (Listed above)
OIAF	Owner's Inspection Agency - Field
OIAP	Owner's Inspection Agency - Plant
GE	Geotechnical Engineer/Owner's Inspection Agency- Field
FQP	Fabricator's Quality Control Program
CQP	Contractor's Quality Control Program
NR	Not Required
NA	Not Applicable

In-Situ Bearing Strata for Foundations – 31 20 00

Item	Agent	Scope
1. Bearing materials for foundations.	GE	Verify materials below foundations are adequate to achieve the design bearing capacity (GE).
2. Bearing strata for foundations.	GE	Verify excavations are extended to proper depth and have reached proper material for conformance to the structural drawings, specifications, and/or geotechnical report (GE).
3. Bearing surfaces of foundations.	GE OIAF	Inspect bearing surfaces for conformance to the requirements of the structural drawings, specifications, and/or geotechnical report. Observe field conditions for cold weather protection, as required (OIAF). Review OIAF reports (GE).

Controlled Gravel Fill for Building (Prepared Fill) –31 20 00

Item	Agent	Scope
1. Fill Material.	GE OIAF	Perform classification and testing of compacted fill materials for conformance to the requirements to the structural drawings, specifications, and/or geotechnical report (OIAF). Review OIAF reports (GE).
2. Installation of controlled gravel fill	GE OIAF	Provide full-time inspection of installation to verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill (OIAF). Review OIAF reports (GE).

Cast-in-Place Concrete – 03 30 00

Item	Agent	Scope
1. Mix Design.	SER OIAF	Review mix designs for conformance to specifications (SER). Perform plant inspection for use of proper mix proportions and mix techniques (OIAF).
2. Materials Certification	OIAF	Review for conformance to construction documents (OIAF).
3. Batching Plant.	SER OIAF	Review plant certificates and quality control procedures. Perform in-plant inspections as required to insure concrete quality (OIAF). Review OIAF reports (SER).
4. Reinforcing Installation.	SER OIAF	Inspect reinforcing for size, quantity, condition, and placement of reinforcing steel and embedded items for conformance to the contract documents and approved shop drawings (SER, OIAF).
5. Formwork Geometry.	OIAF	Inspect formwork for general conformance with the construction documents (OIAF).
6. Concrete Placement.	SER OIAF	Observe concrete placement operations. Verify conformance to specifications including cold-weather and hot weather placement procedures. During concrete placement, perform slump, density, and air content tests in conformance with construction documents (OIAF). Review OIAF reports (SER).
7. Evaluation of Concrete Strength.	SER OIAF	Perform strength evaluation tests on concrete cylinders in accordance with the construction documents (OIAF). Review concrete test reports for conformance with the construction documents (SER).
8. Curing and Protection.	SER OIAF	Review hot and cold weather protection procedures. After concrete placement, observe curing and protection procedures for conformance with construction documents (OIAF). Review OIAF reports (SER).

Unit Masonry – 04 20 00

Item	Agent	Scope
1. Material Certification.	ARCH SER	Review material certificates for conformance to construction documents (ARCH, SER).
2. Evaluation of Masonry Strength.	SER OIAF	Sample and test the masonry mortar and grout, brick, concrete masonry units, and the concrete prism at the approved frequency for conformance with the construction documents (OIAF). Review test reports for conformance with the specifications (SER).
3. Proportioning, Mixing and Consistency of Mortar and Grout.	OIAF	Inspect field-mixing procedures for conformance to the specifications (OIAF).
4. Installation of Masonry.	ARCH SER OIAF CQP	Inspect unit masonry placement, mortar application, and grouting operations for conformance to the construction documents (ARCH, OIAF, CQP). Review all reports for conformance with the construction documents (SER).
5. Veneer Installation and Attachment to the Back-up Structure.	ARCH OIAF CQP	Observe the installation of the brick veneer, including relieving angles, loose lintels, accessories, and attachments to the back-up structure, for conformance with the construction documents, the approved shop drawings, and the approved sample panels and mock-ups (ARCH, OIAF, CQP)
6. Reinforcement Installation.	SER OIAF CQP	Inspect reinforcing steel for size, quantity, condition and placement for conformance to SER approved submittals and Contract Documents. Inspect welding of reinforcement and review welder's certifications (SER, OIAF, CQP).
7. Weather Protection.	OIAF CQP	Inspect protection for cold and hot weather for conformance with the specifications (OIAF, CQP).
8. Anchorage.	OIAF CQP	Inspect anchorage of masonry to structural members, foundation walls, or other construction, and the installation of embedded items for conformance with the Contract Documents (OIAF, CQP).

Structural Steel – 05 12 00

Item	Agent	Scope
1. Fabricator Certification and Quality Control Procedures.	SER OIAP	Review each fabricator's and welder's certificates and the fabrication shop quality control procedures (OIAP). Review OIAP reports (SER).
2. Fabricator Inspection. (780 CMR 1705.4.2 and 780 CMR R1705.4.2)	FQP OIAP SER	Inspect in-plant fabrication, or review Fabricator's approved Independent Inspection Agency's reports (FQP, OIAP). Review OIAP reports (SER)
3. Material Certification.	FQP OIAP SER	Review steel mill reports for conformance to the specifications (FQP,OIAP, SER).
4. Bolting.	OIAP OIAF FQP	Review field and shop bolting procedures for conformance with the construction documents. Inspect and test all field and shop bolted connections in accordance with specifications and approved shop drawings. Verify bolt size and grade (OIAP, OIAF, FQP). Review reports (SER).
5. Welding.	OIAP OIAF FQPTL	Review field and shop welding procedures for conformance with the construction documents Check welder qualifications. Visually inspect all field and shop welds in accordance with construction documents and approved shop drawings (OIAP,OIAF,FQP). Review reports (SER).
6. Structural Framing, Details and Assemblies.	SER OIAP OIAF	Inspect for size, grade of steel, camber, installation and connection details. Check against approved construction documents and shop drawings (OIAP, OIAF). Review reports (SER).

Steel Deck – 05 31 00

Item	Agent	Scope
1. Manufacturer's Certification and Quality Control Procedures.	SER OIAP	Review the manufacturer's certificates for production and quality control procedures (OIAP, SER).
2. Material Certification.	SER FQP OIAP	Review for conformance to the contract documents (SER, FQP, OIAP).
3. Installation.	SER OIAF CQP	Inspect placement, laps, welds, side lap attachment, and screws or other mechanical fasteners as per approved shop drawings. Check welder qualifications (OIAF, CQP). Review OIAF reports (SER).

Section 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. General requirements for temporary facilities and controls for each site.
- B. Temporary utilities.
- C. Construction facilities.
- D. Temporary construction.
- E. Construction aids.
- F. Vehicular access and parking.
- G. Temporary barriers and enclosures.
- H. Staging and scaffolding
- I. Site and environment controls.
- J. Temporary protection from moisture, mold and dust.
- K. Fire prevention measures.
- L. Security measures.
- M. Project identification and temporary signage.
- N. Removal of temporary utilities, controls, and facilities.

1.2 GENERAL REQUIREMENTS

- A. The General Contractor shall provide and maintain all temporary facilities, controls, and construction aids as specified herein, until they are replaced by permanent work, or until Project Substantial Completion, as appropriate.
 - 1. Additional temporary facilities and controls which may be specified under individual Trade Contract sections are the responsibility of the respective Trade Contractors.
 - 2. Temporary facilities removed from the Project shall remain the property of the General Contractor, except as otherwise specified.
 - 3. Contractor work space offices to be installed on site for necessary services, off-site, or in the project construction space as required due to the constrained site. General Contractor to provide a logistics plan, per phase, including use of the building during the school year and during vacation periods.
 - 4. Contractor may utilize an area within the work zone inside the building and fit out as required, as long as this does not interfere with the project work and normal school operations.
- B. Except where specifically noted otherwise, cost or use charges for temporary facilities, utility services, controls, and construction aids and similar items specified in this Section or

as required to perform the Work, are not chargeable to the Owner or Architect, and will not be accepted as a basis of claims for a Change Order.

- C. Establish and initiate use of each temporary facility at time first reasonably required for proper performance of the Work. Terminate use and remove facilities at earliest reasonable time when they are no longer needed, or when permanent facilities have, with authorized use, replaced the temporary facilities.
 - 1. Locate temporary facilities where they will serve Project adequately and result in minimum interference with performance of the Work.

1.3 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.
 - 2. Schedule showing implementation and termination of each temporary utility within 15 days of commencement of the Work.
 - 3. Shop drawings:
 - a. Temporary signage.
 - b. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A 10 - Safety Requirements for Construction and Demolition.
 - 2. NFPA 70 - National Electrical Code.
 - 3. NFPA 241 - Building Construction and Demolition Operations.

1.5 TEMPORARY WEATHER PROTECTION

- A. Definition of Weather Protection: "Weather Protection" means temporary protection of work that may be adversely affected by moisture, cold, heat, and wind by the use of temporary covers, enclosures, and heat. Maintain at least the minimum temperatures specified. Comply with specific requirements which are specified within individual Specification sections.
 - 1. Temperature at the working surface shall be at least forty degrees Fahrenheit (40 degrees F). This provision does not supersede any specific greater requirements for methods of construction of curing of materials.
 - 2. General Contractors Responsibilities:
 - a. The General Contractor shall furnish and install all "weather protection" required for ongoing and in-place work related to the building envelope. The General Contractor is responsible to ensure that protection is provided for the building, including all adjacent school spaces and all materials and equipment from weather at all times.
 - b. At completion of work, the General Contractor shall remove temporary weather protection and restore all surfaces.

3. Trade Contractors Responsibilities: Individual Trade Contractors (including Masonry and Roofing and Flashing Trade Contractors, refer to 00 73 00 – SUPPLEMENTARY INSTRUCTIONS TO BIDDERS for additional requirements) are responsible for all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions and when winter conditions are encountered.
 - a. The General Contractor shall provide temporary heat for all Trade Contractor enclosures.
 4. Proposed Plan: The General Contractor shall within 30 calendar days after Award of Contract, submit three copies of a typewritten proposed plan for “Weather Protection” and obtain the Architect’s and Owner’s written approval.
 5. Reporting Requirements:
 - a. Within thirty (30) calendar days after Contract award, the General Contractor shall submit in writing to the Owner for approval, three copies of its proposed plan for weather protection.
 - b. The General Contractor shall furnish and install accurate Fahrenheit thermometers at places designated by the Owner to determine whether the required temperature is being maintained.
 6. Weather protection materials, equipment, and the installation thereof, shall comply with all the safety rules and regulations including provisions for adequate ventilation and fire protection devices.
 7. Use of Permanent Heating System(s): The General Contractor may choose, if the Owner approves, to use the existing heating systems, permanent heating system for temporary heat after the building is enclosed and the system has been tested and is ready to operate.
 - a. The HVAC Trade Contractor shall thoroughly clean and restore to first class condition, acceptable to the Owner, all portions of the permanent heating system that are used for heating during construction.
 - b. Use of the permanent heating system for weather protection shall not affect any heating system guarantee that may be due to the Owner; such guarantee shall begin to run only when the Owner accepts the building.
 - c. The use of any existing permanent heating systems shall not interrupt or negatively affect adjacent occupied spaces that are not included in the scope of work.
- B. Additional weather protection requirements: The General Contractor is responsible to ensure that the protection is provided by for the building interior and all materials and equipment from weather at all times (year round).
1. Where removal of roofing, roof sheathing, windows, doors, and other items is necessary to accomplish work, have materials and workmen ready to provide adequate and approve temporary covering of exposed areas.
 2. Temporary coverings shall be attended as necessary to insure effectiveness and to prevent displacement.
 3. General Contractor shall repair or replace all elements of the building damaged by failure to properly protect them from the weather to the satisfaction of the Architect at no additional cost to the Owner.

1.6 TEMPORARY UTILITIES, GENERAL REQUIREMENTS

- A. General Installation: Install temporary utility service(s), or connect to existing service(s) as indicated, and as specified. Comply with all applicable laws, regulations, and requirements of authorities having jurisdiction.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.7 TEMPORARY UTILITIES, ELECTRICITY

- A. Temporary electricity: The Owner will pay for electrical energy required for temporary light and power, only to the degree it is available on site for the Project while under construction. Additional requirements are specified under Division 26 - ELECTRICAL, and as follows:
 - 1. Electric power service: The electrical contractor shall provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics. Include, transformers, overload protected disconnects, automatic ground-fault interrupters and distribution switch gear. Location of the connection to the existing service shall be as coordinated, and approved by the owner.
 - a. Heavy electrical loads such as welding and other equipment with similar special power requirements must be powered by individual installers using portable electric generators at each users own cost.
 - 1) Except as otherwise specifically provided, all additional costs resulting from such use shall be borne by the General Contractor.
 - 2. Distribution: A grounded receptacle (outlet) for an extension cord shall be provided by the Electrical Trade Contractor within one hundred (100) feet of any part of the building. Individual users are responsible for their own work lamps and extension cords.
 - 3. Removal of the connections and all temporary service connections by the electrical contractor after the permanent power is permitted

1.8 TEMPORARY UTILITIES, LIGHTING

- A. Temporary lighting: The Electrical Trade Contractor shall provide lighting with local switching to fulfill security requirements and provide illumination for construction operations and traffic conditions. Maintain lighting, replace broken lamps and provide routine repairs.
 - 1. Temporary lighting shall be based on the following requirements:
 - a. Rooms or spaces under 250 square feet: Two 100 watt lamps.
 - b. Rooms or spaces over 250 square feet and under 500 square feet: Four 100 watt lamps.
 - c. Rooms or spaces 500 square feet and over: Two 200 watt lamps for spaces 500 to 1000 square feet, and two 200-watt lamps for every additional 1,000 square feet or fraction thereof.
 - d. Provide sufficient additional fixtures and lamps to insure proper lighting in stairwells, corridors and passage areas.
 - 2. Lamps: The Electrical Filed Sub-bid Contractor shall furnish and install all lamps, both initial and all required replacements until the date of Substantial Completion.
 - 3. Use of permanent lighting fixtures.
 - a. Permanent building lighting may be utilized during construction.

- b. Permanent lighting fixtures which have been used during Construction shall be thoroughly cleaned by the Electrical Filed Sub-bid Contractor.
 - c. Immediately prior to the Architect's inspection for Substantial Completion the Electrical Filed Sub-bid Contractor is required to replace all lamps, which are broken, burned out or are producing reduced light output (darkened).
- B. Protective any additional night lighting required and provide required outdoor lighting to illuminate the construction areas, staging, stockpiles, trenches, dangerous projections, excavations and similar conditions and as additionally required to protect the safety of workmen, other personnel, and the public and as an aid in the protection against theft and vandalism.
 - 1. Shield lighting to protect overflow beyond Contract limits, protect neighbors from night light overflow.
 - 2. Existing site lighting to remain

1.9 TEMPORARY UTILITIES, INTERNET

- A. Temporary internet service: Provide internet service at time of project mobilization, and pay all costs for installation, maintenance, and removal. The General Contractor shall pay service charges through date of Substantial Completion.
 - 1. For General Contractor's Field Office, General Contractor shall provide and maintain internet and email service. Internet service shall include e-mail account allowing a minimum of 10mb attachments to ensure exchange of all construction related e-mail to General Contractor's field office. Provide WIFI capability as [part of internet service.

1.10 TEMPORARY UTILITIES, WATER

- A. Temporary water: The General Contractor shall provide and maintain water service and distribution piping of sizes and pressures adequate for construction, including water meter and hose bib(s) at location(s) to be determined by General Contractor so that water is available throughout the construction by the use of hoses.
 - 1. Coordinate connection to the existing system with the owner
 - 2. Provide shutoffs and backflow preventors as required
 - 3. Protect piping and fittings against freezing.

1.11 TEMPORARY HEATING AND COOLING

- A. Temporary heat: Provide heat for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Provide vented self-contained equipment that is UL approved and acceptable to local fire department. Within the building, Use of propane, gasoline-burning space heaters, open flame, or salamander type units is prohibited.
 - 1. Vent heaters directly to outside air, in areas where concrete is less than 15 days old.
 - 2. In enclosed areas, maintain a minimum temperature of 50 degrees Fahrenheit; provide higher temperatures where required by individual specification sections. General Contractor is required to provide enclosures necessary to maintain specified temporary heat.
 - 3. Permits from the fire department is required for self-contained units.

1.12 TEMPORARY VENTILATION AND HUMIDITY CONTROL

A. General:

1. Humidity Control: Monitor and regulate relative humidity as required for the installation of all interior products. Relative humidity shall be maintained within the limits set by manufacturers of all interior materials and equipment. Refer to individual specification sections in Divisions 6, 8, 9, 10, 11 and 12 for additional environmental requirements.
 - a. General Contractor shall enclose interior work areas, protect from weather, and maintain specified temperature and humidity prior to commencement of construction activities relating to interior finishes.
2. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.
 - a. During construction, General Contractor shall meet or exceed the minimum requirements of the SMACNA IAQ Guideline for Occupied Buildings under Construction, 2008 edition.

B. Monitor Humidity: Provide Hygrometer to measure temperature and relative humidity in each construction area.

1. Provide dehumidifier(s), as required to maintain humidity of enclosed areas below 70 percent. Humidity level shall be maintained in all areas where interior finish work is being performed, and all areas where interior finishes has been completed.
2. Provide fans as specified herein, and as required to eliminate significant variation in humidity levels within enclosed spaces.

C. Temporary Construction Ventilation: General Contractor shall maintain sufficient temporary ventilation of areas where materials are being used that emit VOC's and maintain ventilation continuously during installation and until emissions dissipate after installation. If continuous ventilation is not possible via the building's HVAC system(s) then General Contractor shall supply ventilation via open windows and temporary fans, sufficient to provide no less than three air changes per hour.

1. Vent all areas directly to outside. Areas shall not be vented to other enclosed areas.
2. During dust producing activities (e.g. drywall installation and finishing) General Contractor shall turn off ventilation system and protect openings in supply and return HVAC system from dust infiltration. Provide temporary ventilation as required.
3. Dissipation of VOC's: The period after installation shall be sufficient to dissipate odors and elevated concentrations of VOCs. A minimum time period of 72 hours is required except where longer periods of time are specified under individual specification sections.

D. Preconditioning: Prior to installation, General Contractor shall allow products which have odors and VOC emissions to off-gas in dry, well-ventilated space outside of building for 14 calendar days, in order to allow for reasonable dissipation of odors and emissions.

E. Storage and fabrication sheds: Provide as required, sheds, equipped to accommodate materials and equipment involved.

1. Trade Contractors and subcontractors are responsible for their own storage facilities, coordinate locations.

- F. Maintain approach walks to field office and storage/fabrication sheds free of mud, water, and snow.
- G. When permanent facilities are enclosed with operable utilities, relocate offices and storage into building, with written agreement of Owner, and remove temporary buildings.

1.13 FIELD OFFICES AND SHEDS

- A. General:
 - 1. Availability: Provide General Contractor's Field Office. Provide offices ready for occupancy within 15 days after date fixed in Notice to Proceed.
 - 2. Field offices: Provide furnished, insulated, weathertight, office(s) which shall be portable or mobile building(s), or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.
 - a. Securely support trailer on temporary masonry or preservative treated wood piers and not on trailer wheels. Anchor trailer to prevent overturning due to wind or other causes.
 - 3. Location: The location of the field office(s) and storage areas for equipment and materials shall be upon cleared portions of the job site or areas to be cleared, and shall require review and written acceptance of the Architect. Submit plans showing field office and storage facilities for equipment and materials for acceptance by the Architect.
 - a. Offices and sheds located within the construction area, or within 30 feet of building lines shall be of noncombustible construction. Comply with requirements of NFPA 241.
 - b. Construction of offices shall have sound insulation adequate to exclude sounds of routine construction activities and reduce server noise to less than 70 dB.
 - c. Access to trailer shall conform to Massachusetts Regulation 521 CMR - Architectural Access Board.
 - 4. General:
 - a. General Contractor shall provide periodic cleaning and maintenance of field offices and storage areas.
 - b. Provide air conditioning and heating to maintain a temperature range of 65 to 78 degrees F.
 - c. Provide sufficient lighting for 50 foot candles at desk top level over 100 percent of floor area.
 - d. Excluding computer, computer software and related equipment all other non-consumed furnishings and equipment, will be returned to General Contractor upon project completion.
- B. General Contractor's field office(s): Provide habitable office(s) or space, of size to accommodate personnel, include as a minimum the following:
 - 1. Size: General Contractor field office shall be adequate in size office trailer. Sectioning of trailer shall be as required by General Contractor. Each section of trailer shall have direct access to an exterior locking door and a communicating door.
 - 2. Furnishings:
 - a. Conference table of sufficient size with seating to accommodate personnel and anticipated visitors.

- b. Racks and files for Contract Documents, submittals and Project Record Documents.
 - c. Maintain a complete set of current project drawings and specifications at this office at all times. Maintain a file with all approved shop drawings, permits and other data pertinent to the Work.
- 3. Outdoor weather thermometer with high/low readings.
- 4. Hard-hats for site visitors.
- 5. Duplex convenience outlets, at least one per wall.
- 6. Telephone and internet service as specified herein above.
- 7. Other equipment and furniture as the General Contractor deems necessary.
- 8. Maintenance: The General Contractor shall maintain all field offices, equipment and furnishings in a clean and orderly condition, including but not limited to washing the floors, bathrooms and trash removal once per week, performed by a professional bonded and insured cleaning service.
- 9. Trailers to be relocated as required by the General Contractors phasing plan, and recommended that the IT services space in the building at the Ground floor can be used at the later phases for the GC offices through the end of the field construction, or other location as approved by the Owner/Architect. Should space in the building be utilized for field offices, or construction use, these spaces are to be to be completely finished or re-finished to new after use, and returned to the City.
- 10. High Speed Internet Connection: Provide the following High Speed Internet Connection and related equipment:
 - a. Internet connection shall be dedicated for the use of the occupants of this office space only, and shall not be shared with other office spaces, or outside users without permission of the Architect.
 - b. High Speed Internet Connection to be fully configured and operational on all computer workstations specified in section j. Owner's Site Office Technology.
 - c. Routers with built-in wireless must have wep encryption configured and turned on. WEP key information shall be provided to the Architect.
 - d. Provide surge protector for all Internet access/network equipment.
 - e. Provide Architect with all account numbers, user names, and passwords applicable to the ISP agreement, as well as support contact information such as Toll-Free and 24/7 support phone numbers for said ISP for use in contacting the ISP during times of apparent lack of connectivity.
 - f. General Contractor shall advise it's subcontractors of the location of any wires or cables associated with high-speed internet and power connections to the Owner's Field Office to avoid disruption of service during construction or site work.
- 11. Printers, Copiers, and consumables: Provide as required
- 12. Data Cabling: Provide data cabling as required:
- C. Storage and fabrication sheds: Provide as required, sheds, equipped to accommodate materials and equipment involved.
 - 1. Trade Contractors and subcontractors are responsible for their own storage facilities, coordinate locations.

- D. Maintain approach walks to field office and storage/fabrication sheds free of mud, water, and snow.
- E. When permanent facilities are enclosed with operable utilities, relocate offices and storage into building, with written agreement of Owner, and remove temporary buildings.

1.14 SANITARY FACILITIES

- A. One existing exterior single-occupant portable toilet unit is located adjacent to the work area and will be available for use by the contractors. If the contractors require additional sanitary facilities, they shall be furnished and maintained as described herein.
- B. Sanitary facilities: Provide self-contained single-occupant chemical toilet units, wash facilities and drinking water fixtures.
 - 1. Locate sanitary facilities within the fenced construction zone.
 - 2. Permanent facilities located in completed work may not be used by the General Contractor's personnel.
- C. Provide toilet tissue, paper towels, paper cups, cleaning compounds and similar materials.
- D. Maintain facilities, throughout term of construction, and keep clean, provide covered waste containers for used material.

1.15 CANTEEN SERVICES

- A. Canteen vehicles must access the worksite at predetermined times coordinated with the Owner, and are limited to service within the construction site only.

1.16 FIRST AID AND FIRE EXTINGUISHERS

- A. First aid supplies: Comply with governing regulations.
- B. Fire extinguishers: Provide and maintain on site, adequate fire extinguishers UL rated for A-B-C type fires. Provide red-painted plywood standards for each extinguisher. Additionally provide a dry chemical fire extinguisher at each location where welding, torch cutting and other similar hazardous work is in progress.
 - 1. At welding and heat cutting work: Provide not less than a Multi-purpose dry chemical type (mono ammonium phosphate) fire extinguisher, 20 pound capacity, multi-purpose rated "2A, 120 B:C".

1.17 CONSTRUCTION AIDS - USE OF PERMANENT ELEVATORS

- A. Temporary use of elevator(s): Use of the permanent elevators during construction for the transportation of personnel and material shall not be permitted.

1.18 VEHICULAR ACCESS AND PARKING

- A. Vehicular access: Construct temporary all-weather access roads from public thoroughfares to serve construction area, of a width and load bearing capacity to provide unimpeded traffic for construction purposes.
 - 1. Extend and relocate as Work progress requires, provide detours as necessary for unimpeded traffic flow.
 - 2. Locate access roads where acceptable to Architect/Engineer.

- B. Provide and maintain access to fire hydrants free of obstructions. Provide unimpeded access for emergency vehicles. Maintain 20 foot width driveways with turning space between and around combustible materials.
 - Arrange for off-site parking areas as needed to accommodate construction personnel with General Contractor, Awarding Authority and the City of Worcester as applicable.
- C. Snow and ice removal: Maintain all vehicular and pedestrian access roads and walkways free from ice and snow during the winter season for the duration of the Project.
- D. Towing Services: Make arrangements to have illegally parked and stopped vehicles towed. Post conspicuous warning signs. Obtain approval of signs from authorities having jurisdiction.
- E. Prior to Substantial Completion, the installed base for permanent roads and parking areas may be used for construction traffic.
 - 1. Avoid traffic loading beyond paving design capacity.
- B. Prior to Substantial Completion, the installed base for permanent roads and parking areas may be used for construction traffic.
 - 1. Avoid traffic loading beyond paving design capacity.
 - 2. Permanent parking structures and final paved areas may be used by construction personnel on execution of agreement with the City of Worcester.

1.19 VEHICULAR TRAFFIC CONTROL

- A. The General Contractor shall not close or obstruct any portion of any street public or private, without obtaining permits therefore from the proper authorities.
 - 1. Provide and pay for police traffic details at anytime that construction takes place in a public street (right of way). The General Contractor is responsible for coordinating, requesting, and paying the prevailing rate of wage for police traffic details directly with the City of Worcester Police Department.
- B. The school campus is active for school operations from approximately 7:00am through 10:00pm, Monday through Saturday. The General Contractor shall not obstruct any portion of on-site school related or emergency vehicle traffic at any time. Any roadway work shall be coordinated with the owner at least seven (7) days in advance and have the owner's written approval prior to beginning the related work.
- C. Construction parking control: Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Owner's operations, or construction operations.
 - 1. Monitor parking of construction personnel private vehicles. Maintain free vehicular access to and through parking areas. Prohibit parking on or adjacent to access roads, or in non-designated areas.
- D. Vehicle and Equipment Security: Lock all unattended vehicles including construction machinery and equipment. Do not leave vehicles or equipment unattended accessible to public with the motor running, or with keys easily accessible.
- E. Traffic signals and signs: Provide, operate and maintain temporary equipment, services, and personnel, with traffic control and protective devices, as required to direct and maintain an orderly flow of traffic in all areas under General Contractors control, or affected by

General Contractors operations, including but not limited to haul routes, at site entrances, at on-site access roads, and parking areas during construction.

1.20 DUST CONTROL

- A. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
 - 1. Take all necessary measures and provide equipment and materials to minimize dust from rising and blowing across the site and also to control surface water throughout the operation so that it does not run onto paved ways without being filtered. Control all dust created by construction operations and movement of construction vehicles, both on site and on paved ways.
 - 2. During the progress of the work, maintain the areas of construction activities including sweeping and sprinkling of streets as necessary. Provide and use calcium chloride for more effective dust control, when deemed necessary by regulatory agencies, without additional cost to the Owner.
- B. Construction Entrances: maintain construction entrances
- C. Prevent air-borne dust from dispersing into ducts (air supply and return) during construction. Seal all open ends of completed ductwork, and overnight work-in-progress. Inspect ducts on daily basis to ensure seals are intact. Protect ductwork waiting, to be installed with surface wrapping.
 - 1. Ductwork protection during construction is a joint responsibility between the General Contractor and HVAC Filed Sub-bid Contractor.
 - 2. HVAC Filed Sub-bid Contractor is responsible to wipe down internal surfaces of ductwork immediately prior to installation to remove all dust and debris.
- D. Prevent air-borne dust from dispersing into occupied spaces. Provide interior dust-tight temporary partitions as specified under the Article entitled "Interior enclosures".
 - 1. Provide air filters over openings and grilles in air-return ducts occurring within construction areas.
 - 2. Provide openings in temporary partitions where air-return grilles occur outside of work areas. In each opening, provide standard 2 inch thick, throw-away type filter having a rated efficiency of 35 percent. Review with Architect size requirements of filtered openings, locations of openings and how many are required.
 - 3. Replace air filters as required to maintain their efficiency.

1.21 NOISE CONTROL

- A. Develop and maintain a noise-abatement program and enforce strict discipline over all personnel to keep noise to a minimum.
- B. Execute construction work by methods and by use of equipment which will reduce excess noise.
 - 1. Equip air compressors with silencers, and power equipment with mufflers.
 - 2. Manage vehicular traffic and scheduling to reduce noise
- C. Interior work involving cutting, drilling, hammering or noise generating procedures shall be completed during times schedule with the Owner in advance.

1.22 TEMPORARY BARRICADES

- A. Provide barriers and barricades to prevent unauthorized entry to construction areas.
 - 1. Comply with standards and code requirements for erection of barricades, where required provide lighting, including flashing lights.
 - 2. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against.
 - 3. Provide special barriers necessary to protect entrances and areas around building and to prevent persons from coming in contact with material or construction operations.
- B. Provide temporary enclosures, as required, for protection of construction from exposure to weather, other construction operations and similar activities. Where heat is needed and the building envelope is incomplete, provide enclosures where there is no other provision for containment of heat.
 - 1. Provide doors with self-closing hardware and locks.
 - 2. Provide barricades and protective entrances at least 48 inches high around openings in floors, and elevators.
- C. Provide temporary roofing as needed to maintain the building water tight.

1.23 TEMPORARY FENCES

- A. Construction fence: Provide a 6 foot high commercial grade chain link fence around construction site; equip with vehicular and pedestrian gates and locks.
 - 1. Relocation of all fences and gates as required due to construction phasing. Relocations shall be provide at no additional cost to the Owner.
 - 2. Vehicular and Pedestrian Gates: Build into fence at approved locations. Provide gates with cross-bracing, and hung on heavy strap hinges with post and hook for double gates. Provide heavy hasps and padlocks.
 - a. Provide a set of keys to Owner's Project Manager to facilitate emergency access.

1.24 HOISTING, STAGING, AND UNLOADING

- A. Subcontractors are responsible for provision of all hoisting, staging, bracing, scaffolding, and rigging required for completion of their work. Subcontractors shall comply with applicable laws and regulations regarding construction of staging, operation of lifts, and any other applicable requirements.
- B. Subcontractors shall provide manpower and equipment necessary to accept delivery, unload, store as directed by the General Contractor, protect, provide security, distribute, install in sequence directed by the General Contractor, and clean any materials, systems and equipment furnished and installed by the subcontractor. Subcontractor shall provide the same except for the furnishing of materials to a common offloading point on site for any materials furnished by others and installed under the scope of work of subcontractor. Subcontractor shall document receipt of all materials, systems and equipment on forms acceptable to the General Contractor.
- C. Take note of building access and make provisions to ensure that equipment and materials will fit through permanent doorways and or structure. Any work required to create openings such as removal of doors/windows or walls in areas where equipment will not fit through openings shall be paid for by the contractor requiring the opening/access.
- D. Shared staging will be provided in the auditorium for above ceiling work at an elevation determined by the GC for a maximum of 5 months. All above ceiling work shall be

- completed prior to scheduled scaffold removal date.
- E. Any contractor requiring a crane on site must have an FAA permit.
- F. Hoisting onto the occupied building during normal school hours will not be permitted. All hoisting shall be coordinated with the owner at least seven (7) days in advance by the general contractor. Hoisting shall not begin until the owner's written acknowledgement is provided to the General Contractor.

1.25 POLLUTION CONTROL

- A. Provide methods, means, and facilities required to prevent contamination of soil, water, or atmosphere by, the discharge of noxious substances from construction operations.
 - 1. Comply with all applicable Federal, State, County, and municipal laws regarding pollution.
 - 2. Prevent pollution of streams, lakes, or reservoirs with fuels, oils, bitumens, calcium chloride, acids, waste products, effluents, chemicals or other harmful substances. Prevent from such substances from entering storm drains and sanitary sewers.
- B. Provide equipment and personnel, perform emergency measures required to contain any spillage and to remove contaminated soils or liquids.
 - 1. Excavate and legally dispose of any contaminated earth off-site, and replace with suitable compacted fill and topsoil.

1.26 EROSION AND SEDIMENT CONTROL

- A. General: Comply with requirements with Division 31 – EARTHWORK and as specified herein. The more stringent requirements shall apply.
 - 1. Obtain all required permits from authorities having jurisdiction regarding erosion control and silt fence.
- B. Erosion and sediment control: Provide an erosion and sediment control program for minimizing erosion and siltation during the term of construction. The following minimum erosion control principles shall apply to the land grading and construction phases:
 - 1. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - a. Stripping of vegetation, grading, or other soil disturbance shall done in a manner which will minimize amount of bare soil exposed at one time. Whenever feasible, natural vegetation shall be retained and protected.
 - b. Erosion control devices shall be installed as early as possible in the construction sequence prior to start of clearing and grubbing operations and excavation work.
 - c. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
 - 2. Sediment shall be retained on-site. Temporary erosion protection shall be accomplished by covering land with erosion protection materials, as appropriate for prevailing conditions.
 - a. Use baled hay or straw to trap sediment and prevent sediment from clogging drainage systems. Handle baled units in manner to prevent from breaking apart.
 - b. Locate baled hay or straw where required and as directed by the Architect and stake bales to prevent overturning, flotation, or displacement.
 - c. Remove deposited sediment periodically.

- d. Temporary seeding, mulching, or other suitable stabilization measures, shall be used to protect exposed critical areas during prolonged construction or other land disturbance, where the period of exposure will be greater than two (2) months.
- 3. Drainage provisions shall accommodate increased runoff resulting from modifications of soil and surface conditions during and after development or disturbance. Such provisions shall be in addition to existing requirements.
 - a. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
- 4. Cut and fill slopes and stockpiled materials shall be protected to prevent erosion.

1.27 PEST CONTROL

- A. Provide rodent control as necessary to prevent infestation of construction and storage areas. Employ methods and use materials which will not adversely affect conditions at the site or on adjoining properties.

1.28 FIRE PREVENTION MEASURES

- A. Prior to commencement of work at the site, General Contractor shall develop and implement a safety plan in accordance with NFPA 214 and meet with the Local Fire Marshal to review the plan.
- B. NFPA plan in accordance with the AHJ, must be prepared by a licensed professional, and be stamped and signed
 - 1. Plan site and building access in the event of fire.
 - 2. Access paths for heavy fire fighting equipment shall be laid out and maintained.
 - 3. Free access from streets to fire hydrants and to outside connections for standpipes, sprinklers or other fire extinguishing equipment shall be provided and maintained.
- C. The General Contractor shall take all necessary precautions for the prevention of fire during construction. Install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, and other access routes. Ascertain and comply with requirements of Project insurance carrier, local fire department and the state fire marshal.
 - 1. Maintain the area within contract limits orderly and clean.
 - a. Remove combustible rubbish promptly from the site and when required, store combustible materials in containers in fire-safe locations.
 - 2. Maintain clear access to exits from within the building.
 - 3. Smoking is not permitted in the building or adjacent areas.
- D. Establish procedures for fire protection for welding, cutting and open torch work, and other potentially hazardous operations. Obtain permission from local authorities having jurisdiction for such work as required by law. Provide special fire extinguishers at welding and torch cutting work.
 - 1. After Owner occupancy or partial occupancy: Maintain a fire watch when fire protection and warning systems have been temporarily de-activated. Maintain watch during all working hours for full period of de-activation.

2. The General Contractor will assign personnel to inspect all construction areas at the end of each day's work for fire hazards prior to lock-up.
- E. Provide for outside storage of gas tanks, sufficiently clear of any structure. Promptly remove welding and cutting equipment from the building when no longer required. Do not store welding or cutting materials within the building when work is not being performed.
- F. Permanent fire protection system may be activated to meet these requirements. Replace fusible link heads and other expended or discharged components at time of Substantial Completion.

1.29 SECURITY MEASURES

- A. Protect Work, and Owner's, operations from theft, vandalism, and unauthorized entry.
- B. Initiate a security program in coordination with Owner's, existing security system at job mobilization.
 1. Maintain security program throughout construction period until Owner acceptance precludes the need for General Contractor security
- C. Provide entry control:
 1. The General Contractor shall ensure all workers have completed the Worcester Public Schools' CORI form process and confirm they are not restricted from accessing the school premises. There shall be an on-site log of workers that have completed the process. Any worker not listed in the log may be required to leave the premises immediately.
 2. Restrict entrance of persons and vehicles into Project Site.
 3. Allow entrance only to authorized persons with proper identification.
 4. Maintain a daily log of workmen and visitors, make available to Owner on request.
 5. Owner will control entrance of persons and vehicles related to Owner's operations.
 6. Coordinate access of Owner's personnel to site in coordination, with Owner's security forces.
- D. Do not allow cameras on site or photographs taken except by written approval of Owner.

1.30 PROJECT IDENTIFICATION AND TEMPORARY SIGNAGE

- A. General: Signs other than those specified herein are not permitted, except those required by law or expressly authorized by the Owner.
 1. At all times during the project, signage must clearly direct occupants and the general public in the safe use of the building. Signs must clearly indicate areas of no admittance and further must clearly define and direct users to building entries, exits, and other important destinations.
 - a. All such interim signage must be painted by a professional sign painter on 3/4-inch medium density overlay plywood with letters no less than 3 inches in height.
 - b. Coordinate required signage with Architect/Engineer.
- B. Project sign:
 1. Provide one 8-foot wide by 4-foot-high foot project sign of exterior grade MDO plywood and wood frame construction, painted, with self-adhesive color printed text with reproduction of building rendering. Architect will provide signage design.

- a. Color prints for rendering shall be 3M Scotchprint marking film series 8640 or equal, 4 mil thickness, "ControlTac" vinyl film as manufactured by 3M company having a positionable pressure activated pigmented adhesive.
 - b. Overlay protecting film, Scotchprint Film, clear overlaminating film, as manufactured by 3M company.
- 2. Project sign shall include title of project, and names of Owner, Architect, professional subconsultants, General Contractor.
- 3. Project sign shall additionally include statement that project is partially funded by the donors as provided to the contractor
- 4. Erect on site at location established by Owner/Architect.
- C. Signage at perimeter of construction site: Provide clear and visible warning signage with appropriate language such as: "Prohibited Access – Hard Hat Only – No Admittance – Authorized personnel Only".

1.31 REMOVAL OF TEMPORARY UTILITIES, CONTROLS, AND FACILITIES

- A. Remove temporary materials and construction prior to Substantial Completion.
 - 1. Do not remove erosion control devices until after all disturbed earth has been paved or vegetated.
- B. Remove underground work and compacted materials to a depth of 2 feet; fill and grade site as specified.
- C. Restore permanent facilities used during construction to specified condition.
- D. Clean and repair damage caused by installation or use of temporary work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Definition of Terms
- B. Basic product requirements.
- C. General environmental requirements for products.
- D. Recycled content of materials.
- E. Regional materials.
- F. Sustainable wood, chain of custody.
- G. Owner furnished products.
- H. Product delivery and handling requirements.
- I. Product storage and protection requirements.
- J. Construction waste management.

1.2 RELATED SECTIONS

- A. Section 01 25 13 –PRODUCT SUBSTITUTION PROCEDURES:
 - 1. Product options.
 - 2. Product substitution procedures.

1.3 DEFINITION OF TERMS

- A. "Products" is defined as new material, machinery, components, equipment, fixtures, and systems used in the Work. Products do not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for re-use.
- B. "Materials" are products that are shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
- C. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.
- D. Definitions in this article are not intended to negate the meaning of other terms used in Contract Documents, including "specialties", "systems", "structure", "finishes", "accessories", "furnishings", "special construction", and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

1.4 BASIC PRODUCT REQUIREMENTS

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
 - 1. Where possible utilize materials harvested and manufactured regionally, within a 500-mile radius of the project site. Refer to Regional Materials Article herein this Section.
- B. To the fullest extent possible, provide products of the same kind, from a single source.
- C. Provide interchangeable components of the same manufacturer, for similar components.
- D. When the General Contractor has the option of selecting two or more products, ensure that products selected shall be compatible with products previously installed or approved.
- E. Provide all products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
- F. Galvanic Corrosion: Install materials in manner which will effectively isolate dissimilar metals which may potential for galvanic corrosion. Use non-absorptive dielectric material, isolation coatings, or other protective isolator approved by Architect.
- G. Fasteners, Anchors, and Connections: Provide all fasteners, anchors, and connections needed to safely, securely, and appropriately secure all Work permanently in place.
 - 1. General: The Contractor is solely responsible for the capacity, suitability, adequacy, and safety of all welded, fastened and anchored connections.
 - a. Comply with applicable code requirements regarding fastener selection and installation.
 - b. Provide at least two fasteners for each individual item being fastened.
 - c. Utilize fastener manufacturer's published load tables for working loads to assist in determining fastener size and space. Do not use ultimate load capacity in determining fastener selections.
 - d. Provide a minimum safety factor of 4.
 - e. Select and utilize fasteners having minimum galvanic corrosion factor.
 - f. Hydrogen embrittlement prevention:
 - 1) Do not use high-strength and low-alloy fasteners which have been subjected to an acid pre-treatment (because they can become brittle and fail), utilize instead equivalent capacity and size bi-metal, stainless steel or high strength aluminum fasteners, as appropriate to the conditions and materials where being used.
 - 2) Utilize low-hydrogen electrodes for welding high-strength steels to prevent hydrogen embrittlement.
 - 2. To permit the General Contractor control over means and methods, some fastener conditions may not be fully defined in the Contract Documents. In particular, individual specification sections that require delegated independent engineering. In such instances the General Contractor is fully responsible to determine method of fastening appropriate for each condition. The General Contractor shall take into consideration substrate material(s) and product(s) being fastened, live and dead loading, and both atmospheric and visual exposure considerations. General Contractor is responsible to determine fastener type, material, finish, size, diameter, length and spacing.

3. Torque structural fasteners as recommended by fastener manufacturer, or as otherwise specified in the Contract Documents.
 4. The General Contractor is solely responsible for the capacity, suitability, adequacy, and safety of all welded, fastened and anchored connections.
- H. Permanent Labels and Nameplates:
1. Restrictions:
 - a. Do not provide labels, nameplates, or trademarks which are not required by code, or regulations.
 - b. Do not provide labels, nameplates or trademarks when individual specification sections specifically exclude them.
 - c. Do not expose manufacturers, suppliers, or installer's name, logo, or trade names on normally visible surfaces.
 2. Location for required labels: Required labels, approval plates and stamps shall be located on a concealed surface, or where required for observation after installation on accessible non-conspicuous surface.
 3. Data Plates: Provide permanent data plate on each item of service-connected or power-operated equipment.
 - a. Data Plate Information: Include manufacturer, model, serial number, date of manufacture, capacity, ratings, power requirements, and all other similar essential data.
 - b. Locate data plates on easily accessible surface that is inconspicuous in occupied spaces.

1.5 GENERAL ENVIRONMENTAL REQUIREMENTS FOR PRODUCTS

- A. Prohibit the use of or incorporation into the work of materials which contain toxic, hazardous and harmful materials.
1. Hazardous materials: Defined as pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA), the International Agency for Research on Cancer (IARC) or regulated under OSHA Hazard Communication Standard, 29 CFR 1910.1200.
 2. Harmful materials: Defined as materials which contain the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade the utility of the environment for aesthetic, cultural, or historical purposes.
 3. Owner restricted materials: Defined as all products to which the Owner has a reasonable objection because of its content, composition, properties, or characteristics.
- B. Vapors, Gases, Fumes, Odors:
1. General: Comply with all state and federal VOC requirements. Where ever possible use non-VOC materials.
 - a. Limit use of products to the greatest extent possible which have "off-gassing", fumes, flammability, and other harmful characteristics.
 - 1) Prohibit use of products which contain substances that contribute significantly to the production of photochemical smog, tropospheric ozone, or poor indoor-air quality.

- b. Limit use of ozone-depleting compounds to the greatest extent possible. An ozone-depleting compound is any compound with an ozone-depletion potential greater than 0.01 (CFC 11 = 1).
 - c. Use organic and biodegradable cleaners to the greatest extent possible.
 - 2. Do not install, use for installation, and use for cleaning those materials which may produce objectionable (to Owner and public) vapors, gases, fumes, odors, or similar conditions.
 - 3. Do not install or use products which may have possible chemical or biological reactions with other on-site materials.
- C. Toxicity of prefabricated wood products (composite wood and agrifiber products): Products shall contain no added urea-formaldehyde resins.
 - 1. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.
- D. Adhesives: Provide adhesives approved by the manufacturers of the products being adhered which are low-VOC or no-VOC, non-flammable, waterproof after cured, odor free.
 - 1. All adhesives, sealants and sealant primers used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) shall comply with the requirements of the South Coast Air Quality Management District (SCAQMD) Rule 1168 VOC limits, Less Water and Less Exempt Compounds and Green Seal GS-36 Aerosol Adhesives VOC Limits.
 - a. South Coast Air Quality Management District (SCAQMD) Rule 1168 VOC limits, Less Water and Less Exempt Compounds:
 - 1) Architectural Applications VOC Limit [g/L less water]
 - a) Indoor Carpet Adhesives 50
 - b) Carpet Pad Adhesives 50
 - c) Wood Flooring Adhesives 100
 - d) Rubber Floor Adhesives 60
 - e) Subfloor Adhesives 50
 - f) Ceramic Tile Adhesives 65
 - g) VCT & Asphalt Adhesives 50
 - h) Drywall & Panel Adhesives 50
 - i) Cove Base Adhesives 50
 - j) Multipurpose Construction Adhesives 70
 - k) Structural Glazing Adhesives 100
 - 2) Specialty Applications VOC Limit [g/L less water]
 - a) PVC Welding 510
 - b) CPVC Welding 490
 - c) ABS Welding 325
 - d) Plastic Cement Welding 250
 - e) Adhesive Primer for Plastic 550
 - f) Contact Adhesive 80
 - g) Special Purpose Contact Adhesive 250
 - h) Structural Wood Member Adhesive 140
 - i) Sheet Applied Rubber Lining 850
 - j) Top & Trim Adhesive 250

- 3) Sealants VOC Limit [g/L less water]
 - a) Architectural 250
 - b) Other 420
- 4) Substrate Specific Applications VOC Limit [g/L less water]
 - a) Metal to Metal 30
 - b) Plastic Foams 50
 - c) Porous Material (except wood) 50
 - d) Wood 30
 - e) Fiberglass 80
- 5) Sealant Primers VOC Limit [g/L less water]
 - a) Architectural Non Porous 250
 - b) Architectural Porous 775
 - c) Other 750
- 2. Green Seal GS-36 Aerosol Adhesives VOC Limits:
 - a. Aerosol Adhesives VOC Limit [g/L less water]
by weight
 - 1) General purpose mist spray 65% VOCs
 - 2) General purpose web spray 55% VOCs
 - 3) Special purpose aerosol adhesives (all types)
70% VOCs
- E. Carpet systems: Refer to Section 09 68 00 - Carpeting for VOC requirements.
- F. Interior Paints: Provide products that comply with specified VOC limits, refer to Section 09 91 00 – PAINTING for additional requirements.
 - 1. For interior applications use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24) and the chemical restrictions (Restricted Components listed below) of Green Seal Standard GS-11, Paints, First Edition, May 20, 1993; Green Seal Standard GC-03, Anti-Corrosive Paints, Second Edition, January 7, 1997; and South Coast Air Quality Management District Rule 1113, Architectural Coatings, rules in effect on January 1, 2004, as follows:
 - a. Green Seal GS-11 Limits for Interior Paints:
 - 1) Flat Paints and Coatings: VOC not more than 50 g/L.
 - 2) Non-Flat Paints and Coatings: VOC not more than 150 g/L.
 - b. Green Seal GS-03 Limits for Anti-Corrosive Coatings:
 - 1) Anti-Corrosive Coatings (Gloss, Semi-Gloss and Flat): VOC not more than 250 g/L.
 - c. South Coast Rule #1133 VOC Limits for Architectural Coatings:
 - 1) Bond breakers: VOC not more than 350 g/L.
 - 2) Clear wood finishes:
 - a) Varnishes: VOC not more than 350 g/L.
 - b) Sanding sealers: VOC not more than 350 g/L.
 - c) Lacquer: VOC not more than 550 g/L
 - 3) Clear brushing lacquers: VOC not more than 680 g/L.
 - 4) Concrete curing compounds: VOC not more than 350 g/L.
 - 5) Dry-fog coatings: VOC not more than 400 g/L.

- 6) Fireproofing exterior coatings: VOC not more than 350 g/L.
 - 7) Fire retardant coatings:
 - a) Clear: VOC not more than 650 g/L.
 - b) Pigmented: VOC not more than 350 g/L.
 - 8) Graphic art (sign) coatings: VOC not more than 500 g/L.
 - 9) Industrial maintenance (IM) coatings: VOC not more than 250 g/L.
 - 10) High temperature (IM) coatings: VOC not more than 420 g/L.
 - 11) Zinc rich (IM) primers: VOC not more than 100 g/L.
 - 12) Japans/faux finishing coatings: VOC not more than 350 g/L.
 - 13) Magnesite cement coatings: VOC not more than 450 g/L.
 - 14) Mastic coatings: VOC not more than 300 g/L.
 - 15) Metallic pigmented coatings: VOC not more than 500 g/L.
 - 16) Multi-color coatings: VOC not more than 250 g/L.
 - 17) Pigmented lacquer: VOC not more than 550 g/L.
 - 18) Pre-treatment wash primers: VOC not more than 420 g/L.
 - 19) Primers, sealers and undercoaters: VOC not more than 200 g/L.
 - 20) Quick-dry enamels: VOC not more than 250 g/L.
 - 21) Quick-dry primers sealers and undercoats: VOC not more than 200 g/L.
 - 22) Recycled coatings: VOC not more than 250 g/L.
 - 23) Rust preventative coatings: VOC not more than 400 g/L.
 - 24) Shellac-Clear: VOC not more than 730 g/L.
 - 25) Shellac-Pigmented: VOC not more than 550 g/L.
 - 26) Specialty primers: VOC not more than 350 g/L.
 - 27) Stains: VOC not more than 250 g/L.
 - 28) Sealers:
 - a) Waterproofing sealers: VOC not more than 250 g/L.
 - b) Waterproofing concrete and masonry sealers: VOC not more than 400 g/L.
 - 29) Wood preservatives: VOC not more than 350 g/L.
- G. Sealants: Provide products that comply with specified VOC limits. Refer to Section 07 92 00 – JOINT SEALANTS for additional requirements.
1. Only use sealant and primers that comply with the following limits for VOC content:
 - a. Architectural Sealants: 250 g/L.
 - b. Roofing Sealants: 450 g/L.
 - c. Roadway Sealants: 250 g/L.
 - d. Sealant primer: 250 g/L.
 2. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.
 3. Avoid the use of the following products: Butyl Rubber; Solvent Acrylic; Neoprene; Styrene Butadiene Rubber; Nitril.
- H. Material Safety Data Sheets (MSDS): Obtain and maintain on-site record data sheets for each product brought onto the Site.
1. Maintain an organized file of Material Safety Data Sheets at the job-site for quick reference.

2. Furnish MSDS for all finishes, paints, coatings, curing compounds, sealers, adhesives, mastics, waterproofing, dampproofing, sealants, cleaning chemicals, carpets, upholstery, fabrics and all similar products.
- I. Cleaning and maintenance products:
 1. Provide data on manufacturers' recommended maintenance, cleaning, refinishing and disposal procedures for materials and products utilized. These procedures are for final General Contractor cleaning of the project prior to substantial completion and for provided materials and products as required by the specific specification sections.
 - a. Where chemical products are recommended for these procedures, provide documentation to indicate that no component present in the cleaning product at more than 1% of the total mass of the cleaning product is a carcinogen or reproductive toxicant as defined in the lists in this specification section.
 - b. For purposes of reporting, identification of product VOC contents shall not be limited to those regulated.
 2. Avoid cleaning products containing alpha-pinene, d-limonene or other unsaturated carbon double bond alkenes due to chemical reactions with ozone to form aldehydes, acidic aerosols, and ultra fine particulate matter in indoor air.
 - J. Establish written General Contractor's safety and emergency response procedures for safety precautions, accidents, emergency conditions, and clean-up methods.
- 1.6 OWNER'S PROPRIETARY PRODUCTS
- A. Owner's proprietary products: Under provisions of Massachusetts General Laws, Chapter 30, Section 39M(b) the Owner has determined that specific products shall be proprietary for 'sound reasons in the public interest'. This determination has been made under vote of the Building Committee, and has been recorded in writing for public record.
 - B. The following products are designated as proprietary:
 1. Automatic temperature controls: Alerton/ABS.
 2. Access control and video surveillance (with Axis camera): Genetec Unified Security System.
 3. Non-interchangeable core key cylinders: Schlage Everest 29T FSIC
 4. IP Telephone system: ShoreTel.
 5. Network switches: HP.
 6. Wireless access points: Cisco "Meraki".
 7. Document cameras: Epson.
 8. Interactive ultra-short-throw projectors with laser light source: Epson "Brightlink".
- 1.7 OWNER FURNISHED PRODUCTS
- A. Owner Furnished Products: As provided in the General Conditions, the Owner will provide products by others under a separate agreements.
 1. Owner's responsibilities regarding Owner furnished products:
 - a. Arrange for and deliver Owner reviewed shop drawings, product data, and samples to General Contractor.
 - b. Arrange and pay for product delivery to site.

- c. On delivery, inspect products jointly with General Contractor.
 - d. Submit claims for transportation damage, and replace damaged, defective, or deficient items.
 - e. Arrange for manufacturers' warranties, inspections, and service agreements.
 - 2. General Contractor's responsibilities regarding Owner furnished products:
 - a. Review Owner reviewed shop drawings, product data, and samples to General Contractor.
 - b. For Owner-Furnished, General Contractor Installed (OFCl) Products: Receive and unload products at site, inspect for completeness or damage, jointly with Owner.
 - c. Handle, store, and provide temporary protection.
 - d. Repair or replace items damaged after receipt.
 - e. As required by this Contract, finish, install, and clean products.
 - f. Provide protection of installed work.
 - g. When not installed under this Contract, the General Contractor shall coordinate Owner installed work with interfacing work of this Contract. The General Contractor shall provide temporary protection and final cleaning of Owner installed products, except as directed otherwise.
 - 3. Items noted in Drawings as "Not in Contract" or "NIC", identify work or products which are furnished by Owner; such work requires coordination with the Work of this Contract and may require installation by the General Contractor.
- B. The General Contractor has coordinating responsibility for Testing laboratory services as identified under Section 01 45 29 - TESTING LABORATORY SERVICES and as specified under individual specification sections.

1.8 PRODUCT DELIVERY AND HANDLING REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instructions and as specified in individual specification sections.
- 1. Packing: Arrange for the return of packing materials, such as wood pallets, where economically feasible.
 - 2. Ductwork: All ductwork shall be sealed from time of manufacturer, with seals intact upon delivery to construction site, and remain so, until ready for installation. General Contractor is jointly responsible with Trade Contractor to ensure ducts are properly sealed and maintained.
 - a. Store ductwork in clean dry conditions and keep sealed while it is stored.
- B. Packaging: Deliver materials in recyclable or in reusable packaging such as cardboard, wood, paper, or reusable blankets, which will be reclaimed by supplier or manufacturer for recycling.
- 1. General: Minimize packaging materials to maximum extent possible while still ensuring protection of materials during delivery, storage, and handling.
 - a. Unacceptable Packaging Materials: Polyurethane, polyisocyanurate, polystyrene, polyethylene, and similar plastic materials such as "foam" plastics and "shrink-fit" plastics.

- b. Reusable Blankets: Deliver and store materials in reusable blankets and mats reclaimed by manufacturers or suppliers for reuse where program exists or where program can be developed for such reuse.
 - 1) Non-returnable containers should be donated to local and community organizations to the greatest extent possible to reduce quantity of disposed materials.
 - c. Pallets: Where pallets are used, suppliers shall be responsible to ensure pallets are removed from site for reuse or for recycling. Avoid use of virgin wood pallets whenever possible. It is preferable that pallets be manufactured from recycled wood and recycled plastic.
 - d. Corrugated Cardboard and Paper: Where paper products are used, recycle as part of construction waste management recycling program, or return to material's manufacturer for use by manufacturer or supplier.
 - e. Sealants, Paint, Primers, Adhesives, and Coating Containers: Return to supplier or manufacturer for reuse where such program is available.
 - 2. Purchase materials in bulk where possible. Take measures to avoid individual packaging for volume purchases.
 - C. Labeling of plastics used for packaging: Plastic is marked by manufacturers for type of plastic material in accordance with the Society of Plastic resin codes. Maintain marks, or sort by manufacturer's resin codes for recycling purposes.
 - 1. Type 1: Polyethylene Terephthalate (PET, PETE).
 - 2. Type 2: High Density Polyethylene (HDPE).
 - 3. Type 3: Vinyl (Polyvinyl Chloride or PVC).
 - 4. Type 4: Low Density Polyethylene (LDPE).
 - 5. Type 5: Polypropylene (PP).
 - 6. Type 6: Polystyrene (PS).
 - 7. Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.
 - D. Schedule deliveries to avoid delays in installation of products, to minimize long-term storage, to prevent overcrowding of construction spaces and to limit potential damage to stored materials. Coordinate with installation to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
 - E. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
 - F. Provide equipment and personnel to handle and store products by methods to prevent soiling, disfigurement, or damage.

1.9 PRODUCT STORAGE AND PROTECTION REQUIREMENTS

 - A. Store and protect products in accordance with manufacturer's instructions and as specified in individual specification sections.
 - 1. Provide all necessary equipment and personnel to store products by methods to prevent soiling, disfigurement and damage.

2. Avoid excessive material handling and potential product damage, locate storage areas convenient to work areas.
 3. Store and protect products with seals and labels intact and legible.
 4. Store and handle materials in a manner as to prevent loss from weather and other damage.
- B. For exterior storage of fabricated products, place on sloped supports, above ground.
- C. Provide off-site storage and protection when site does not permit on-site storage or protection.
1. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
 2. Store sensitive products in weather-tight, climate controlled enclosures.
 3. Prevent contact with material that may cause corrosion, discoloration, or staining.
- D. Store loose granular materials on solid flat surfaces in a well-drained area; prevent mixing with foreign matter.
- E. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.
- F. Store heavy materials in locations and in a manner that will not damage or disfigure existing, or new construction.

1.10 MOLD PROTECTION

- A. General:
1. Keep building materials dry to prevent the growth of mold and bacteria, including, but not limited to: gypsum wallboard, wood, porous insulation, paper, and fabric.
 2. Cover materials to prevent rain damage, and if resting on the ground, use spacers to allow air to circulate between the ground and the materials.
 3. Thoroughly dry all water damaged materials within 24 hours from time of moisture damage. Materials that have been damp or wet for more than 24 hours shall be jointly reviewed by General Contractor and Architect to determine whether damp/wet materials need to be disposed.
 - a. Review moisture damaged materials for signs of mold and mildew, including any with moisture stains, from the site and properly dispose of them.
 - b. Replace water damaged and moldy materials with new, undamaged materials.

1.11 CONSTRUCTION WASTE MANAGEMENT

- A. Source separation: Separate, store, protect, and handle at the site identified recyclable and salvageable waste products in order to prevent contamination of materials and to maximize recyclability and salvageability of identified materials.
- B. Return: Set aside and protect incorrectly delivered and substandard products and materials and return to supplier for credit.
- C. Recycling: Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 73 00
EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Examination of existing conditions and acceptance of conditions.
- B. Project preparation.
- C. Surveying and field engineering.
- D. Execution of the Work.
- E. Cutting and patching of in-place work
- F. Cleaning.
- G. Building flushout.
- H. Protecting installed work.

1.2 EXAMINATION OF AND ACCEPTANCE OF EXISTING CONDITIONS

- A. The General Contractor, its subcontractors and Trade Contractors shall inform themselves of existing conditions before submitting his bid, and shall be fully responsible for carrying out all work required to completely and properly execute the work of the Contract, regardless of the conditions encountered in the actual work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed, except those conditions described in the General Conditions.
- B. Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing damage to structure surfaces, equipment, or to surrounding properties which could be misconstrued as damage resulting from selective demolition work; file with Architect prior to starting work.

1.3 SURVEYING AND FIELD ENGINEERING

- A. Employ a Land Surveyor or Professional Engineer registered in the Commonwealth of Massachusetts and acceptable to the Architect.
 - 1. Submit evidence of Surveyor's Errors and Omissions (E&O) Insurance coverage in the form of an Insurance Certificate.
- B. Submittals.
 - 1. Submit name, address, and telephone number of at least three proposed Land Surveyors and obtain Architect's acceptance before starting survey work.
 - 2. On request, submit documentation verifying accuracy of survey work.
 - 3. Submit a copy of registered site drawing and certificate signed by the Land Surveyor, that the elevations and locations of the Work are in conformance with the Contract Documents.

- C. Examination.
 - 1. Verify locations of survey control points prior to starting work.
 - 2. Promptly notify Architect/Engineer of any discrepancies discovered.
- D. Survey Reference Points.
 - 1. General Contractor shall locate and protect survey control and reference points.
 - 2. Control datum for survey is that indicated on Drawings.
 - 3. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
 - 4. Promptly report to Architect/Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
 - 5. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to the Architect.
- E. Survey Requirements.
 - 1. Provide field engineering services. Utilize recognized engineering survey practices.
 - 2. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer and water service piping.
 - a. The existence and location of underground utilities and construction indicated on Drawings as existing are not guaranteed. Before beginning sitework, verify the existence and location of underground utilities and other construction.
 - 3. Establish a minimum of 2 permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on Project Record Documents.
 - 4. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - a. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - b. Grid or axis for structures.
 - c. Building foundation, column locations, and ground floor elevations.
 - 5. Periodically verify layouts by same means.
- F. Project Record Documents.
 - 1. As-built survey, progress submissions: Surveyor shall develop an as-built survey for the work-in-place. Copies of survey shall be submitted along with request for payments for foundation work, site utilities and paving work.
 - 2. Surveyor's log: Maintain a complete and accurate surveyor's log of control and other surveys, as required by Owner and authorities having jurisdiction. Make this log available for reference.
 - 3. Submit Final Property Survey and log under the provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1.4 PROTECTION OF ADJACENT ELEMENTS

- A. Protect installed Work and provide special protection where called for in individual specification Sections.

- B. Protect existing facilities and adjacent properties from damage from construction and demolition operations. Provide temporary and removable protection for installed products and occupied areas.
- C. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials. Coordinate with requirements under individual specification sections.
- D. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- E. Protect all existing landscape areas not indicated to be cleared. Do not deface, injure, or destroy trees or other plant life. Do not remove or cut trees or other plant life, without authorization from the Owner. Do not attach any anchorages, ropes, cables or guys to any trees scheduled to remain.
 - 1. Prohibit traffic from landscaped areas.
 - 2. The General Contractor shall be responsible for repairs to damages resulting from this project without additional cost to the owner.
- F. Protect non-owned vehicles, stored materials, site and structures from damage.
- G. Refer to respective Sections for other particular protection requirements.

1.5 PROTECTION OF INTERIOR CONCRETE SLABS

- A. No satisfactory chemical or cleaning procedure is available to remove petroleum stains from the concrete surface. Prevention is therefore essential for areas scheduled to receive concrete stains and sealers, specified under Division 3.
 - 1. All hydraulic powered equipment must be diapered to avoid staining of in-place concrete.
 - 2. No trade will park vehicles on the inside slab. If necessary to complete their scope of work, drop cloths will be placed under vehicles at all times.
 - 3. No pipe cutting machine will be used on the inside floor slabs.
 - 4. Steel will not be placed on interior slabs to avoid rust staining.

1.6 EXECUTION REQUIREMENTS FOR INSTALLATION, APPLICATION AND ERECTION

- A. Inspection of conditions: The Installer of each component shall inspect the substrate and conditions under which Work is performed. Do not proceed until unsatisfactory conditions have been corrected.
- B. Resource Efficiency of Materials:
 - 1. Use construction practices such as material reduction and dimensional planning that maximize efficient use of resources and materials.
 - a. Recheck measurements and dimensions, before starting installation.
 - 2. Provide materials that utilize recycled content to maximum degree possible without being detrimental to product performance or indoor air quality.
 - 3. Where possible and feasible, provide for non-destructive removal and re-use of materials after their service life in this building.

- C. Manufacturer's instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that they are more stringent than requirements in Contract Documents.
- D. Inspect material immediately upon delivery and again prior to installation Reject damaged and defective items.
- E. Install each component during weather conditions and project status that will ensure the best results. Isolate each part from incompatible material as necessary to prevent deterioration.
- F. Coordinate temporary enclosures with inspections and tests, to minimize uncovering completed construction for that purpose.
- G. Limiting exposures: Supervise operations to ensure that no part of construction, completed or in progress, is subject to harmful or deleterious exposure.
 - 1. Such exposures include, but are not limited to the following:
 - a. Excessive static or dynamic loading.
 - b. Excessive internal or external pressures.
 - c. Excessive weathering.
 - d. Excessively high or low temperatures or humidity.
 - e. Air contamination or pollution.
 - f. Water or ice.
 - g. Chemicals or solvents.
 - h. Heavy traffic, soiling, staining and corrosion.
 - i. Rodent and insect infestation.
 - j. Unusual wear or other misuse.
 - k. Contact between incompatible materials.
 - l. Theft or vandalism.
- H. Provide attachment and connection devices and methods necessary for securing each construction element. Secure each construction element true to line and level. Allow for expansion and building movement.
- I. Visual effects: Provide uniform joint widths in exposed Work. Arrange joints to obtain the best effect. Refer questionable choices to the Architect for decision.
- J. Mounting heights: Where mounting heights are not indicated, review heights with Architect, prior to commencement of Work.
- K. Cleaning and protection: During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- L. Clean and maintain completed construction as often as necessary through the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

1.7 CUTTING AND PATCHING OF IN-PLACE WORK

- A. Scope: General Contractor is responsible for coordination and quality of all cutting and patching work. Cutting and patching of the Work includes, but is not limited to:
 - 1. All cutting, altering, patching, and fitting as necessary for the Work to comply with the Contract Documents.
 - a. Make all products and their components of the Work fit together properly.
 - b. Fully integrate all cutting and patching, to present the visual appearance of an entire, completed, and unified project in compliance with the Contract Documents.
 - 2. Provide openings in elements of the Work, and the patching of same, for penetrations required by all trades, including but not limited to mechanical, plumbing, fire protection and electrical work.
 - a. Individual Trade Contractors are responsible for designated types of coring and drilling penetrations for piping, conduit, ducts and other penetrations.
 - 3. Uncover work to provide for installing, inspecting, or both, of ill-timed work;
 - 4. Remove and replace work not conforming to requirements of the Contract Documents or as otherwise determined to be defective.
 - 5. Patch and match all surfaces and products disturbed or damaged.
 - 6. Remove samples of in-place construction as specified for testing.
- B. Structural elements: Do not cut and patch structural elements in a manner that would reduce the load-carrying capacity or load deflection ratio. Always obtain written approval of the cutting and patching proposal before cutting and patching structural elements.
 - 1. Do not drill through structural beams, slabs or columns. Core drilling through concrete block walls and stair platforms must be approved by the Architect.
 - 2. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the structure.
- C. Exposed elements: Employ appropriate tradesperson to perform cutting and patching for weather exposed and moisture resistant elements, and sight exposed surfaces.
- D. Penetrating elements: Fit work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. At penetrations of fire rated walls, partitions, ceiling or floor construction, completely seal voids with fire rated materials in accordance to applicable codes and regulations, and compatible to surrounding construction.
- E. Visual requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.
- F. Operational and safety limitations: Do not cut and patch operating elements or safety components in a manner that would reduce their capacity to perform as intended, or would increase maintenance, or decrease operational life safety of the building when occupied.
- G. General requirements of cutting and patching:
 - 1. Submit written proposals to perform cutting and patching when cutting work affects the following:

- a. Structural integrity of any element in the project.
 - b. Integrity of weather-exposed or moisture-resistant elements.
 - c. Aesthetic and visual qualities of exposed-to-view elements.
 - d. Work of Owner or work performed under separate Contract.
2. Cutting: Cut in-place construction using methods least likely to damage elements of as-built construction.
 3. Coring and Drilling of holes incidental to work of individual sections shall be performed by the trade requiring the penetration, except as follows:
 - a. All Trade Contractors and subcontractors to identify all holes through steel beams, masonry walls, concrete walls, concrete decks, slabs and the like (and provide sleeves to be installed by the Masonry or Concrete subcontractor) as part of the coordination drawing process. Failure to provide this information in advance, the Trade Contractors and subcontractors shall pay for installation all holes.
 - b. Coordination of all coring and drilling and resultant patches necessary for the completion of this Contract and for the quality and appearance of all patch Work in exposed-to-view finished materials.
 4. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break; for assemblies, refinish entire unit.

1.8 PROGRESS CLEANING AND DISPOSAL OF WASTE MATERIALS

- A. General: Maintain site in a clean and orderly condition. Maintain work and surrounding areas free of waste materials, debris, and rubbish; remove from site on a on-going basis through-out the term of construction.
 1. Adjacent Areas: Keep adjacent areas, neighboring properties, public ways, and all nearby areas clean and free of construction debris and dirt daily including wind blown debris.
 2. Trade Contractors and subcontractors are responsible for daily cleanup and removal of their own rubbish, debris, shipping materials and waste materials throughout the term of their work.
 3. General Contractor shall furnish dumpsters and provide general site cleaning services, except as explicitly specified otherwise under individual Sections of the Specifications.
- B. Control accumulation of waste materials and rubbish; periodically dispose of off-site. The General Contractor shall bear all costs, including fees resulting from such disposal.
- C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
 1. Do not burn or bury rubbish and waste materials on site.
 2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
 3. Do not dispose of wastes into streams or waterways.
 4. Comply with requirements of authorities having jurisdiction including, without limitation, requirements related to fire prevention, rodents, pests, vermin, waste storage, waste trucking, waste removal, waste disposal, street cleaning, truck tire cleaning, and other requirements.

- D. Clean interior areas prior to start of finish work and maintain areas free of dust and other contaminants during finishing operations.
- E. Maintain project in accordance with all local, Commonwealth of Massachusetts, and Federal Regulatory Requirements.
- F. Store volatile wastes in covered metal containers, and remove from premises daily.
- G. Prevent accumulation of wastes which create hazardous conditions.
- H. Provide adequate ventilation during use of volatile or noxious substances.
 - 1. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
 - 2. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- I. Use only those materials which will not create hazards to health or property and which will not damage surfaces.
- J. Use only those cleaning materials and methods recommended by manufacturer of surface material to be cleaned.
- K. Execute cleaning to ensure that the buildings, the sites, and adjacent properties are maintained free from accumulations of waste materials and rubbish and windblown debris, resulting from construction operations.
- L. General Contractor shall provide on-site containers (dumpsters) for collection and containment of, waste materials, debris and rubbish.
 - 1. Trash Barrels and Containers: Use containers with tightly fitting lids. Use only steel containers and lids when there is any evidence of rodent or pest activity.
 - 2. Returnables: Provide special, labeled containers for deposit returnables such as soda cans.
- M. Remove waste materials, debris, and rubbish from site at least once weekly, and dispose off-site. Comply with NFPA 241 for removal of combustible waste.
- N. Handle material in a controlled manner with as few handlings as possible. Do not drop or throw materials from heights.
- O. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not damage surrounding surfaces.

1.9 SITE MAINTENANCE AND CLEANING

- A. Maintain traffic and parking areas in a sound condition, free of excavated material, construction equipment, products, mud, snow, and ice.
 - 1. Provide means of removing mud from vehicle wheels before entering public streets and Owner's parking areas and access.
- B. Maintain existing and permanent paved areas used for construction.
 - 1. If any street or private way shall be rendered unsafe by the General Contractors operations, the General Contractor shall make such repairs or provide such temporary ways or guards as shall be acceptable to the governing authority.

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2. Promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

1.10 FINAL CLEANING

- A. Scheduling: Perform final cleaning immediately prior to the Architect's review of the project for issue of the Certificate of Substantial Completion.
 1. Re-clean all surfaces, materials and products of the Work immediately prior to Owner's occupancy of the Project.
 - a. Should the Owner occupy any portion of the Work prior to completion of the Contract, the responsibilities for interim and final cleaning shall be in accordance with the General Conditions.
- B. Qualifications: Commercial cleaning firm, with a minimum of 3 years experience specializing in the post-construction cleaning of facilities.
- C. Protection: During the operation of final cleaning, protect surrounding materials and finishes against undue damage by the exercise of reasonable care and precautions. Clean, or repair all products and surfaces which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.
- D. General cleaning requirements:
 1. Control accumulation of waste materials and trash. Recycle or dispose of off-site at intervals approved by the Owner and in compliance with waste management procedures.
 2. Remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste.
 3. Remove all advertising matter and temporary instructional material from exposed surfaces throughout.
 4. Use only methods and cleaning materials which are compatible with and as recommended by the manufacturer of the material being cleaned.
 5. Finished surfaces: Remove paint smears, spots, marks, dirt, mud and dust and similar disfigurement created by the Work, from all exposed to view existing or new interior and exterior finished surfaces.
 6. Polished surfaces: Apply the polish recommended by the manufacturer of the material being polished.
 7. Cleaning Materials: Only non-hazardous cleaning materials shall be used in the final cleanup.
- E. Waste Management and Recycling during Final Cleaning:
 1. Recycle, salvage, and return construction and demolition waste from Project in accordance with requirements.
 2. Arrange for pick-up of salvageable materials in accordance with the Waste Management Plan.
 3. Disposal Operations: Promptly and legally transport and dispose of all trash. Do not burn, bury, or otherwise dispose of trash on the Project site.
- F. Exterior building surfaces:

1. Visually inspect exterior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
 2. Remove all traces of splashed materials from adjacent surfaces.
 3. If necessary to achieve a uniform degree of cleanliness, hose down the exterior of the structure.
 4. In the event of stubborn stains not removable with water, the Architect may require light media-blasting or other non-damaging cleaning at no additional cost to the Owner.
 5. Concrete: Clean exposed concrete free of all foreign matter. If, in the opinion of the Architect, further cleaning of specific areas is required, they shall be scrubbed with water or other cleaning agents. Acid cleaners shall not be used, except as may otherwise specifically permitted in the trade sections.
- G. Bright metal: Clean metal surfaces, hardware, fixtures, appliances, equipment, and similar items free of all foreign matter. As required, lightly scrub specific stains with clean water, mild soap, and soft rags, thoroughly rinsed and wiped with clean, soft white rags. Do not use abrasive cleaners.
- H. Glass: Replace broken, chipped and defective glass. Remove from glass: stains, spots, marks, paint smears; dirt and foreign materials. Clean and polish both surfaces of all interior and exterior glass. Clean and polish mirrors.
- I. Carpet: Vacuum clean carpet and remove all spots and stains.
- J. Hardware: Clean and polish finished hardware, remove marks, stains, scratches and blemishes.
- K. Tile: Clean and polish floor and wall tile, remove grout film and excess grout.
- L. Woodwork: Dust and clean [architectural woodwork and] finish woodwork items, remove all stains, spots, and foreign matter using methods and cleaning agents which will not harm the various finishes.
- M. Site: Sweep exterior paved surfaces broom clean; rake clean unpaved surfaces.
- N. Equipment: Thoroughly clean all items of mechanical and electrical equipment; remove excess oils and grease from exposed surfaces.
1. Clean permanent filters and replace disposable filters if ventilating units were operated during construction.
 2. Clean ducts, blowers and coils, if units were operated at any time without filters during construction.

1.11 BUILDING FLUSH-OUT

- A. Sequencing: Complete all interior finish material installation no less than 14 calendar days prior to Substantial Completion to allow for building flush out. General Contractor shall submit notification to the Architect when all interior finish material installation is complete, highlighting the date of completion.
- B. Building Flush-Out: Comply with requirements of Section 23 00 00.

1.12 PROTECTING INSTALLED WORK

- A. Protect all built, and in-place Work. In addition to requirements specified elsewhere, the General Contractor shall protect all installed work from subsequent damage or deterioration from construction activities, and atmospheric damage until Owner's Substantial Completion and occupancy precludes the need for protection activities. No attempt is made in this Section to list all elements requiring protection or to describe how each element will be protected. It is the responsibility of the General Contractor to determine for itself the scope and nature of protection required.
 - 1. Protection of some products/building elements may be required to remain in place for a large portion duration of the project. As such, materials should be installed to provide adequate protection throughout the full extent of construction activities. Repair or reinstall protection throughout the duration of construction as required.
- B. Finish Products: Some finishes may need to be physically isolated from construction operations by means of protective barriers and coverings.
 - 1. General: After installation, provide coverings to protect products from damage due to traffic and construction operations. Replace protective coverings which may become wet, torn, or ineffective. Remove coverings when no longer needed.
 - 2. Doors, door frames and hardware: Protect from damage due to traffic and construction operations.
 - 3. Floor and Finished Surfaces Protection: Protect against construction traffic, rolling loads, static loads, damage from material movement and storage, or similar causes of damage.
 - 4. Walls: Protect from impact, dents, marks, water damage, and similar damage.
 - 5. Glass: Protect from damage including etching and staining. Keep glass clean.
 - 6. Protect products sensitive to water damage from becoming wet.
 - 7. Protect products sensitive to ultra-violet exposure and atmospheric exposure by limiting exposure to within limits recommended by respective product manufacturer.
 - 8. Protect products from biological growth, molds and mildew.
 - 9. Protect products from rodents and other animals, birds and insect damage.
- C. Roofing and waterproofing systems: Protect and isolate from traffic and construction operations. Protect from chemicals. Work and traffic directly upon roofing and waterproofing is prohibited, provide temporary walkways and platforms.
- D. General Protection from chemicals:
 - 1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners selected for Project unless chemicals being used will not damage adjacent surfaces. Use covering materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 - 2. Do not clean surfaces during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - 3. Neutralize and collect alkaline and acid wastes and dispose of off-site.
 - 4. Dispose of runoff from chemical operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

- E. Save plastic coverings. At completion of Project, reuse if practical; if not, then recycle if local market exists.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Attention is directed to the CONTRACT and GENERAL CONDITIONS and all Sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section.

1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
 - 1. Divisions 02 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 2. Division 07 Section "Penetration Firestopping" for patching fire-rated construction.
 - 3. Each trade contractor, subcontractor is responsible for their cutting and patching unless noted otherwise

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
 - 1. Cutting round holes six (6) inches in diameter or less, or square or rectangular holes 8 x 8 inches or less, in existing assemblies is the work of the trade proposing using the hole or opening.
 - 2. Larger openings or holes shall be coordinated with the installer of the assembly being cut who shall cut, and reinforce or frame the opening or hole so that an effective patch can be made.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - 1. Primary operational systems and equipment.
 - 2. Air or smoke barriers.
 - 3. Fire-suppression systems.
 - 4. Mechanical systems piping and ducts.
 - 5. Control systems.
 - 6. Communication systems.
 - 7. Conveying systems.
 - 8. Electrical wiring systems.

- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 - 1. Water, moisture, or vapor barriers.
 - 2. Membranes and flashings.
 - 3. Exterior curtain-wall construction.
 - 4. Equipment supports.
 - 5. Piping, ductwork, vessels, and equipment.
 - 6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete & Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
 - 5. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent

surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29

Section 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Closeout of incomplete work (punch list) requirements.
- B. Closeout procedures.
- C. Conferences occurring after Substantial Completion.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 01 78 00 – CLOSEOUT SUBMITTALS: Requirements for project record documents.
- C. Section 01 78 36 – WARRANTIES: Administrative and procedural requirements for warranties, guarantees and bonds.

1.3 PUNCH LIST REQUIREMENTS AND PROCEDURES

- A. Definitions:
 - 1. General Contractor's Punch List: Complete list of incomplete and incorrect Work prepared by the General Contractor prior to request of Architect's inspection for Certification of Substantial Completion. As a minimum the List shall include the following information for each work item:
 - a. Location identification organized by Building, Area, Room Number, or combination thereof as appropriate to project.
 - b. Clear identification of each incomplete work item, including all Trade Contractor and subcontractor's work.
 - c. Estimated value of each incomplete work item.
 - d. A short statement of why work is not complete.
 - e. Identify subcontract responsibility, as appropriate to each item.
 - f. Provide Owner with one (1) week advance notice of scheduled punchlist inspections to facilitate Owner participation if preferred.
 - 2. Architect's Punch List: A list of incomplete and incorrect Work prepared by the Architect, which modifies the General Contractor's Punch List, following review and acceptance of the General Contractor's Punch List.
- B. Pre-Closeout requirements: Prior to requesting initial Architect's inspection for Certification of Substantial Completion, submit to the Architect a full and complete list of all incomplete work items (General Contractor's Punch List).
- C. Punch list procedures at Substantial Completion:
 - 1. Architect will review submitted General Contractor's Punch List and determine whether it is suitable to proceed with the Substantial Completion Process.

- a. If the Architect determines that the amount of completed work is insufficient to be considered for Substantial Completion, the Architect will not proceed with the Punch lists process until sufficient completion of the Project is achieved.
 - b. The Architect will review the General Contractor's Punch List and if the Architect determines that it does not reflect proper identification of the incomplete and incorrect work, he/she will request revision and resubmission of the General Contractor's Punch List.
 - c. If the Architect determines that the amount of work indicated on the General Contractor's Punch List is excessive, the Architect will suspend its review until the scope of Work identified in the General Contractor's Punch is reduced to a level satisfactory to the Architect.
 - d. When the Architect reviews and accepts the General Contractor's Punch List as being an accurate reflection of incomplete and incorrect work; the Architect will prepare and issue to the General Contractor the "Architect's Punch List".
 - 1) The Architect's Punch List will be based on the General Contractor's Punch List with modifications and additions as may be required.
 - 2) The Architect's Punch List includes Work which must be completed and corrected prior to Final Completion.
 2. Upon receipt of the Architect's Punch List, the General Contractor shall immediately distribute the list to all Trade Contractors and subcontractors.
- D. Completion of Punch List Work: Make reasonable efforts to ensure that all "Architect's Punch List" items are completed or corrected within 14 calendar days from the date of the Architect's Punch List" or within the Contract Time, whichever is earlier.
- E. Architect's Final Inspection and review of Punch List Work:
1. After General Contractor certification that all punch list Work has been properly completed the Architect will then perform the Final Inspection.
 - a. Incomplete Items: If the Architect discovers any incomplete or incorrect "Architect's Punch List" items or any other deficiency in the work, the Architect will prepare a "Revised Punch List" which may also include other incomplete Contract requirements such as record documents, owner's operation and maintenance manuals, warranties, and other Contract requirements. Architect's site reviews of the Work for this "Revised Punch List" and any subsequent revised Punch Lists shall be performed as additional service to Owner, back-charged to the General Contractor.
 - b. The Architect will assign a dollar value for each item of incomplete or incorrect work remaining at 3 times the estimated value of the work to be withheld from any subsequent application for payment until such time as it is determine the work in question is complete.
- F. Additional Inspections and related additional services fee: The Architect and the Architect's consultants will provide two site inspections, one at Substantial Completion, and one to confirm that the "Architect's Punch List" has been completed.
1. "Revised Punch List: If the Architect prepares and issues a "Revised Punch List: because of the General Contractor's failure to complete the Work, then the Owner shall compensate the Architect and the Architect's consultants for their additional services and additional inspections. The payment for additional services and inspections will be back-charged to General Contractor. The Owner will deduct the

amount of the Architect's additional services fee from final payment to the General Contractor by Change Order.

1.4 CLOSEOUT PROCEDURES - SUBSTANTIAL COMPLETION

- A. Prior to requesting inspection for certification of Substantial Completion, complete the following:
 - 1. On Application for Payment, show 100 percent completion for portions of work claimed as substantially complete.
 - a. Submit list of incomplete items (Punch List), value of incomplete work, and reasons work is not complete.
 - 2. Obtain evidence of compliance with requirements of governmental agencies having jurisdiction including, but not necessarily limited to:
 - a. Certificate of Final Inspections, "signed off" by authorities having jurisdiction.
 - b. Certificate of Occupancy.
 - 3. Submission of product and installation warranties, workmanship bonds, maintenance agreements, installer certifications and similar documents specified in individual sections.
 - 4. Submission of test/adjust/balance reports.
 - 5. Change-over permanent locks and transmit keys to the Owner.
 - 6. Remove temporary facilities and services that are no longer required.
 - 7. Remove mock-ups, field samples and similar items.
 - 8. Complete Final Cleaning, including repair and restoration, or replacement of damaged Work.
 - 9. Remove surplus materials, rubbish and similar elements.
 - 10. Application for reduction of retainage.
 - 11. Consent of Surety.
 - 12. Advise the Owner of the change-over in security provisions.
 - 13. Notification of shifting insurance coverage.
 - 14. Final progress photographs.
- B. Within 2 weeks after receipt of the notice of Substantial Completion from the General Contractor, the Architect will inspect to determine status of completion.
 - 1. Should the Architect determine that the Work is not substantially complete:
 - a. The Architect will notify the General Contractor in writing, stating the reasons therefore.
 - b. The General Contractor shall remedy the deficiencies and send a second written notice of Substantial Completion to the Architect, requesting re-inspection.
- C. When the Architect concurs that the Work is substantially complete:
 - 1. The Architect will prepare AIA Document G 704 - CERTIFICATE OF SUBSTANTIAL COMPLETION, in accordance with the requirements of the GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS, accompanied by the General Contractor's list of items to be completed or corrected, as verified by the Architect.
 - 2. The Architect will submit the Certificate to the Owner, and to the General Contractor, for their written acceptance of the responsibilities assigned to them in the Certificate.

1.5 CLOSEOUT PROCEDURES - FINAL ACCEPTANCE

- A. Prior to requesting inspection for certification of Final Acceptance and final payment, perform the following:
1. Complete incomplete Work. Submit a copy of the final inspection list stating that each item has been completed or otherwise resolved for acceptance.
 2. Prove that all taxes, fees and similar legal obligations have been paid.
 3. Submit final payment requests with release of all liens and supporting documentation.
 4. Provide written assurances that all unsettled claims are in the process of and will be resolved.
 5. Submit updated final statement, including accounting for final additional changes to the Contract Sum. Show additional Contract Sum, additions and deductions, previous Change Orders, total adjusted Contract Sum, previous payments and Contract Sum due.
 6. Submit consent of surety to Final Payment.
 7. Submit evidence of continuing insurance coverage complying with insurance requirements.
 8. Transmit certified property survey.
 9. Remove remaining temporary facilities and services.
 10. Deliver to Owner and obtain receipts for:
 - a. Operation and Maintenance Manuals for items so listed in individual Sections of the Specifications, and for other items when so directed by the Architect. Provide evidence of review and acceptance of operation and maintenance manuals by the Commissioning agent.
 - b. Project Record Documents (as-built drawings) including Autodesk Revit and Portable Document Format (PDF) format drawings on discs. Provide evidence of review and acceptance record documents by the Commissioning agent.
 - c. Warranties and bonds specified in individual Sections of the Specifications. Provide evidence of review and acceptance record documents by the Commissioning agent.
 - d. Keys and keying schedule.
 - e. Spare parts, materials for extra stock, and itemized list of everything delivered.
 - f. Pest control inspection report.
 - g. List of Trade Contractors and subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights weekends, and holidays.
 11. Submit Certification stating the work has been inspected for compliance with the Contract Documents.
 12. Submit Certification stating equipment and systems have been tested in presence of Owner's representative and are fully operational.
 13. Submit Certification stating that Work is 100 percent complete and ready for final inspection.
- B. Within 2 weeks after receipt of the request for Final Acceptance from the General Contractor, the Architect will inspect to determine status of completion.

1. Should the Architect determine that the Work is incomplete or defective:
 - a. The Architect will notify the General Contractor in writing, stating the reasons listing the incomplete or defective work.
 - b. The General Contractor shall take immediate steps to remedy the deficiencies and send a second written notice of request for Final Acceptance to the Architect.
 - c. Costs relative to the Architects re-inspection due to failure of Work to comply with claims made by the General Contractor, will be compensated by the Owner, who will deduct the amount of such compensation from the Final Payment due to the General Contractor.
 - C. After the Architect finds the Work acceptable, the Architect will review the Final Close-out submittals.
 - D. Application for Final Payment: Submit Application for Final Payment in accordance with procedures and requirements of the General Conditions and Supplementary Conditions.
 1. The Architect will prepare a Final Change Order, reflecting approved adjustments to the Contract Sum not previously made by other Change Orders.
- 1.6 CONFERENCES AFTER SUBSTANTIAL COMPLETION
- A. The Owner reserves the right to call for conferences commencing with the date of Substantial Completion and continuing for one year thereafter, for purposes of inspecting the Work and to plan correction of any deficiencies or failures discovered during this period.
 1. Attendance is required by General Contractor's Project Manager, Architect, and each applicator, installer, and supplier as the Owner may direct or the General Contractor may wish to have present. All representatives attending such meetings shall be the same persons, or shall have the same powers and authority, as those attending progress meetings occurring prior to the Date of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 78 00
CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Project Record Documents.
- B. Record Project Manual.
- C. Project Record Drawings (As built drawings).
- D. Project Record Submittals.
- E. Final As-Built Site Survey.
- F. Operation and maintenance data, preventive maintenance instructions.
- G. Materials and finishes manual.
- H. Maintenance contracts.
- I. Spare parts and maintenance materials.

1.2 RELATED REQUIREMENTS

- A. Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION:
 - 1. Coordination Drawing Requirements.
 - 2. Electronic file requirements for base sheets to prepare Project Record Drawings (As-built drawings).
- B. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- C. Section 01 78 36 – WARRANTIES: Administrative and procedural requirements for warranties, guarantees and bonds.

1.3 PROJECT RECORD DOCUMENTS

- A. General: Record documents shall reflect actual “as-built” condition and the products installed. Include all changes and deviations from original Contract Documents, and incorporate information from:
 - 1. Original Contract Documents.
 - 2. Addenda.
 - 3. Change orders.
 - 4. Construction change directives.
 - 5. Field directives, and instructions from the Owner, Architect or regulatory authorities having jurisdiction.
- B. Project Record Documents include, but are not limited to:
 - 1. Record Project Manual.

2. Project record drawings (as-built drawings).
3. Project record submittals.
4. Final Site Survey.
5. Operation and maintenance data, preventive maintenance instructions.
6. Materials and finishes manual.
7. Product warranties and bonds.
8. Maintenance contracts.
9. Record of all test reports and inspections.
10. Wall charts and data such as valve diagrams, electrical panel board directories, and similar information.
11. Organized, complete testing results for the entire project as submitted to the City of Worcester Building Department

C. Labeling and identification of Record Documents

1. Clearly label all record documents with name of Project and the words "Record Document".
2. Date progressive entries of information as appropriate.
3. Date Record Documents with the final submission date.
4. All electronic records shall be similarly organized.

1.4 SUBMITTAL QUANTITY REQUIREMENTS

A. Furnish Architect with the following quantities of each submittal:

1. Record Project Manual: 2 bound copies and 2 electronic versions.
2. Project Record Drawings (as-builts):
 - a. 2 sets of Drawings in Autodesk Revit®, Autodesk AutoCad®, Navisworks and Portable Document Format (PDF) format.
 - b. 2 full-size "blackline print" sets of Drawings.
3. Project Record Submittals: Provide a portable media, including USB flash drive, with all submittals arranged into Divisions, specification sections, and submittal titles.
4. Final Site Survey: 2 bound copies and 2 digital versions.
5. Operation and maintenance data, preventive maintenance instructions: 2 electronic versions.
6. Owner Training Video for operation of building systems and major equipment: 2 copies.
7. Materials and finishes manual: 2 electronic versions.
8. Product warranties and bonds: 2 electronic versions.
9. Maintenance contracts: 2 electronic versions.
10. Record of all test reports and inspections including code sign off drawings and permits: 2 electronic versions.

1.5 RECORD PROJECT MANUAL

A. The General Contractor is responsible to maintain a Project Manual reflecting revisions and changes to the Original Issue Project Manual.

1. Clearly label the Record Project Manual as "Record Document Specifications, in a three ring binder.

2. Do not use Record Project Manual for construction purposes; protect from loss in a secure location.
 3. Record all variations and deviations to the Contract Documents, including changes made by Addenda, Bulletin, Change Order, Change Directive and other modifications to the Contract..
 - a. Cut and paste revisions into their applicable specification section.
 - b. Identify all changes with cross-reference to appropriate Addendum Number, Modification Number, Change Order Number etc.
 4. In each individual Specification Section, under "*Part 2 – Products*", identify all manufacturers and products which are actually used as part of the Work.
 5. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
- B. Record Project Manual: Provide prior to request for Final Acceptance.
1. Manuals shall be in 8-1/2 by 11 inch pages and bound in 3-ring (D-shape) binders with durable plastic covers. Internally subdivide the binder contents by Division with permanent page dividers.
 2. Label front cover and spine of each binder with laser printed titles, dates, and project information.
 3. All information from "in-progress" manual shall be clearly and completely transferred.
 4. Pages shall be undamaged.
 5. Provide 3 bound copies and 5 electronic versions on media acceptable to the City of Worcester.

1.6 ELECTRONIC WEB-BASED SERVICE DOCUMENTS

- A. The General Contractor shall furnish to the Owner, with a portable storage device, containing ALL files that were stored on the web-based program. Such media device shall be usable through a USB port with capacity to store all files. Such files shall include, but not limited to, submittals, RFI's, CO's, CCD's, ASI's, PCO's, as-built drawings, field reports, test reports and meeting minutes.
1. Organize all submittals into folders by division.
 2. Quantity: 2.

1.7 PROJECT RECORD DRAWINGS

- A. The General Contractor is responsible to maintain a clean, undamaged set of blue or black line prints of Contract Drawings and shop drawings for preparing the record drawings.
1. Where shop drawings are used, record a cross-reference at the corresponding location on the Contract Documents.
 2. Site Drawings maintained by the General Contractor and all trades, the coordination drawings file, and other field documents shall be used in preparing the electronic as-built drawings and documents.
 3. General Contractor to compile all trade sets to one organized final file/submission.
- B. Do not use Record Documents for construction purposes; protect from loss in a secure location. Mark-up these drawings to show clearly and completely the actual installation reflecting all changes made in the Work during construction.
1. Mark whichever drawing is most capable of showing conditions accurately.

2. Record all variations and deviations to the Contract Documents, including changes made to schedules, details, and all architectural changes to structure, exterior enclosure, interior partitions and ceilings.
 3. Record new information that is important to the Owner but was not shown on the Contract Drawings or shop drawings.
 4. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
- C. The fire protection, plumbing, mechanical and electrical trades shall be responsible to the General Contractor to keep the record documents for their portions of the work marked currently to record all changes in the mechanical and electrical work made during construction.
- D. The Architect may periodically inspect these record drawings, and their proper maintenance may be a condition precedent to approval of applications for periodic payments.
- E. Deliver all Project Record Documents, shop drawings, product data, and samples to the Architect for the Owner's use, upon completion of the Work and prior to request for Final Acceptance of the Work.
- F. In addition, at the completion of the work, the General Contractor is responsible for the preparation and submittal of neat, clean well drafted, and complete record drawings, at no additional costs to the Owner. These reproducible Project Record Documents shall be transmitted to the Architect as a condition precedent to final payment, and include documents prepared by the food service, fire protection, plumbing, mechanical and electrical trades. All files must be "e-transmitted" to ensure that all associated CAD external references, plot styles, and fonts are included in one file for ease of use by the Owner. All as-built drawing sheets are to be numbered and oriented the same as the contract drawings.

1.8 FINAL AS-BUILT SITE SURVEY

- A. Under provisions of Section 01 73 00 - EXECUTION, Surveyor shall provide final corrected submission of Final Site Survey (As-built property survey) after work has been completed.
1. Final site survey shall show significant features for the Project. Include a certification, signed by the surveyor, to the effect that metes, bounds, lines and levels of the Project are accurately positioned as shown on the survey.
 2. Final site survey drawings shall graphically indicate all items in a similar manner as the original site survey drawings.
 3. Final site survey drawings shall maintain original sheet numbering.
- B. Survey format shall be in accordance with requirements of the authorities having jurisdiction, and show the following as a minimum:
1. Property boundaries.
 2. All required legal descriptions.
 3. Bench marks.
 4. Completed foundation work.
 5. Building extremities.
 6. Pad mounted equipment.
 7. All paving work.

8. Underground utilities and all changes in existing utilities.
 - C. Record deviations from required lines and levels. Advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Final Site Survey, record deviations that are accepted and not corrected.
 - D. Submit signed, sealed and certified copies shall be provided to the architect's office for review prior to filing with authorities having jurisdiction. Ensure information is complete and accurately submitted in a timely fashion.
 1. Recording: At Substantial Completion, have the final survey recorded by or with local authorities as the official "Property Survey".
- 1.9 OPERATION AND MAINTENANCE MANUALS
- A. General: Coordinate content and submission requirements of operation and maintenance manuals with Owner's Commissioning Agent.
 - B. Prepare data in the form of an instructional manual. Furnish separate manuals for each of the following groups of equipment:
 1. Special equipment and systems.
 2. Fire protection system.
 3. Utilities and plumbing systems.
 4. Heating, ventilation and air conditioning system.
 5. Electrical systems.
 - C. Furnish digital and properly identified Manuals prior to request for Final Acceptance.
 1. Manuals shall be in electronic PDF format that is clearly and concisely digitally bookmarked and organized into folders by discipline.
 - a. Keep as currently written.
 - b. Reference drawings shall be in electronic PDF format and inserted in relevant locations to corresponding manual item. Preference is to keep drawings to 11 by 17 inch maximum size.
 - c. Provide warranty spreadsheet/table of contents with PDF hyperlinks to all the warranties throughout the manual files.
 2. Each manual shall include the same following minimum information:
 - a. Table of Contents.
 - b. Directory of General Contractor, Trade Contractors, subcontractors, and major equipment supplies listing addresses, phone numbers and appropriate emergency phone numbers.
 - 1) Include local sources of supplies and replacement parts.
 - c. Directory of Architect and consultants listing addresses and phone numbers.
 - d. Operation and maintenance instructions. Provide schematic diagrams of control systems, circuit directories for each electric panel and charts showing the tagging of all valves.
 - e. Air and water test and balancing reports.
 - f. Maintenance and cleaning instructions for finishes.
 - g. Product and manufacturer's Certificates.
 - h. Photocopies of all extended warranties and bonds.

3. Submit one digital copy of completed volume in final form 21 days prior to Final Inspection. This copy will be returned after final inspection with Architect's comments; Revise and submit all volumes to Owner.
- D. For each item of equipment, include description of equipment, component parts and accessories. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts. Additionally provide the following for each item:
1. Panelboard circuit directories: Provide electrical service characteristics, controls and communications.
 2. Include color coded wiring diagrams as installed.
 3. Operating procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
 4. Maintenance requirements: Include routine procedures and guide for troubleshooting; disassembly, repair, and re-assembly instructions; alignment, adjusting, balancing, and checking instructions.
 - a. Maintenance drawings: Supplement product data to illustrate relation of component parts of equipment and systems, to show control and flow diagrams. Do not use project Record Documents as maintenance drawings.
 5. Provide servicing and lubrication schedule, and list of lubricants required.
 6. Include manufacturer's printed operation and maintenance instructions.
 7. Include sequence of operation by controls manufacturer.
 8. Provide control diagrams by controls manufacturer as installed.
 9. Provide General Contractor's coordination drawings, with color coded piping diagrams as installed.
 10. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
 11. Provide original manufacturer's parts (OEM) list, illustrations assembly drawings, and diagrams required for maintenance.
 - a. Provide list of original manufacturer's spare parts (OEM), current prices, and recommended quantities to be maintained in storage.
 - b. Include local source of supplies and replacement parts, and any other data pertinent for procurement procedures.
 12. Additional requirements: As specified in individual specification Sections.
- E. Standards:
1. Measurements: Provide all measurements in U.S. standard units such as feet and inches, pounds, and cfm; provide additional measurements in the "International System of Units" (SI).
 2. Abbreviations: Provide complete nomenclature of all parts of all equipment; include part numbers of all replaceable parts.
- 1.10 MATERIALS AND FINISHES MANUAL
- A. Furnish digital copies of properly identified manuals for all materials and finishes prior to request for Substantial Completion review.

1. Manuals shall be in electronic PDF format that is clearly and concisely bookmarked or organized into folders by discipline.
 - a. Keep as currently written.
 - b. Reference drawings shall be in electronic PDF format and inserted in relevant locations to corresponding manual item. Preference is to keep drawings to 11 by 17 inch maximum size.
 - c. Provide warranty spreadsheet/table of contents with PDF hyperlinks to all the warranties throughout the manual files.
 - B. Manuals shall include the following:
 1. Product data, with catalog number, size, composition, color, and texture designations for all building products, applied materials, and finishes. Provide information for re-ordering custom manufactured products.
 2. Instructions for care and maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
 3. Moisture protection and weather exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
 4. Additional requirements: As specified in individual specification Sections.
- 1.11 PEST CONTROL INSPECTION AND REPORT
- A. Engage an experienced, licensed exterminator to make a final inspection and fully rid Project of rodents, insects, and other pests.
 1. Prepare and submit report, identify:
 - a. Area or areas which were treated.
 - b. Rodenticides used.
 - c. Manufacturer's data including MSDS, special precautions and applications instructions.
 - d. Pollution preventive measures employed.
- 1.12 SPARE PARTS AND MAINTENANCE MATERIALS
- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.
 - B. Deliver materials to on-site location designated by the Owner; obtain receipt.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 78 36
WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. General: This Section specifies general administrative and procedural requirements for warranties, guarantees and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties. Warranty, Guarantee and Bond requirements of this Section are applicable to all trades, all Divisions of the Specifications, and applies to all Work performed under this Contract.
 - 1. Warranties required under the Contract are in addition to and not in lieu of any remedy or warranty to which the Owner is entitled under law.
 - 2. Warranties required under the Contract are not a waiver of Owner's legal rights.
- B. Construction General Contractor's Procurement Obligations: Do not purchase, subcontract for, or allow others to purchase or sub-subcontract for material or units of work for project where a special project warranty, certification or similar commitment is required, until it has been determined that entities required to countersign such commitments are willing to do so.

1.2 RELATED REQUIREMENTS

- A. General provisions of the Contract, including General and Supplementary Conditions apply to this Section.
- B. Individual Specification Sections contain additional specific requirements for warranties and bonds.
- C. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

1.3 DISCLAIMERS AND LIMITATIONS

- A. General Limitations: It is recognized that specific warranties are intended primarily to protect Owner against failure of the work to perform as required, and against deficient, defective, and faulty materials and workmanship, regardless of sources.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Construction General Contractor of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers, Trade Contractors and subcontractors required to countersign special warranties with the Construction General Contractor.
 - 1. Pro-rating of warranties: Except where explicitly specified otherwise, each warranty issued shall cover the full cost of warranty-related repairs throughout the full term of the warranty.

1.4 DEFINITIONS

- A. Categories of Specific Warranties: Warranties on the work are in several categories, including those of General Conditions, and including (but not necessarily limited to) the

following specific categories related to individual units of work specified in sections of Divisions 2 through 50 of these Specifications:

1. Construction General Contractor's Comprehensive Warranty: The Construction General Contractor shall provide a comprehensive one-year warranty covering all labor, materials, equipment and work related to the entire Contract and shall promptly repair or replace defective and deficient work.
2. Special Project Warranty (Guaranty): A warranty specifically written and signed by Construction General Contractor for a defined portion of the work; and, where required, countersigned by Trade Contractor or subcontractor, installer, manufacturer or other entity engaged by Construction General Contractor. Special Warranties extend time limits provided by standard warranties or to provide greater rights for the Owner.
3. Specified Product Warranty: A warranty which is required by Contract Documents, to be provided for a manufactured product incorporated into the work; regardless of whether manufacturer has published a similar warranty without regard for specific incorporation of product into the work or has written and executed a special project warranty as a direct result of Contract Document requirements.
 - a. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
4. Coincidental Product Warranty: A warranty not specifically required by Contract Documents (other than as specified in this Section), but which is available on a product incorporated into the work, by virtue of the fact that manufacturer or product has published warranty in connection with purchases and use of product without regard for specific applications except as otherwise limited by terms of warranty.

1.5 WARRANTY REQUIREMENTS

- A. Warranty Period is unconditional for a minimum of one year, unless noted in the specific specification section for a longer time period.
- B. Warranty Period Commencement Date: Effective stating date for Warranty periods is the Date of Substantial Completion for Project as listed under Section 01 12 00 Project Phasing.
 1. Equipment and systems start-up, operation and use, occurring prior to Project Substantial Completion, will not be considered commencement of warranty period under any terms of this Contract.
 2. Exceptions: Starting dates for warranties prior to the Project Date of Substantial Completion are not permitted, except for the two conditions below:
 - a. Manufacturer Warranty requirements specified in individual specification sections explicitly specify that a required warranty or guarantee shall be effective on date of shipment, date of manufacturer, or date of installation. The Installer must provide a warranty extension to the date of substantial completion.
 - b. Warranties for Incomplete work: The effective date for warranty of work which has not been completed prior to the Date of Substantial Completion, shall be effective on the date of the Owner's acceptance of the Work.
- C. Related Damages and Losses: In connection with Construction General Contractor's correction of warranted work which has failed, remove and replace other work of project which has been damaged as a result of such failure, or must be removed and replaced to provide access for correction of warranted work.

WARRANTIES

1. Consequential Damages: Except as otherwise indicated or required by governing regulations, special project warranties and product warranties are not extended to cover damage to building contents (other than work of Contract) which occurs as a result of failure of warranted work.
- D. Reinstatement of Warranty Period: Except as otherwise indicated, when work covered by a special project warranty or product warranty has failed and has been corrected by replacement or restoration, reinstate warranty by written endorsement starting on date of acceptance of replaced or restored work.
 1. Reinstated warranty value: The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
 2. Reinstated warranty period: A period of time ending upon date original warranty would have expired, if there had been no failure, but not less than half of original warranty period of time.
- E. Warranties are Irrevocable: Warranties issued to the Owner are irrevocable.
 1. Non-Payment: If warrantor refuses to issue warranty, or attempts to revoke warranty due to lack of payment by any party other than the Owner, the Construction General Contractor shall resolve the payment conflict, and cause the warranty to be issued or reinstated.
 2. Incomplete or incorrect Installation: If warrantor refuses to issue warranty, or attempts to revoke warranty due to improper installation or other deficiency, the Construction General Contractor shall correct the deficiency and cause the warranty to be issued or reinstated.
- F. Transferable Warranties: All warranties shall permit Owner to transfer or assign warranties to future owners or other assignors at no additional cost to the Owner for the full warranty period.
- G. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents. The Construction General Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Owner has benefited from use of the work through a portion of its anticipated useful service life.
 1. Work repairs or replaced under warranty shall be warranted for the full duration of the original warranty.
- H. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
- I. Rejection of Warranties:
 1. Owner reserves the right, at time of substantial completion or thereafter, to reject coincidental product warranties submitted by Construction General Contractor, which in opinion of Owner tend to detract from or confuse interpretation of requirements of Contract Documents.
 2. Owner reserves the right to reject warranties and to limit selection to products with warranties which are not in conflict with the requirements of the Contract Documents.
- J. Owner's right to refuse Work: The Owner reserves the right to refuse to accept work for the project where a special warranty, certification, or similar commitment is required on such

work or part of the work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.6 COMPREHENSIVE WARRANTY

- A. Comprehensive Warranty: In addition to all other warranties, the Construction General Contractor shall issue a Comprehensive Total Contract Warranty which shall include all work of this Contract, without limitation including consequential damages.
 - 1. Duration of Comprehensive Warranty: One full year from date of Substantial Completion.
 - 2. Consequential damages: Warranty includes consequential damages which relate to a warranty claim, these include without limitation:
 - a. All costs required to uncover and repair all work related to warranty claim.
 - b. All costs relating to repair and restoration of damaged property, resulting from warranty claim.
 - c. All costs resulting from failure to conform to the Contract Documents, and for required rebuilding, construction or reconstruction to correct work.
 - d. Perform to the satisfaction of the Owner all repairs, reconstruction, and restoration to original condition of adjacent and related work affected by damage under a warranty claim.
- B. Warranty Claims: Owner will notify Construction General Contractor in writing of each warranty claim. Warranty repairs shall be completed within 30 days of written notice, except as pre-approved by Owner.
 - 1. In the event of an emergency condition, where in the reasonable opinion of the Owner an immediate repair under warranty is necessary, warranty repairs shall be completed within 14 calendar days from date of notice.
 - 2. Owner's right to correct: In the event the Construction General Contractor fails to respond to a warranty claim within the specified time limits, the Owner reserves the right to make the necessary corrections or repairs and recover all costs and expenses from the Construction General Contractor.
- C. Construction General Contractor's responsibilities under Comprehensive Warranty:
 - 1. Notify in writing each affected warrantor and original Trade Contractor, subcontractor, installer, vendor as appropriate to the warranty claim.
 - 2. Manage the warranty claim for the Owner.
 - 3. Assist the Owner in obtaining warranty satisfaction.
 - 4. Arrange and manage all warranty related work including work relating to consequential damages.

1.7 SUBMITTALS

- A. Submit written warranties to the Owner prior to the date certified for Substantial Completion. In compliance with requirements specified under Section 01 77 00 – CLOSEOUT PROCEDURES and Section 01 78 00 – CLOSEOUT SUBMITTALS.
 - 1. When a designated portion of the Work is completed and occupied or used by the Owner by separate agreement with the Construction General Contractor during the construction period, submit properly executed warranties to the Owner within 14 calendar days of completion of the designated portion of Work.

2. Refer to individual section of Divisions 2 through 50 for the determination of units of work which are required to be specifically or individually warranted, and for the specific requirements and terms of those warranties (or guarantees).
 3. Specific Warranty Forms: Where a special project warranty (guaranty) or specified product warranty is required to be executed, prepare a written document to contain terms and appropriate identification, ready for execution by all required parties (including manufacturers, vendors, Trade Contractors and subcontractors). Submit draft to Owner (through Architect) for approval prior to final executions.
- B. Form of Submittal: At Final Completion, compile three (3) copies of each required warranty and bond properly executed by the Construction General Contractor, or by the Construction General Contractor, filed Sub-bid Contractors, subcontractor, supplier or manufacturer. Organize the warranty documents into an orderly sequence based on the Table of Contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
 2. Provide heavy paper dividers with celluloid-covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
 3. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the project title or name, and the name of the Construction General Contractor.
 4. When operating and manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 SCHEDULE

- A. Provide warranties on products and installations as specified in individual specification Sections in Divisions 2 through 50 of the Project Manual.

End of Section

Section 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. General: The work described in this Section consists of selective demolition, cleaning, removal and legal disposal of all structures, equipment and materials indicated for demolition, or careful removal and temporary storage of materials and equipment indicated for salvage and re-use, or salvage and delivery to Owner. No attempt is made in this Section to list the entire scope of selective demolition required on this project or to describe each element to be removed. Drawings indicate both existing construction and final construction. It is the responsibility of the General Contractor to determine for itself the scope and nature of the existing materials, equipment and finishes required for removal or salvage, based on the information provided in the full set of Contract Documents.
- B. Permits: Obtain and pay for all demolition and construction permits required by local authorities having jurisdiction and other regulatory agencies and utility companies.
- C. Selective demolition and removal and disposal work includes, but is not limited to:
 - 1. Removal of exterior site related surfaces, including but not limited to bituminous pavement, concrete pavement, granite curbs, and plantings.
 - 2. Removal and relocation of existing heavy equipment to be relocated within adjacent spaces.
 - 3. Install all temporary barriers, noise, sound and dust controls for work under this section
 - 4. Removal of exterior fenestration and finishes to facilitate the new addition.
 - 5. Cut openings in roofing system as required for new structural steel framing, and new mechanical and plumbing systems, including EPDM roofing system and metal decking.
 - 6. Removal of partitions, doors, metal frames, ceilings, and floor finishes.
 - 7. Removal of toilet partitions, lockers, toilet accessories, and wire mesh partitions.
 - 8. Removal of plumbing, mechanical, and electrical equipment disconnected and placed on ground by others.
 - 9. All interior items, shelving, cabinetry, casework and similar items throughout the work area.

1.2 RELATED REQUIREMENTS

- A. Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS: Procedural and administrative requirements for temporary facilities and controls, including:
 - 1. Temporary heat.
 - 2. Temporary barriers, barricades, and dust control.
 - 3. Temporary fire protection.
- B. Section 01 73 29 - CUTTING AND PATCHING: Procedural and administrative requirements for cutting and patching.
- C. Section 04 20 00 - UNIT MASONRY: Cutting and patching of existing masonry,
- D. Section 05 50 00 – METAL FABRICATIONS: Cutting existing metal roof decking as required
- E. Section 07 53 23 – EPDM ROOFING: Removal of existing membrane roofing, roof insulation, and wood nailers.
- F. Division 21 - FIRE SUPPRESSION
 - 1. Disconnection and dismantling designated fire suppression systems and components. In accordance with the AHJ regulations the existing sprinkler system must be maintained and active, except as scheduled, and outlined in the contractors NFPA filing.
- G. Division 22 - PLUMBING
 - 1. Disconnection, salvage, re-working and re-installation of plumbing system.
 - 2. Disconnection and dismantling designated plumbing systems and components.
- H. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING (HVAC):
 - 1. Disconnection, of rooftop ventilator ducts.
 - 2. Disconnection and dismantling designated mechanical systems and components.
- I. Division 26 - ELECTRICAL:
 - 1. In accordance with the AHJ regulations the existing fire alarm, security systems system must be maintained and active, except as scheduled, and outlined in the contractors NFPA filing.
 - 2. Disconnection and dismantling designated electrical systems and components.
 - 3. Disconnection, salvage, and re-installation of designated light fixtures.

- J. Division 31 - EARTHWORK: Excavation and backfilling for foundations, ramps, below-grade utilities, retaining walls, and exterior concrete slabs.
- K. Individual specification sections: Cutting and patching incidental to work of individual specification sections shall be performed by respective trades, except as specified in Section 01 73 29 – CUTTING AND PATCHING.
- L. Individual specification sections: Utility shutoffs by respective trades.

1.3 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A10.6 – Safety Requirements for Demolition Operations.
 - 2. NFPA 241 – Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.4 OWNERSHIP OF REMOVED MATERIALS

- A. If during the work, articles of unusual value, or, of historical or archaeological significance, are encountered (which have not previously identified as such in the Contract Documents) the ownership of such articles is retained by the Owner. Upon discovery, immediately furnish to the Architect and Owner, information regarding their discovery Resolution shall be handled as a Change in the Work.
- B. Ownership of materials, equipment and furnishings designated for salvage for re-use in this Project or designated for Owner's use is retained by the Owner.
- C. Ownership of materials, equipment and furnishings to be removed from the Project which are not defined by the above two paragraphs is retained by the General Contractor ; if any of these are considered of salvageable value to the General Contractor , they may be removed from the Project as work progresses.
 - 1. On-site storage or sale of removed items is prohibited.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Comply with all requirements of this contract relative to protection, scheduling and coordination with the Owner.
 - 2. Hazardous materials: When hazardous materials are encountered, they shall be handled, removed, and disposed of in accordance with all regulatory agency requirements.

3. Coordinate and arrange with utility, mechanical and electrical trades for their disconnecting, rerouting and maintenance of existing services leading to adjacent occupied buildings, as part of the work of this Contract.
 4. Coordinate Work of this Section with related utilities work identified in the Contract Documents.
- B. Pre-Demolition Meeting: At least two weeks prior to commencing the work of this Section, conduct a pre-demolition conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
1. Required attendees: Architect, General Contractor's project manager and on-site superintendent, demolition subcontractor's project superintendent, and representatives of related utility trades.
 2. Conference Agenda:
 - a. Scheduling of demolition operations. Review critical demolition sequencing with other work.
 - b. Coordination of utility service requirements and disconnects.
 - 1) Review functioning utility services which are to remain in service throughout demolition work.
 - 2) Review requirements for marking location of disconnected utilities, and project record (as-built) requirements.
 - c. Review conditions of existing construction to be demolished.
 - 1) Review extent and location of selective demolition.
 - 2) Review special demolition and salvage procedures required for historic building elements.
 - 3) Exploratory demolition and concealed conditions.
 - d. Coordination of demolition work with work of other contracts.
 - e. Review shoring and bracing procedures, and structural load limitations of existing structure.
 - f. Review of site use, staging, and storage locations for salvaged materials and materials for recycling program.
 - g. Emergency weather protection procedures and weather limitations.
 - h. Review conditions of existing construction to be demolished.
 - i. Review structural load limitations of existing structure.

- j. Review extent and location of selective demolition. Review areas where existing construction is to remain and requires protection
 - k. Review special requirements for temporary protection of existing finishes and materials to remain.
 - l. Review requirements of work performed by other trades that rely on substrates exposed by demolition operations.
 - m. Procedures for processing field decisions.
 - n. Procedures for handling hazardous materials.
 - o. Review fire protection procedures for cutting torches, and other potentially hazardous operations.
 - p. Review general safety regulations and requirements for demolition work.
- C. Sequencing:
- 1. Coordinate and arrange with mechanical and electrical trades for their disconnecting, rerouting and maintenance of existing services in the buildings as required, as part of the work of this Contract.
- D. Scheduling:
- 1. Comply with all requirements of this contract relative to protection, scheduling, phasing, and coordination with the Owner.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
- 1. Schedule: Prior to commencement of work, prepare a schedule indicating proposed methods and sequence of operations for demolition work.
 - a. Include coordination for shut-off, capping, and continuation of utility services as required, together with details for dust and noise control protection.
 - b. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations. Receive acceptance from Architect prior to commencing work.
 - 2. Shop drawings: Indicate demolition sequencing and locations of salvageable items.
 - 3. Design Data: Submit calculations for bracing and shoring, signed and sealed by professional engineer registered in the Commonwealth of Massachusetts.

4. Permits: Submit copy of permits required by regulatory agencies for demolition.
 5. Special Procedure Submittals: Submit copies of written agreements from private landowners, landfill operators, or other agencies accepting disposal of demolished materials at least two weeks prior to commencement of demolition work.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Record Documentation: Indicate actual location of capped site utilities.

1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for demolition work, safety of structure, dust control, and disposal of debris. Conform to procedures applicable when discovering hazardous materials or contaminated substances.
1. The General Contractor is directed not to disturb or attempt removal of any discovered hazardous materials or contaminated substances. Immediately notify both the Owner and the Architect upon discovery of such conditions.
- B. Obtain and pay for required permits and licenses required from authorities prior to commencing demolition work. Arrange and pay for legal disposal of removed materials and equipment, obtain proper disposal receipts for verification.
- C. Notify affected utility companies and Owner before starting work and comply with utility company requirements.
- D. Do not close or obstruct egress width to exits. Do not disable or disrupt building fire or life safety systems without 3 days prior written notification to the Owner.

1.8 QUALITY ASSURANCE

- A. General: Conduct the work in a manner giving prime consideration to protection of the public; protection from the weather, control of noise, shocks and vibration; control of dirt and dust; orderly access for and storage of materials; protection of existing buildings; protection of adjacent surfaces and property; coordination and cooperation with the Owner at all times.
1. Comply with all requirements of this contract relative to protection, scheduling and coordination with the Owner.
- B. Qualifications:
1. Demolition: Company specializing in performing work of this section with minimum 3 years documented experience.

2. Shoring and bracing design: Design shoring, and bracing, under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

1.9 SITE CONDITIONS

- A. Comply with wind and weather conditions established at pre-demolition meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Condition of Structures: Owner assumes no responsibility nor makes any claim as to the actual condition or structural adequacy of any existing construction to be demolished. The General Contractor shall investigate and assure himself of the condition of the work to be demolished and shall take all precautions to ensure safety of persons and property.
 1. Notify both Owner and Architect, if any type of hazardous chemicals, gases, explosives, flammable material, unmarked containers, or similar dangerous substances are discovered. Cease work in affected areas until directed by Architect. Continue work in other areas.
- B. The General Contractor shall have examined the existing conditions per requirements of the Conditions of the Contract and Division 1 - General Requirements, and reviewed Contract Documents prior to commencement of demolition. Coordinate and verify scope of selective demolition with other portions of work specified in other sections, and under separate Contract. Change orders will not be issued for the removal of any exposed to view materials or equipment, which are either indicated on the Drawings for removal, or not indicated, but necessary to remove for the Work of this Project.
- C. Layout of demolition in masonry construction. After General Contractor identifies areas requiring demolition and subsequent patching of masonry. Masonry Trade Contractor shall indicate on walls the extent of masonry cutting and demolition work which will be performed by the General Contractor. Necessary finished patching of openings will be performed by the Masonry Trade Contractor.
- D. Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing damage to structure surfaces, equipment, or to surrounding properties which could be misconstrued as damage resulting from selective demolition work; file with Architect prior to starting work. Comply with requirements of Section 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION.

3.2 PREPARATION

- A. General: Provide necessary protection of non-work areas during demolition operations. Provide, erect and maintain temporary barriers as required to protect non-construction related pedestrian and vehicular traffic using the adjacent portions of the site and building.
 - 1. Erect and maintain temporary partitions to prevent the spread of dust, odors, and noise to permit continued Owner occupancy of adjacent facility.
- B. Protect existing structures which are not to be demolished. Protect designated materials and equipment to be removed and retained by Owner.
 - 1. Cover or otherwise protect as necessary existing equipment, furniture and furnishing located beyond the immediate demolition work.
 - 2. Protect existing landscaping materials, structures, and appurtenances which are not to be demolished.
- C. Prevent movement of structure; provide required bracing and shoring.
 - 1. Protect existing active utility services and structures from damage during selective demolition work including during installation of bracing and removal of same. Repair or replace damages to satisfaction of Owner.
- D. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations.

3.3 GENERAL REQUIREMENTS FOR SELECTIVE DEMOLITION

- A. Conduct demolition to minimize interference with adjacent building areas, in compliance with governing laws and buildings, with prime consideration given to the safety, protection and convenience of the public and Owner's personnel.
 - 1. Maintain protected egress and access to the Work at all times.
- B. Perform selective demolition in an orderly and careful manner. Carefully cut materials to be removed to eliminate damage to portions to remain. Protect existing structure designated to remain.
 - 1. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.
 - 2. Except as otherwise required by Project phasing requirements, proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 3. Locate equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

4. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent. Do not throw trash from windows or from roof.
 5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 7. Pull nails and fasteners which remain after removal of attached material. Remove lath, strapping and other substructures associated with finishes to be removed.
 8. Where existing finishes are indicated to be removed, remove down to bare subsurface clean without any foreign residue, without causing damage to the subsurface.
 - a. After removal of non-asbestos finish flooring materials. Remove underlying mastic and prepare substrate to receive new flooring materials by shotblasting method. Create a uniform 20 mil profile. Mechanically scarify areas which cannot be profiled by shot blast method. Thoroughly wash all flooring substrate and leave clean and dry ready for application of new flooring materials.
- C. Remove foundation walls and footings as indicated on Drawings, and where indicated, to a minimum of two feet beyond area of new construction.
- D. Cutting openings and holes: Neatly cut openings and holes plumb, square, and true to dimensions required. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces.
1. All penetrations in floors and roof shall be framed with miscellaneous metal work prior to cutting and demolition of deck and concrete.
 2. Repair damage done to existing elements of building to remain, except repairs specified to be provided under other Sections. Repairs shall be done in such manner as to closely match construction, appearance and quality of original work.
- E. Use of cutting torches:
1. Do not use cutting torches until work area is cleared of flammable materials.
 2. Maintain adequate ventilation when using cutting torches.
 3. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations.

4. Maintain fire watch and portable fire-suppression devices during flame-cutting operations. Comply with fire prevention measures specified under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
- F. Carefully observe existing structure during demolition operations, cease operations immediately if structure appears to be in danger. Immediately notify both Architect and Owner's Project Representative. Do not resume demolition operations until directed.
- G. Disconnect, cap and clearly identify designated utilities within demolition areas.
 1. Cap and remove abandoned existing utilities back to locations indicated, or to limit line of Contract where terminations are not indicated.
 - a. Pipes to be demolished that require a connection shall be removed to the extent required to install the new connection. Remove ripe sections by saw-cutting, removing a complete pipe section to an existing joint, or other adequate means which results in a clean joint.
 2. Protect and maintain conduits, drains, sewers, pipes, and similar utilities that are not to be demolished
- H. Disconnect existing equipment and fixtures to be removed, or services abandoned, and piping, wiring, and conduit which would otherwise be exposed in the finished work. Remove from site disconnected equipment and fixtures and piping not to be reused.
 1. General Contractor to remove and dispose of all equipment not tagged or scheduled for reuse.
- I. Abandoned Equipment, Utilities, Systems: Remove in their entirety. Abandonment in place is not acceptable, except where an item is specifically indicated to be abandoned in place.
 1. "Abandoned" means the item is not operational in the completed Contract.
 2. Without limitation, remove abandoned pipes, tubing, conduits, wires, cables, ducts, equipment, machines, and all elements and items related to abandoned work including, without limitation, hangers, connectors, anchors, valves, drains, strainers, sumps, panels, mounting boards, grounding rods, ground connectors, boxes, dampers, plenums, insulation, escutcheons, trims, and all other related items.
 3. Where an existing element is indicated to be abandoned in place, the abandoned item shall be cut off and, if hollow, capped.
 - a. Cut off sufficiently below the finished plane to permit space for patching over the abandoned element. The General Contractor shall provide all cutting and chipping required to recess the cut element, and to coordinate depth of cut-offs required for finishing.

3.4 BRACING

- A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace. Provide suitable bracing materials which will support loads imposed
- B. Do not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to Architect.
- C. Install internal bracing, if required, to prevent spreading or distortion to braced frames.
- D. Maintain bracing until structural elements are re-braced by other bracing or until permanent construction is able to withstand designed live and dead loads.
- E. Remove bracing in stages to avoid disturbance or damage to existing structure.
- F. Repair or replace adjacent work damaged or displaced through installation or removal of bracing work.

3.5 EXPLORATORY DEMOLITION AND CONCEALED CONDITIONS

- A. Exploratory Demolition and Concealed Conditions:
 - 1. Selective demolition work includes controlled exploratory demolition work which is indicated on Drawings and as may be additionally field directed by the Architect. Additional exploratory demolition may also be required to thoroughly investigate and determine the exact location of existing concealed work or to expose concealed conditions to view.
 - 2. Exploratory demolition may be used to clarify the Contract Documents to improve the interface of new and existing work.
- B. Concealed conditions: Carefully check for concealed structure, pipes, conduits, wires, utilities, systems, and other elements before beginning cutting and selective demolition work.
- C. Discovery: When unknown, concealed utilities and systems are discovered, verify the purpose, routing, circulation, origin, and termination of these items.
 - 1. If the unknown, concealed items are part of a system to be abandoned, remove the item in its entirety.
 - 2. Protect discovered concealed items are part of an existing system to be preserved and incorporated into the Work, or part of an active system to remain. Protect system elements from disturbance and notify both Owner and Architect and follow the Architect's directions
 - a. In circumstances when existing system to remain is damaged due to the Work (including cutting, demolition or exploratory investigation) notify

both Owner and Architect immediately. Repair or re-route the damaged system components as directed by the Architect at no additional cost to the Owner

3.6 GENERAL DUST CONTROL

- A. General Contractor shall employ dust and pollution prevention procedures at all times.
 - 1. Clean up loose debris daily, or more frequently as required, to prevent the wind spreading debris. Keep dumpsters covered when not in use.
 - 2. Wet down debris (as appropriate) to prevent air pollution by dust rising from demolition work. Wet down dumpsters to prevent fires caused by vandals.
 - 3. Employ tarpaulins on all trucks carrying debris.

3.7 SALVAGE MATERIALS AND PRODUCTS

- A. Carefully salvage and provide safe storage for products designated for salvage, reuse, as indicated on the Drawings, as specified herein, or as requested by Owner for reuse on the project, or to be stored for Owner's future use. Take particular care with finished items and items requiring special handling.
 - 1. Remove items indicated to be salvaged with extreme care to prevent damage.
 - 2. All components and parts of salvaged items shall be saved and packaged.
- B. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area as designated by Owner.
 - 5. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - 3. Protect items from damage during transport and storage.
 - 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.8 SPECIFIC DEMOLITION REQUIREMENTS FOR MATERIALS AND SURFACES.

A. Floors, General:

1. Completely remove existing flooring located in areas scheduled to receive new flooring surfaces and as additionally indicated. Remove all finish flooring layers of flooring down to the existing substrate.
 - a. Completely remove flooring systems to substrate, including full removal of all setting beds and adhesives.
2. Remove resilient flooring and adhesive in strict accordance with the technical bulletin entitled "Recommended Work Practices for the Removal of Resilient Floor Covering", as issued by Resilient Floor Covering Institute (RFCI).
3. The General Contractor shall provide all patching of flooring substrates and subfloors. Respective finish flooring trades and Trade Contractors are responsible for patching of finish flooring systems matching abutting surface. Trade Contractor patching work is as follows:
 - a. Resinous Flooring: (Contractor, refer to Section 09 67 23)
 - b. Linoleum Flooring: (Flooring Trade Contractor, refer to Section 09 65 43)

B. Walls, General:

1. Remove interior walls and partitions as indicated and as needed to accommodate new work.
2. Where existing walls-to-remain are indicated to receive new finishes, completely remove trim and fasteners.
3. The General Contractor shall provide patching of substrates and back-up systems except where such materials are specified as part of a Filed-subcontractors system. Finishes work shall be provided under individual product specification sections. Trade Contractor patching work is as follows:
 - a. Ceramic tile walls and base: (Tile Trade Contractor, refer to Section 09 30 13)
 - b. Masonry walls and partitions (Masonry Trade Contractor, refer to Section 04 00 01).

C. Ceilings, General:

1. Where ceilings are indicated to be removed, also remove ceiling mounted systems and equipment leaving only bare structure free from hangers.
 2. Patching: The General Contractor shall provide patching of substrates and back-up systems except where such materials are specified as part of a Trade Contractor's system. Ceiling work shall be provided under individual product specification sections.
- D. Doors and Frames: Where doors and frames are indicated to be removed from walls or partitions which are to remain, remove doors and frames carefully so as to minimize damage to wall. Repair and patch wall as necessary to accommodate new door frame or other new work.
- E. Masonry: Masonry Trade Contractor, specified under Section 04 00 01, is responsible for demolition of existing masonry chimneys.
- F. Roofing: Roofing and Flashing Trade Contractor, specified under Section 07002, is responsible for demolition of roofing system components.
1. Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
 2. Remove existing EPDM membrane roofing system, including membrane, insulation, flashings, copings, and roof accessories down to metal deck substrate.
 3. Coordinate with the HVAC equipment removal
- G. Below-grade voids: Existing basements, cisterns and other below grade voids shall be filled with compatible fill material suitable acceptable by Architect for proposed construction and compacted per specific requirements defined in Division 31.
- H. Concrete, General: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.
- I. Concrete Slabs (suspended and slabs-on-grade): Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- J. Masonry: Demolish in small sections. Except where toothing is required, cut masonry using power-driven saw at junctures with construction to remain. Remove masonry between saw cuts.
- K. Elevator Equipment: Elevator Trade Contractor specified under Section 14 24 24 is responsible to completely remove all elevator equipment associated with elevators

as indicated, including but not limited to, cab, platform, rails, hoistway entrances, machines, and cables.

- L. Plumbing Equipment: Plumbing Trade Contractor specified under Division 22 is responsible to disconnect, cap and lower to floor items required to be removed, including but not limited to fixtures, equipment, water heaters, piping, hangers, valves, and insulation. General Contractor is responsible for removal from site and proper disposal.
- M. Heating, Ventilation, Air Conditioning. and Refrigeration (HVAC&R) Equipment:
 - 1. Drain system components designated for disposal of all lubricants, hydraulics, and refrigerants without releasing into atmosphere.
 - 2. HVAC&R Trade Contractor(s) specified under Division 23 is responsible to disconnect, cap and lower to floor items required to be removed, including but not limited to, ductwork, piping, fans, VAV boxes, unit ventilators, and all similar system equipment. General Contractor is responsible for removal from site and proper disposal.
- N. Electrical Equipment and Lighting Fixtures:
 - 1. Electrical Trade Contractor specified under Division 26 is responsible to disconnect, cap and lower to floor items required to be including but not limited to, panelboards, light fixtures, and overhead devices including, fire alarm, intercom, bus ducts. General Contractor is responsible for removal from site.

3.9 REPAIRS

- A. Repair all damage done to elements of buildings and structures to remain, except repairs specified to be provided under other Sections, or as indicated for removal in subsequent project phase(s). Repairs shall be done in such manner as to closely match construction, appearance and quality of original work.

3.10 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated or specified to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Comply with requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL, and specified waste diversion goals.
 - 2. As work progresses, regularly remove demolished materials from site. Do not allow demolished materials to accumulate on-site, except as required for materials determined to be reused, salvaged, or as required for waste segregation and diversion for recycling.

3. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn or bury demolished materials on site, arrange for legal disposal of the same.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.
 1. Comply with waste management reporting requirements on forms acceptable to the Owner.
 2. Record the amount (in tons or cubic yards) of material landfilled from the Project, the identity of the landfill, the total amount of tipping fees paid, transportation costs (if separate) and the total disposal cost. Include manifests, weight tickets, receipt, and invoices

3.11 CLEANING

- A. Daily cleaning: Sweep all street and roads affected by demolition operations.
- B. Upon completion of the work of this Section; remove unused tools and equipment, surplus materials, rubbish, debris, and dust. Leave area in raked or broom-clean condition, as appropriate.
- C. Upon completion of the work of this Section; clean adjacent structures and facilities of dust, dirt and debris caused by demolition work to the satisfaction of Owner, owner(s) of adjacent properties, and authorities having jurisdiction.

End of Section

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods and services referenced in or related to this Section shall also be bound by the documents identified in Division 00 Procurement and Contracting Requirements and Division 01 General Requirements.

1.2 SUMMARY

- A. Work Included: This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes. Cast-in-place concrete shall include, but not be limited to the following:

1. Foundations, piers, and footings.
2. Slabs-on-grade.
3. Fill for steel deck.
4. Foundation walls.
5. Equipment pads and bases. Housekeeping pads.
6. Exterior concrete door pads.
7. Concrete storage container pads.
8. Concrete thrust and anchor blocks.
9. Exterior pads for HVAC and electrical equipment.
10. Exterior concrete sidewalks where indicated.
11. Concrete for miscellaneous items: exterior equipment relocation and additional site structures.
12. Miscellaneous concrete for fills and encasement.
13. Provide and install concrete base at mockup.

- B. Related Sections include the following:

1. Section 01 45 00, QUALITY CONTROL.
2. Section 01 45 29, TESTING LABORATORY SERVICES
3. Section 01 45 90, PROGRAM OF STRUCTURAL TESTS AND INSPECTIONS, Program of Structural Tests and Inspections, Schedule of Tests and Inspections
4. Section 03 05 13, CONCRETE SEALERS.
5. Section 04 20 00, UNIT MASONRY; Masonry work.
6. Section 05 12 00, STRUCTURAL STEEL; Structural steel.
7. Section 05 31 00, STEEL DECK.
8. Section 06 10 00, ROUGH CARPENTRY.
9. Section 07 00 01, FOUNDATION WATERPROOFING.
10. Section 07 11 13, BITUMINOUS DAMPPROOFING.
11. Section 07 26 00, VAPOR RETARDERS.
12. Section 07 95 13, EXPANSION JOINT COVERS.
13. Section 31 20 10, EARTH MOVING; Excavation and establishment of subgrade elevations, site preparation.

- C. Alternates: Not applicable.
- D. Items To Be Installed Only: Not applicable.
- E. Items To Be Furnished Only: Not Applicable.

1.3 SUBMITTALS

- A. Refer to Section 01 33 00, SUBMITTAL PROCEDURES for submittal provisions and procedures.
- B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water-stops, joint systems, curing compounds, dry-shake finish materials, and others if requested by the Architect or SER.
- C. Shop drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement.
 - 1. All reinforcing shop drawings for concrete and masonry walls shall be shown on walls elevations with a scale of 1/4 in. = 1 ft. - 0 in.
 - 2. Include special reinforcing required for openings through concrete structures.
 - 3. Submit shop drawings of formwork for Architecturally Exposed Concrete showing cone tie patterns and form liner layout.
- D. Electronic Submittals: Refer to Section 01 33 00 for Submittal Procedure. In addition, provide Engineer (1) fullsize paper print of each shop drawing, in addition to the electronic submittal. Paper copy will be retained by the Engineer and electronic copy will be returned. Review cycle will not commence until paper copy of shop drawing has been received.
- E. Concrete mix design for each mix specified. Supporting test data shall be submitted if requested.
- F. Proposed method of curing concrete and associated products.
- G. Proposed precautions for hot weather and cold weather concreting.
- H. Samples of materials as requested by Architect, including names, sources, and descriptions.
- I. Laboratory test reports for concrete materials and mix design test.
- J. Description of Methods and Sequence of Placement. For each type of specially-finished concrete provide description of methods and sequence of placement.
- K. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where requirements that are more stringent are shown or specified:

1. Massachusetts State Building Code, Current Edition.
2. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings".
3. ACI 318, "Building Code Requirements for Reinforced Concrete".
4. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice".
5. Manual of Standard Practice for Detailing Reinforced Concrete Structures ACI 315.
6. ACI 308, "Recommended Practice for curing Concrete"
7. ASTM C 94, Ready-Mixed Concrete.

B. Inspection, Testing, and Quality Control

1. A Program of Inspection and Testing of cast-in-place concrete work will be established by the Structural Engineer of Record (SER) who will direct the implementation of tests as carried out by an Independent Testing Agency, under a separate contract with the Owner. Materials and workmanship shall be subjected to inspection and testing in mill, shop, and/or field by the SER and/or Testing Agency. Such inspection and testing shall not relieve the Contractor of his responsibility to provide his own inspection, testing, and quality control as necessary to furnish materials and workmanship in accordance with requirements of Contract Documents.
2. The General Contractor shall notify the SER and the Testing Agency prior to start of any phase of concrete work so as to afford them reasonable opportunity to inspect the work. Such notification shall be made at least 24 hours in advance.

C. Project Data:

1. Concrete Curing and Protection: Submit to the Architect/SER in accordance with the requirements of Contract Documents, detailed methods proposed for use for curing and protection prior to commencement of concrete work. This shall include winter protection and hot weather concrete methods.

D. Preconstruction Conference. Attend a preconstruction conference prior to the start of architectural concrete construction. Discussion will include the following:

1. The Contractor's program to obtain the specified quality of architectural concrete.
2. The procedures and methods for construction of preconstruction mock-ups specified herein.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products in accordance with Section 01 60 00, PRODUCT REQUIREMENTS.

1. Reinforcing steel and other items to be embedded in cast-in place concrete which are stored at the project site shall be above ground on platforms, skids

or other supports, protected from the elements by a waterproof covering ventilated to prevent condensation.

- B. General Contractor shall provide and pay for all dumpster services during the entire construction period. Suppliers and Sub-Contractors to bring all rubbish and debris to the dumpster location daily. No costs are to be assessed to the suppliers or Sub-Contractors by the General Contractor for this service.
- C. General Contractor, Sub-Contractors, and suppliers are all individually to furnish their own staging, scaffolding, and hoisting equipment necessary to get workers, material, and equipment from the point of delivery at the project site to the point of use or installation within the building and project site. All crane and rigging services required are the responsibility of each individual trade.

1.6 PRECONSTRUCTION MOCK-UPS

A. General

- 1. Schedule mock-up casting for acceptance 5 days prior to casting of concrete surfaces represented by the mockups.
- 2. Locate mock-up panels in non-public areas accepted by the Architect.
- 3. Continue to cast mock-ups until acceptable mock-ups area produced. Accepted mock-ups shall be the standard for color, texture, finish, jointing, and workmanship for the work.
- 4. Mock-up sequence of forming, placing, form removal, curing, and finishing shall be reviewed and accepted by the Architect.
- 5. Demonstrate in the construction of the mock-up formwork the sealer material, form release agent, and curing materials and methods to be used.
- 6. Mock-up formwork shall be inspected and accepted by the Architect before placing of concrete.
- 7. Use the same concrete mixes and placement procedures, accepted in mock-ups, in the final work, unless otherwise directed by the Architect.
- 8. Protect accepted mock-ups from damage until completion and acceptance of the work represented by the mock-up.
- 9. Remove mockups from site at completion of project.

- B. Mockups: Cast mockups of full-size sections simulating actual design and execution conditions for concrete mix materials, reinforcement, formwork, placing sequence, form removal, curing, finishing, methods and materials of stain removal and correction of defective work, and overall standard of workmanship.

- 1. Build mockups in the location and of the size indicated or, if not indicated, at a location designated by the Construction Manager.
 - a. Wall 4' x 8' Section
- 2. Notify Architect three days in advance of dates and times when mockups will be constructed.
- 3. Obtain Architect's approval of mockups before starting construction.
- 4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed concrete. If approved by the Landscape Architect mockup panels may be part of the final construction.
- 5. Demolish and remove approved mockups (not part of final construction) from the site when directed by Architect.

PART – 2 PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
 - 1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two (2) edges and one (1) side for tight fit.
- C. Concrete Column Forms: Sonotube Concrete Forms, manufactured by Sonoco, 1 North Second Street, Hartsville, South Carolina 29550. Toll Free (888) 875-8754. Website www.sonotube.com.
 - 1. Description: Multiple layers of 100 percent recycled paperboard, spirally wound, and laminated with adhesive.
 - 2. Interior Surface: Smooth with spiral seam. Moisture barrier plastic coating.
 - 3. Exterior Surface:
 - a. Sonotube RainGuard – 100 percent recycled paper, b. Sonotube Commercial - Moisture Barrier outer label.
 - 4. Forms will impart visible spiral mark on concrete columns.
 - 5. 1-piece, 1-time-use forms.
 - 6. Recyclable.
 - 7. Inside Diameter: As indicated on the Drawings.
- D. Chamfer strips shall be wood, PVC or rubber strips.
- E. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 mg/l volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties for Concrete Below Grade or Areas Not Exposed to View: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal.
 - 1. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.

2.2 METAL REINFORCING MATERIALS

- A. All steel is to consist of a minimum of 95% recycled steel with over 80% post-consumer and 15% pre-consumer recycled content in compliance with LEED requirements.
- B. Reinforcing Bars;

1. ASTM A 615, Grade 60, deformed.
 2. ASTM A 706, Grade 60, deformed, for all reinforcing to be welded.
 3. ASTM A 775, Epoxy Coating for Reinforcing Bars.
- C. Steel Wire: ASTM A 82, plain, cold-drawn steel, Refer to "Special Requirements for Architecturally Exposed Concrete" for required stainless steel wire.
- D. Welded Wire Fabric: ASTM A 185, welded steel wire fabric. All welded wire fabric shall be supplied in flat sheets.
- E. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.
1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Concrete bricks may be used to support reinforcing steel where application allows.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II.
1. Use one (1) brand of cement throughout Project unless otherwise acceptable to Architect. Refer to Section 2.08, "Special Requirements for Architecturally Exposed Concrete"
- B. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for Architecturally Exposed Concrete.
1. For Architecturally Exposed Concrete surfaces, do not use fine or coarse aggregates that cause spalling.
- C. Natural sand: ASTM C33.
- D. Water: Potable, clean and free from oils, acids, alkali, and other deleterious material.
- E. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.
- F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- G. Water-Reducing Admixture: ASTM C 494, Type A.
- H. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.
- I. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.
- J. Water-Reducing, Accelerating Admixture: ASTM C494, Type E.

2.4 RELATED MATERIALS

- A. Water-stops: Provide flat, dumbbell-type or center-bulb-type water-stops at construction joints and other joints as indicated. Size to suit joints.

- B. Polyvinyl Chloride Water-stops: Corps of Engineers CRD-C 572.
- C. Sand Cushion: Clean, manufactured, or natural sand.
- D. Vapor Retarder: Refer to Section 07 26 00 for vapor retarder.
- E. Vapor Retarder Mastic: Refer to Section 07 26 00 for liquid-applied vapor retardant membrane mastic coating for steel encased in concrete. Mastic to be compatible with Vapor Retarder.
- F. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- G. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
 - 1. Water proof paper.
 - 2. Polyethylene film.
 - 3. Polyethylene coated burlap.
- H. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq. ft./gal.
- I. Evaporation Control: Mono-molecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
- J. Underlayment Compound: Free-flowing, self-leveling, pumpable, cement-based compound for applications from one (1) inch thick to feathered edges.
- K. Bonding Agent: Polyvinyl acetate or acrylic base.
- L. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.
- M. Epoxy Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.
- N. Clear Penetrating Sealer for Concrete: Refer Section 03 05 13, CONCRETE SEALERS.
- O. Preformed Expansion Joint Filler: Resilient, flexible, non-extruding, expansion-contraction joint filler. Cellular fibers securely bonded together, uniformly saturated with asphalt. Joint filler shall conform to the following standards and have the following requirements:
 - 1. ASTM D1751.
 - 2. Resilience: When compressed to half its original thickness, recover to a minimum of 70 percent of its original thickness.
 - 3. Thickness: ½".

2.5 PROPORTIONING AND DESIGNING MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

- B. Submit written reports to Architect of each proposed mix for each class of concrete at least fifteen (15) days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect/SER
- C. Footings: Proportion normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4,000 psi.
 - 2. Maximum Slump: 4 inches.
 - 3. Slump may be increased to 6 inches with use of Mid-Range Water Reducing Admixture.
 - 4. Maximum water-cement ratio: 0.48
 - 5. No substitution of other cementitious materials for Portland Cement.
- D. Foundation Walls: Proportion normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4,000 psi.
 - 2. Maximum Slump: 3 inches.
 - 3. Slump may be increased to 5 inches with use of Mid-Range Water Reducing Admixture.
 - 4. Air-entrained
 - 5. Maximum water-cement ratio: 0.48
 - 6. No substitution of other cementitious materials for Portland Cement.
- E. Slab-on-grade (Typical interior slab-on-grade, unless notes otherwise): Proportion normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 3,000 psi
 - 2. Maximum Slump: 4 inches.
 - 3. Slump may be increased to 6 inches with use of Mid-Range Water Reducing Admixture.
 - 4. Maximum water-cement ratio: 0.55
 - 5. No substitution of other cementitious materials for Portland Cement.
- F. Suspended slabs: Proportion normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 3,000 psi
 - 2. Maximum Slump: 4 inches at point of discharge (at the truck).
 - 3. Slump may be increased to 6 inches with use of Mid-Range Water Reducing Admixture. (after Field verification of original slump limit)
 - 4. Maximum water-cement ratio: 0.55
 - 5. No substitution of other cementitious materials for Portland Cement.
- G. Exterior Walks, Aprons, Stairs, Ramps, and Miscellaneous Exterior Structures: Proportion normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4,500 psi
 - 2. Maximum Slump: 4 inches.
 - 3. Slump may be increased to 6 inches with use of Mid-Range Water Reducing Admixture.
 - 4. Air-entrained
 - 5. Maximum water-cement ratio: 0.42
- J. Under no conditions shall water be added to the concrete mixes at the site.

- K. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by SER. Laboratory test data for revised mix design and strength results must be submitted to and accepted by SER before using in Work.
- L. All pumped concrete shall contain mid-range water reducing admixture or high range water reducing admixture (superplasticizer) added at the site. Maintain slumps as specified above

2.6 ADMIXTURES

- A. Use mid-range water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete for pumping, placement and workability.
- B. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F.
- C. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:
 - 1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure: 5.0 percent (moderate exposure); 6.0 percent (severe exposure) for 3/4-inch maximum aggregate.
- D. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.
 - 1. When air temperature is between 85 degrees F and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to seventy-five 75 minutes, and when air temperature is above 90 degrees F, reduce mixing and delivery time to sixty (60) minutes.

PART 3- EXECUTION

3.1 GENERAL

- A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMS

- A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347.

- B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal. Use 6 mil poly to cover rustication keyways to ensure easy removal without chipping concrete.
- D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete to prevent mortar leaks and maintain proper alignment.

3.3 VAPOR RETARDER/BARRIER INSTALLATION

- A. General: Refer to Section 07 26 00 for material requirements and installation requirements.

3.4 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as specified.
 - 1. Avoid cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers.

- D. Place reinforcement to maintain minimum coverage as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install flat welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one (1) full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

- A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.
- B. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.
- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise.
- D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- E. Water-stops: Provide water-stops in construction joints as indicated. Install water-stops to form continuous diaphragm in each joint. Support and protect exposed water-stops during progress of Work. Field-fabricate joints in water-stops according to manufacturer's printed instructions.
- F. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated. Joint fillers and sealants are specified under Division 7.
- G. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels or patterns as shown. Use a "Soff-Cutt", or approved equal, saw for cuts 1/8 inch wide by one-fourth of slab depth or inserts 1/4 inch wide by one-fourth of slab depth, except use 1/4 inch wide sawn joints for joints filled with epoxy joint filler. Saw cutting shall begin immediately after final finishing.
 - 1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
 - 2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
 - 3. If joint pattern is not shown, provide joints not exceeding fifteen (15) feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays). Joint fillers and sealants are specified under Division 7.

3.6 INSTALLING EMBEDDED ITEMS

- A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.
- B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.7 PREPARING FORM SURFACES

- A. General: Coat contact surfaces of forms with an approved, non-residual, low-VOC, form-coating compound before placing reinforcement.
- B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
 - 1. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.8 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Vapor Retarder: Do not install interior concrete slab-on-grade until the vapor retarder has been installed and inspected. Inspection of vapor retarder to take place after sealing all penetrations and installing all reinforcing.
- C. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete", and as specified.
- D. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.
- E. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than twenty-four (24) inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
 - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least six (6) inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

- F. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.
 - 1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
 - 2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
 - 3. Maintain reinforcing in proper position on chairs during concrete placement.
- G. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures. When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F and not more than 80 degrees F at point of placement.
 - 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
 - 3. Cover walls and slabs with thermal blankets. Provide poly tents with heat for twenty-four (24) hours when temperature is 40 degrees F or below.
- H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 degrees F. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
 - 3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
 - 4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.
- I. Re-tempering of concrete which has partially hardened, that is, mixing with or without additional cement, aggregates, or water, shall not be permitted.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction (other than waterproofing systems). This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

- B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.
- C. Smooth-Rubbed Finish: Provide smooth-rubbed finish on scheduled concrete surfaces to receive smooth-formed finish treatment not later than one (1) day after form removal.
 - 1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces to receive grout-cleaned finish treatment.
 - 1. Combine one part portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard Portland cement and white Portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
 - 2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least thirty-six (36) hours after rubbing.
- E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, Portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.
 - 1. After placing slabs, finish surface to tolerances of F(F) 30 (floor flatness) and F(L) 25 (floor levelness) measured according to ASTM E 1155. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes. Finish surfaces to following tolerances in accordance with ASTM 1155
 - a. Floor Flatness Number F_F : Specified Overall Value = 30
Minimum Local Value = 20
 - Floor Levelness Number F_L : Specified Overall Value = 25
Minimum Local Value = 20

- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.
1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture. Finish surfaces to following tolerances in accordance with ASTM 1155
 - a. Concrete slabs-on-grade:

Floor Flatness Number F_F :	Specified Overall Value = 30 Minimum Local Value = 20
Floor Levelness Number F_L :	Specified Overall Value = 25 Minimum Local Value = 20
 - b. Concrete slab-on-deck shall be finished with floor flatness tolerances in accordance with ACI 302-8.15 and $F_F = 30$ minimum.
- C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or thin-set quarry tile, paint, or another thin film-finish coating system.
1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to following tolerances in accordance with ASTM 1155:
 - a. Resilient flooring, carpet, ceramic or thin set quarry tile, paint, or thin film-finish coating system:
 - 1) Concrete slabs-on-grade:

Floor Flatness Number F_F :	Specified Overall Value = 35 Minimum Local Value = 25
Floor Levelness Number F_L :	Specified Overall Value = 25 Minimum Local Value = 20
 - 2) Concrete slab-on-deck shall be finished with floor flatness tolerances in accordance with ACI 302-8.15 and $F_F = 30$ minimum.
 2. Grind smooth any surface defects that would telegraph through applied floor covering system.
- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.

- E. Non-slip Broom Finish: Apply a non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- F. Non-slip Aggregate Finish: Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, sloped walks.
 - 1. After completing float finishing and before starting trowel finish, uniformly spread 25 lbs. of dampened non-slip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as specified.
 - 2. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose non-slip aggregate.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than seven (7) days.
- C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.
- D. Provide moisture curing by the following methods:
 - 1. Use continuous water-fog spray.

2. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a four (4) inch lap over adjacent absorptive covers.
- E. Provide moisture-retaining cover curing as follows:
1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least three (3) inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- F. Apply curing compound on exterior slabs, walks, and curbs as follows:
1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within two (2) hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within three (3) hours after initial application. Maintain continuity of coating and repair damage during curing period.
 2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
- G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.
1. Cure concrete slabs and surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.13 REMOVING FORMS

- A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F for twenty-four (24) hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

3.14 REUSING FORMS

- A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.15 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.
1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than one (1) inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
 2. For surfaces exposed to view, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- B. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.
- C. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
 2. Correct high areas in unformed surfaces by grinding after concrete has cured at least fourteen (14) days.
 3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.
 4. Repair defective areas, except random cracks and single holes not exceeding one (1) inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

- D. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.
- E. Repair methods not specified above may be used, subject to acceptance of Architect.

3.16 JOINT FILLING

- B. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least nine months. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semi-rigid epoxy joint filler full depth in saw-cut joints and at least $\frac{3}{4}$ inches deep in formed joints. Overfill joints and trim joint filler flush with the top of the joint after hardening.

3.17 THRUST AND ANCHOR BLOCKS

- A. Minimum bearing areas for thrust blocks and dimensions of anchor blocks will be as shown on the Drawings.
- B. Concrete for thrust and anchor blocks will be placed against undisturbed earth, and wooden side forms will be used to provide satisfactory lines and dimensions. Felt roofing paper will be placed to protect the joints. No concrete will be placed so as to cover joints, bolts or nuts, or to interfere with the removal of the joints.

3.18 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. An independent Testing Laboratory, chosen by the Owner, will be retained for this project to perform such laboratory services as are required. The engagement of this laboratory will in no way relieve the Contractor of his responsibility to furnish materials and construction in conformance with the drawings and specifications.
- B. Sampling and testing for quality control during concrete placement may include the following.
 - 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 - a. Slump: ASTM C 143; one (1) test at point of discharge (at the truck before adding plasticizers) for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
 - b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one (1) for each day's pour of each type of air-entrained concrete.
 - c. Concrete Temperature: ASTM C 1064; one (1) test hourly when air temperature is 40 degrees F and below, when 80 degrees F and above, and one (1) test for each set of compressive-strength specimens
 - d. Compression Test Specimen: ASTM C 31; one (1) set of four (4) standard cylinders for each compressive-strength test, unless otherwise directed.

- Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
- e. Compressive-Strength Tests: ASTM C 39; one (1) set for each day's pour exceeding five (5) cu. yds. plus additional sets for each fifty (50) cu. yds. more than the first twenty-five (25) cu. yds. of each concrete class placed in any one (1) day; one specimen tested at seven (7) days, two specimens tested at twenty-eight (28) days, and one specimen retained in reserve for later testing if required.
- 2. When frequency of testing will provide fewer than five (5) strength tests for a given class of concrete, conduct testing from at least five (5) randomly selected batches or from each batch if fewer than five (5) are used. When total quantity of a given class of concrete is less than fifty (50) cu. yds., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
 - 3. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 - 4. Strength level of concrete will be considered satisfactory if averages of sets of three (3) consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
- C. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within twenty-four (24) hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at twenty-eight (28) days, concrete mix proportions and materials, compressive breaking strength, and type of break for both seven (7) day tests and twenty-eight (28) day tests.
 - D. Any material or workmanship that is rejected by the SER and/or the Testing Agency either at the plant or at the job site, shall be replaced promptly by the Contractor at no expense of the Owner.
 - E. Non-destructive Testing: Impact hammer, sonoscope, or other non-destructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
 - F. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other ASTM approved methods.

END OF SECTION

Section 03 45 00

PRECAST ARCHITECTURAL CONCRETE
(TRADE CONTRACT REQUIRED AS PART OF SECTION 04 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Trade Contract Requirements: As provided under Section 04 00 01 – MASONRY TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 04 00 01.

1.2 SUMMARY

- A. The work of this Section consists of furnishing finished and cured, reinforced plant-cast architectural concrete units. Provide formwork with openings, blockouts, or inserts as required for the proper location and installation of work by other trades. Notify appropriate trades when items are ready for installation:
- B. Furnish the following items for installation under related sections:
 - 1. Finished and cured, reinforced plant-cast architectural concrete water table
Section 04 20 00 - UNIT MASONRY
- C. Install the following furnished as supplied by other sections:
 - 1. Accessories such as but not limited to clips, ties, anchors, bolts and plates to be cast into concrete.

1.3 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 04 00 01 - MASONRY TRADE CONTRACT REQUIREMENTS: Trade Contract requirements for work of this Section.
- C. Section 04 20 00 - UNIT MASONRY:

1. Installation of precast concrete units furnished under this Section 03 45 00.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 1. ACI 318 - Building Code Requirements for Reinforced Concrete.
 2. ANSI/ASTM A 36 - Structural Steel.
 3. ANSI/ASTM A 185 - Welded Steel Wire Fabric for Concrete Reinforcement.
 4. ANSI/ASTM A 307 - Carbon Steel Externally Threaded Standard Fasteners.
 5. ASTM A 325 - High Strength Bolts for Structural Steel Joints.
 6. ANSI/ASTM A 386 - Zinc Coating on Assembled Steel Products.
 7. ASTM A 615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
 8. ASTM A 666 - Stainless and Heat Resisting Chromium-Nickel Steel Sheet Strip, Plate and Flat Bar for Structural and Architectural Applications.
 9. ANSI/ASTM C 31 - Making and Curing Concrete Test Specimens in the Field.
 10. ASTM C 33 - Concrete Aggregates.
 11. ASTM C 143 - Test for Slump of Portland Cement Concrete.
 12. ASTM C 150 - Portland Cement.
 13. ASTM C 260 - Air Entraining Admixtures for Concrete.
 14. AWS - D1.1 - Structural Welding Code.
 15. PCI - Manual For Structural Design of Architectural Precast Concrete.
 16. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.
 17. PCI MNL-120 - Design Handbook - Precast and Prestressed Concrete.
 18. All applicable federal, state and municipal codes, laws and regulations for structural concrete

1.5 DESIGN REQUIREMENTS

- A. Design units and all connections and embedded items to design loads as calculated in accordance with 2021 International Building Code with Massachusetts Building Code, Tenth Edition amendments, and erection forces.
 - 1. Precast concrete fabricator shall prepare design calculations and connection details in accordance with PCI Manual 121, "Manual for Structural Design of Architectural Precast Concrete". The calculations and connection details shall be certified, stamped and signed by a Structural Engineer registered in the State where project is located.
 - 2. Design Loads: Design panels and connections to support total loads including dead loads, live loads, earthquake loads, thermal loads, wind loads and other loads as prescribed by applicable building codes for this project location and by reference standards.
 - 3. Connection Points: Connect precast to building structure only at locations approved by building structural engineer and as indicated on the approved shop drawings.
- B. Design units to accommodate construction tolerances, deflection of building structural members and clearances of intended openings.
- C. Design and size components to withstand seismic loads and sway displacement as calculated in accordance with applicable building code.
- D. Design component connections to accommodate building movement and thermal movement. Provide adjustment to accommodate misalignment of structure without unit distortion or damage.

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's complete product data specifications for portland cement, each admixture proposed to be used, integral colorants, curing compounds, compressible fillers, and other manufactured items.
 - 2. Shop drawings:
 - a. Reinforcement Drawings show: elevations dimensions of concrete, reinforcement clearances; brackets, openings, sleeves or other items furnished by other Sections; and shapes, dimensions, and details of reinforcement and accessories.

- b. Except as otherwise noted, approval of shop drawings will be for size and arrangement of components. Errors in dimensions shown on shop drawings shall be responsibility of Construction Manager. Check and coordinate cast-in-place concrete work with work of other trades before submitting shop drawings.
 - c. Do not proceed with fabrication of material or performance of work until corresponding item on shop drawing has been approved by the Engineer.
 - 3. Samples:
 - a. Manufacturer's standard samples of integral colorant material, for initial selections by the Architect.
 - b. After receipt of initial approval of the submittals required hereunder, and selections of integral colorants, submit one 12 by 12 by 2 inch piece of each type and finish of architectural concrete for preliminary approval of the Architect.
 - 4. Test Reports: Submit preliminary test results for the Architect's approval at least three weeks prior to the beginning of the work. In addition to the test reports specified under "Quality Control", submit the following from the testing laboratory through the Construction Manager to the Architect:
 - a. Preliminary Design Mix Reports (ACI 301).
 - b. Aggregate Soundness Test Reports (ASTM C 88).
 - c. Aggregate Staining Test Reports (ASTM C 641).
 - d. Air Entrainment Test Reports (ASTM C 260).
 - 5. Sustainable Design Submittals:
 - a. Recycled content: Provide manufacturer's written certification of recycled content. Indicate post-consumer and pre-consumer recycled content and provide documentation certifying products are from recycled sources. (MA-CHPS Credit MW.c2).
 - b. Regional materials: Indicate location of content of extraction, harvesting, and recovery; indicate the distance between extraction, harvesting, and recovery and the project site. Indicate percentage of product content from qualified locations. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site. (MA-CHPS Credit MW c5).
- B. Submit maintenance data under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS; indicate surface cleaning instructions.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with PCI MNL-116, PCI MNL-120, PCI Manual For Structural Design of Architectural Precast Concrete,
- B. Welding: ANSI/AWS D1.1.
- C. Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Massachusetts.

1.8 QUALIFICATIONS

- A. Precast Manufacturer and Erectors: Qualified in accordance with PCI MNL-117.
- B. Welders: Employ only experienced welders who are certified for the specific weld processes and positions required and who have been qualified within the preceding 12 months under AWS standard qualification procedure for the type of work required.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Handle precast units to position, consistent with their shape and design. Lift and support only from support points.
- B. Lifting or handling equipment: Capable of maintaining units during manufacture, storage, transportation, erection, and in position for fastening.
- C. Blocking and lateral support during transport and storage: Clean, non-staining, without causing harm to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.
- D. Protect units to prevent staining, shipping, or spalling of concrete.
- E. Mark units with date of production in location not visible to view when in final position in structure.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1. Coordinate the placement of anchorage devices and embedded inserts.

PART 2 - PRODUCTS

2.1 CONCRETE MIX

A. Concrete materials:

1. Cement: ASTM C 150, Portland Type III - High Early Strength, white color. Use only one brand throughout project.
2. Fine Aggregate: Washed, inert, sand of with color characteristics which when combined with other constituents will produce concrete of specified color. Fine aggregate shall conform to ASTM C33.
3. Coarse Aggregate: Provide aggregate conforming to ASTM C 33. Hard, durable, carefully selected and graded; free of material causing staining or reacting with cement. 3/8 inch and 3/4 inch stone of color, type and size gradation to Architect approved sample.
4. Air Entraining Admixture: ASTM C260 as approved by Architect.
5. Water-Reducing Admixture: ASTM C494, Type A, unless otherwise approved by Architect.
6. Water: Clean and not detrimental to concrete.

B. Design of Concrete Mix

1. Prepare design mixes for each type of concrete required, and obtain the Architect's approval of the proposed design mix. Provide cement and aggregate control to provide two uniform colors of precast concrete.
2. Proportion mixes either by laboratory trial batch or field experience methods, using materials to be employed on the Work for each type of concrete required, and complying with ACI 211.1.
3. Concrete mix: Provide separate back-up and facing mixes or only face mix at fabricator's option.
 - a. General: Comply with ANSI/ACI 301.
 - b. Minimum compressive strength: 5,000 psi (28 day strength)
 - c. Air entrainment: 5 to 7 percent.
 - d. Concrete slump: 3 to 4 inches.

- e. No calcium chloride will be permitted in mix.

C. Reinforcing Steel: As engineered by fabricator:

1. ASTM A615, 60 ksi yield grade; deformed billet steel, unfinished, of sizes shown on the approved shop drawings.
2. ANSI/ASTM A 185, welded steel wire fabric; in flat sheets, unfinished, of sizes shown on the approved shop drawings.
3. Tie wire, minimum 16 gage annealed type.

D. Color Additives:

1. Color additives manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include, the following, or approved equal:
 - a. Davis Colors, Beltsville, MD, product: "Davis Colors".
 - b. L.M. Scofield Company, Douglasville, GA, product: "Chromix".
 - c. Bayer Corporation, Pittsburgh, PA, product: "Bayferrox".
2. Materials: Color additives shall contain pure, concentrated mineral pigments specially processed for mixing into concrete, resistant to alkalis and complying with ASTM C979.
 - a. Color additives containing carbon black are not acceptable.
 - b. Provide color as selected by the Architect matching approved samples.
3. Admixtures: Do not use calcium chloride admixtures.
4. Color: Match existing precast cap at concrete stem wall.

2.2 SUPPORT DEVICES

- A. General: Connecting hardware shall be engineered and designed by the fabricator to accommodate all loads to which it will be subject both in the permanent condition and due to handling. Connection details indicated on the drawings shall be considered minimum required and shall be strengthened as necessary in accordance with design calculations.
- B. Connecting and Support Devices: ANSI/ASTM A 666, Type 316 stainless steel.

2.3 FABRICATION

- A. Fabrication procedure to conform to PCI MNL-117.
- B. Maintain plant records and quality control program during production of precast units. Make records available upon request.
- C. Use rigid molds, constructed to maintain precast unit uniform in shape, size and finish.
- D. Maintain consistent quality during manufacturing.
- E. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.
- F. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items as indicated on approved shop drawings.
- G. Locate hoisting devices to permit removal after erection.
- H. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
- I. Minor patching in plant is acceptable, providing structural, adequacy and appearance of units is not impaired.

2.4 FINISH - PRECAST UNITS

- A. Finish: Match adjacent existing precast cap at concrete stem wall.

2.5 FABRICATION TOLERANCES

- A. Maximum Out of Square: 1/8 inch in 10 feet, non-cumulative.
- B. Variation From Dimensions Indicated on approved shop Drawings: Plus or minus 1/8 inch.
- C. Maximum Misalignment of Anchors, Inserts, Openings: 1/8 inch .
- D. Maximum Bowing of Units: Length of bow/360.

- E. Location of Reglets: 1/4 inch from true position.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation of precast concrete units is included under Section 04 20 00 - UNIT MASONRY.

End of Section

Section 04 00 01
MASONRY SUB-BID CONTRACT REQUIREMENTS
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 0 and Division 1 Specification Sections, apply to this Section.

1.2 TIME, MANNER AND REQUIREMENTS FOR SUBMITTING FILED SUB-BID CONTRACT BIDS:

- A. The work of this section is work of a Publicly Bid Filed sub-bid Contractor and includes the following requirements.
1. Specification requirements for the Filed sub-bid Contract "Masonry" include all the following listed Specification Sections, in their entirety:
 - a. Section 04 20 00 – UNIT MASONRY
 - b. Section 03 45 00 – PRECAST ARCHITECTURAL CONCRETE

- B. Filed sub-bid contract bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the City of Worcester Purchasing Division, City Hall, Room, 455 Main Street, Worcester, MA 01608 at the time and place stipulated in the "Invitation to Bid/Notice to Contractors." Along with the time of the bid opening, the following shall appear on the upper left hand of the envelope:

Name of Filed Sub-Bidder: Print Name of Filed Sub-Bidder

Project: WTHS TUFTS VET TECH CLINIC RENOVATION

Filed Sub-bid for Section: 04 00 01 – MASONRY

- C. Each filed Sub-bid contract bid submitted for work under this Section shall be on forms furnished by the City of Worcester as required by Section 44F of Chapter 149 of the General Laws, as amended. Filed Sub-bid contract bid forms may be obtained at the Purchasing Division in person, or by written request.
- D. Filed Sub-bid contract bids filed with the City of Worcester shall be accompanied by a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the City of Worcester in the amount of five (5) percent of the bid. A filed Sub-bid accompanied by any other form of bid deposit than those specified will be rejected.
- E. Additional Requirements:
1. Filed Sub-bidder's attention is directed to Massachusetts G.L. Chapter 149 §44H, as amended, which provides in part as follows:
 2. Each filed Sub-bidder shall list in Paragraph E of the "Form for Sub-Bid" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that sub-

subtrade requires such listing, provided that, in the absence of a contrary provision in the Specifications, any sub-bidder may, without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the Awarding Authority that he does customarily perform such class of work with persons on his own payroll and is qualified to do so. This Section of the Specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.

Class of Work	Reference Specification	Paragraphs

- F. The work to be completed by the Filed Sub-Contractor for the work of this Section is shown on the following listed Drawings:
- The Work of this Trade Contract is shown on the following Drawings:
AD3.1, AD3.2, AD3.3, A1.0, A2.1, A2.2, A3.0, A3.1, A3.2, A4.1, A4.2, A5.0, A5.1, A6.1, A6.2, A6.11, A6.12, A6.13, A6.14, A8.0, A8.1, A8.2, A8.3, A8.4, A8.5, A8.6, A8.7, A8.8, A9.1, A9.2, A9.3, A10.1, A10.2, A11.1, A11.2, A11.3, A12.1, A12.2, S1.1, S1.2, S3.1, S3.2, S4.1, S4.2
 - Related items which may require coordination or impact work of this trade are shown on the following Drawings:
FP1.1, FP3.1, P1.1, P3.1, P3.2, P3.3, DH3.1, DH4.1, H3.1, H3.2, H4.1, H4.2, H5.1, H5.2, H5.3, H5.4, E0.1, E0.2, ED1.1, ED1.2, ED1.3, EH1.1, EH1.2, EH1.3, EL1.1, EL2.1, EL2.2, EL2.3, EL2.4, EL2.5, EP1.1, EP2.1, EP3.1, EP3.2, EP4.1, EP4.2, EP4.3, EP4.4, EP4.5, EP4.6, FA0.1, FA1.1, FA2.1, FA3.1, FA3.2, SC0.1, SC1.1, SC1.2, SC2.1, TC0.1, TC1.1, TC1.2
 - The complete List of Drawings for the Project is provided in Section 00 01 15.
 - Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Filed Sub-Contractor's responsibility to determine full extent of work of this Section by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Sub-Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.4 QUALITY ASSURANCE

- A. Company specializing in work described in the above listed individual specification Sections with minimum 5 years documented experience.

1.5 SEQUENCING

- A. Phasing: Refer to Section 01 10 00 - SUMMARY, and Drawings for phasing and milestone completion requirements which affect the General Contractor's Work and the Work of this General Contractor. Coordinate work of this Sub-Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Sub-Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Masonry Filed Sub-Contractor shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work and all other Work requiring such equipment as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 - 1. Scaffolding and staging required pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-Contractor.
 - 2. Masonry Filed Sub-Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed Sub-Contractor.
 - 4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each work day to prohibit access to the scaffolding by unauthorized individuals.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed Sub- Contractor shall be furnished, installed, operated and maintained in safe conditions by this Filed Sub-Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 – EXECUTION

3.1 SITE MAINTENANCE

- A. The Masonry Filed Sub- Contractor shall furnish and maintain dumpsters to adequately control the disposal of all trash, construction debris, and waste materials resulting from the work of this Filed Sub-Contract.
 - 1. The Masonry Filed Sub-Contractor is responsible for all costs to obtain, maintain and disposal of dumpsters.
 - 2. Disposal: Empty dumpsters on frequent regular basis as necessary to prevent overflow spillage. Legally dispose of waste off-site.
- B. Daily clean work areas. Sweep and place into the dumpster(s) furnished by this trade, all pallets, construction debris, unused masonry materials, and other waste materials resulting from the Work of this Filed Sub-Contract.
- C. After completion of the work of this Section, remove equipment, tools, and unused materials, remove all remaining waste materials and construction debris related to the work of this Filed Sub-Contract. Clean all wall, partition, and floor areas completely free from deposits of mortar, wash down residues and materials installed under this Section.

End of Section

Section 04 20 00
UNIT MASONRY
(TRADE CONTRACT REQUIRED AS PART OF 00 04 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Trade Contract: As provided under Section 04 00 01 – MASONRY Trade Contract REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 04 00 01.

1.2 SUMMARY

- A. Furnish and install:
 - 1. Brick masonry veneer construction for exterior walls backed by structural light gauge metal framing and concrete foundations.
 - 2. Pointing and tooling joints of brick after installation.
 - 3. Grout fill for back of masonry veneer at grade level wherever ties or anchorage items occur, and as further indicated in the Drawings.
 - 4. Reinforcing, ties, anchors, and other metal accessories, for anchoring unit masonry together and to other materials.
 - 5. Engineering of veneer anchorage where masonry cavity exceeds 4 ½".
 - 6. Compressible joint fillers for control joints in unit masonry work and joints with structural steel.
 - 7. Built-in metal and membrane masonry flashing.
 - 8. Non-Shrink grout at foundation wall shelf full perimeter to provide positive flow away from building,
 - 9. Control and expansion joints in masonry construction- as shown on Architectural and Structural drawings.
 - 10. Mortar stop netting to hold mortar droppings and prevent blockage of weep vents.
 - 11. Continuous sealant between through wall flashing and brick masonry below.
 - 12. Continuous sealant behind metal through wall flashing.
 - 13. Installation of masonry anchors and accessories furnished by other trades.
 - 14. Sealant at metal through wall flashing lap joint splice.
 - 15. Through wall flashing termination and lap joint splices including lap sealant at all edges.
 - 16. Mineral wool insulation in cavity wall masonry veneer construction or as otherwise noted on the drawings.
 - 17. Termination bar and sealant at through wall flashing.

- B. Place, install and build-in, as work progresses, the following products and materials furnished under the indicated Sections:
 - 1. Anchor bolts, wood blocking, and anchorage items furnished or set by other trades as specified in individual Sections.
 - 2. Reinforced plant-cast architectural concrete water table furnished by Section 03 45 00 - PRECAST ARCHITECTURAL CONCRETE.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- 1. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work shall be carried out. The Awarding Authority (Owner) shall not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Trade Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he shall produce the required results.
 - a. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.4 RELATED REQUIREMENTS

- A. Section 00 72 01 – SUPPLEMENTARY INSTRUCTIONS TO BIDDERS: Responsibilities for cutting and patching.
- B. Section 01 45 29 – TESTING LABORATORY SERVICES: Testing, observation, and inspections of Unit Masonry installation. Perform testing of masonry, mortar and grout specified herein.
- C. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- D. Section 02 41 19 - SELECTIVE DEMOLITION: Coordination of masonry demolition.
- E. Section 03 30 00 – CAST-IN-PLACE CONCRETE: Concrete foundation work, walls and slabs.
- F. Section 03 45 00 – PRECAST ARCHITECTURAL CONCRETE: Furnish finished and cured, reinforced plant-cast architectural concrete water table for installation under Section 04 20 00.
- G. Section 04 00 01 - MASONRY TRADE CONTRACT REQUIREMENTS: Trade Contract requirements for work of this Section.
- H. Section 05 12 00 - STRUCTURAL STEEL: Welding of masonry anchors to structural steel.
- I. Section 05 40 00 - COLD-FORMED METAL FRAMING: Structural light gage metal framing for support of masonry veneer.

- J. Section 05 50 00 - METAL FABRICATIONS: anchor bolts, with nuts and washers; inserts and sleeves required to attach miscellaneous metal items to masonry for installation as part of this Section 04 20 00.
- K. Section 06 10 00 - ROUGH CARPENTRY: Setting and temporary bracing of hollow metal frames occurring in masonry, and removal of temporary centering when frames have been built into the masonry.
- L. Section 07 11 13 – BITUMINOUS DAMPPROOFING: Dampproofing of all structural steel encased below the ground level concrete floors, concrete foundation, including all columns, base plates and all bracing assemblies.
- M. Section 07 21 00 – THERMAL INSULATION: Insulation identified for installation under this Section.
- N. Section 07 27 13 – MEMBRANE AIR BARRIERS: Vapor-permeable air barrier membrane system at metal stud back up including specified sheet membrane flashings, required primers and adhesives.
- O. Section 07 53 23 – EPDM ROOFING
- P. Section 07 62 00 – SHEET METAL FLASHING AND TRIM.
- Q. Section 07 84 00 - FIRESTOPPING.
- R. Section 07 92 00 - JOINT SEALANTS: Sealant, caulking materials, and compressible joint bead back-up, in conjunction with masonry work.
- S. Section 09 29 00 – GYPSUM BOARD: Exterior sheathing

1.5 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. The Masonry Society TMS 402/602 - "Specifications for Masonry Structures"
 - 2. ASTM A82 - Steel Web, Plain, for Concrete Reinforcement.
 - 3. ASTM A123 - Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products.
 - 4. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 5. ASTM A497 - Welded Wire Fabric; Deformed, for Concrete Reinforcement.
 - 6. ASTM A615 - Deformed and Plain Billet-Steel Bar for Concrete Reinforcement.
 - 7. ASTM A641 - Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 8. ASTM B117 - Salt Spray (Fog) Testing.
 - 9. ASTM B633 - Electrodeposited Coatings of Zinc on Iron and Steel.
 - 10. ASTM C5 - Quicklime for Structural Purposes.
 - 11. ASTM C55 - Concrete Building Brick.
 - 12. ASTM C62 - Building Brick.
 - 13. ASTM C67 - Sampling and Testing Brick and Structural Clay Tile.

14. ASTM C90 - Load-Bearing Concrete Masonry Units.
15. ASTM C129 - Non-Load Bearing Concrete Masonry Units.
16. ASTM C140 - Method of Sampling and Testing Concrete Masonry Units.
17. ASTM C144 - Aggregate for Masonry Mortar.
18. ASTM C150 - Portland Cement.
19. ASTM C207 - Hydrated Lime for Masonry Purposes.
20. ASTM C216 - Facing Brick.
21. ASTM C270 - Mortar for Unit Masonry.
22. ASTM C387 - Packaged, Dry, Combined Materials, for Mortar and Concrete.
23. ASTM C404 - Aggregates for Masonry Grout.
24. ASTM C476 - Grout for Masonry
25. ASTM C578 – Preformed, Cellular Polystyrene Thermal Insulation
26. ASTM C595 - Blended Hydraulic Cement.
27. ASTM C652 - Hollow Brick (Hollow Masonry Units Made from Clay or Shale).
28. ASTM C778 – Specification for Standard Sand.
29. ASTM C780 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
30. ASTM C954 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs.
31. ASTM C1019 - Method of Sampling and Testing Grout.
32. ASTM C1072 - Method for Measurement of Masonry Flexural Bond Strength.
33. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry.
34. ASTM C1329 – Standard Specification for Mortar Cement.
35. ASTM C1357 – Test Methods for Evaluating Masonry Bond Strength.
36. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
37. ASTM D2000 - Classification System for Rubber Products.
38. ASTM D2287 - Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.
39. ASTM E119 - Fire Tests of Building Construction and Materials.
40. ASTM E447 - Compressive Strength of Masonry Prisms.
41. ASTM E488 - Strength of Anchors in Concrete and Masonry Elements.
42. ASTM E518 - Test Method for Flexural Bond Strength of Masonry.
43. American National Standards Institute Building Code requirements.
44. MCAA – Hot and Cold Weather Masonry Construction.
45. NFPA 285 (National Fire Protection Association): Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
46. National Concrete Masonry Association.

- B. The following reference materials are hereby made a part of this Section by reference thereto:

1. UL Fire Resistance Directory.
2. BIA applicable Technical Notes, Research Reports and Standards, including, but not limited to the following
 - a. BIA Research Report Number 15 – Causes and Control of Efflorescence in Brickwork.
 - b. BIA Technical Notes, Number 18A – Accommodating Expansion of Brickwork.
 - c. BIA Technical Notes, 20 - Cleaning Brick Masonry
 - d. BIA Technical Notes 23 - Efflorescence
3. IMI: Masonry Construction Guide Manual.
4. PCA, "Concrete Masonry Handbook".
5. NCMA applicable TEK Bulletins.
6. NCMA TEK Bulletin Number 45, Removal of Stains from Concrete Masonry Walls
7. TMS 402/602 Building Code Requirements and Specifications of Masonry Structures.

1.6 SEQUENCING

- A. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to ensure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.7 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 2. Material certificates: Provide for the following, signed by manufacturer and the Unit Masonry Trade Subcontractor certifying that each material complies with requirements.
 - a. Each different cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 - b. Each material and grade indicated for reinforcing bars.
 - c. Each type and size of joint reinforcement.
 - d. Each type and size of anchors, ties, and metal accessories.

3. Material test reports from a qualified independent laboratory employed and paid by the Unit Masonry Trade Subcontractor indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:
 - a. Mortar complying with the proportion requirements of ASTM C270 and tested in accordance with the mortar aggregate ratio in ASTM C780.
 - b. Grout mixes: Include description of type and proportions of grout ingredients.
 - c. Masonry units: report for tests performed within the previous six months.
4. Provide compatibility letters from each manufacturer for all components stating that flashing materials are compatible with air barrier specified in other Sections.
5. Provide welding certificates for all welders who will be working on this project.
6. Shop drawings:
 - a. Provide elevations and details of masonry work showing reinforcing and coursing: indicate locations of expansion joints and control joints.
 - b. Detailing for Interfacing Trades: Submit project specific coordination details clearly indicating interfaces with adjacent materials and systems. Coordinate dimensions, tolerances, and sequencing with other Trades and the GC.
7. Verification samples:
 - a. Samples of each masonry accessory or anchorage item required.
 - b. Brick masonry units.
8. Delegated Design Submittals:
 - a. The Unit Masonry Trade Subcontractor shall pay for and provide calculations for loading and stresses bearing a Professional Structural Engineer's seal, licensed to practice in the State of Massachusetts. Show masonry ties, joint reinforcement, and design load requirements for loading of cavity walls and other performance requirements as required by the 2021 International Building Code with Massachusetts Building Code, Tenth Edition amendments (780 CMR).

1.8 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Single-source responsibility for facing units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.
- C. Single-source responsibility for concrete masonry units. Obtain concrete masonry units for the project from a single manufacturer.
- D. Single-source responsibility for mortar materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each

aggregate. Where colored mortar is required provide batch tickets confirming all materials are from a single production run to ensure uniformity of the mix.

- E. Single source responsibility for prepackaged mortar materials: Obtain masonry cement or masonry mortar from a single manufacturer. Where colored mortar is required provide batch tickets confirming all materials are from a single production run to ensure uniformity of the mix.
- F. Inspection, Testing, and Quality Control: A program of Inspection and Testing of structural masonry work shall be established by the Structural Engineer of Record (SER) who shall direct the implementation of tests as carried out by an independent testing agency. All costs for inspection and testing shall be borne by the Owner.
- G. Qualifications:
 - 1. Installer: Company specializing in performing the masonry work of this Section with minimum of 10 years documented experience. Work shall be done by skilled workmen, fully instructed as to the requirements of this Specifications, and adequately supervised during the work. Installing contractor shall assign supervision of all grouting and reinforcing to personnel who have successfully completed International Masonry Institute training course for Grouting and Reinforced Masonry Construction, or comparable program approved by the architect. The supervisor responsible for the placement of reinforced assemblies shall be present at the time of each grout pour.
 - 2. Welders Certificates: Utilize only qualified welders employed on the Work. Submit verification that Welder's are AWS D1.1 and D1.4 qualified within the previous 12 months.
 - 3. Testing Agencies: To qualify for performing tests and inspection specified in this Section, an independent testing laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM C1093, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the progress of the Work.
 - 4. Professional Engineer Qualifications: Design structural elements including reinforcement, anchors and supports, under direct supervision of Professional Engineer experienced in design of this Work and licensed in the Commonwealth of Massachusetts
- H. Preconstruction Testing Service: Owner shall engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services shall be made by Owner. Retesting of materials failing to meet specified requirements shall be done at the Unit Masonry Trade Subcontractor's expense.
 - 1. Three cylinders tested for compressive strength at 10 days: ASTM C91 test.
 - 2. Obtain sample face brick units (minimum 4) and test for conformance to ASTM C67.
 - 3. Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C 140.
 - 4. Prism Test: For each type of wall construction indicated, per ASTM C1314.
 - 5. Mortar Test: For mortar properties per ASTM C270.
 - 6. Grout Test: For compressive strength per ASTM C1019.

- I. Inspection, Testing, and Quality Control: A program of Inspection and Testing of structural masonry work will be established by the Structural Engineer of Record (SER) who will direct the implementation of tests as carried out by an independent testing agency. All costs for inspection and testing will be borne by the Owner.

1.9 REGULATORY REQUIREMENTS

- A. Fire performance characteristics: Where indicated, provide materials and construction identical to those of assemblies whose fire resistance has been determined per ASTM E119 by a testing and inspecting organization, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.10 MOCK-UPS

- A. Provide mock-up elements for field panel in accordance with Section 01 43 39 – MOCKUPS at exterior location where directed by Architect. Mock-up shall demonstrate quality of work, construction methods, and relationship to other work.
- B. Coordinate with GC and architect for on-site location of mock-up panel.

1.11 PRE-INSTALLATION CONFERENCE

- A. At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
 - 1. Required attendees: Architect, Contractor, Mason's Project Superintendent, and representatives of other related trades and representatives for installers of related work specified under the following Sections:
 - a. Section 03 30 00 – CAST-IN-PLACE CONCRETE
 - b. Section 05 12 00 – STRUCTURAL STEEL
 - c. Section 05 40 00 – COLD FORMED METAL FRAMING
 - d. Section 06 10 00 – ROUGH CARPENTRY
 - e. Section 07 27 13 – MEMBRANE AIR BARRIERS
 - f. SECTION 07 53 23 - EDPM ROOFING
 - g. Section 07 62 00 – SHEET METAL FLASHING AND TRIM
 - h. Section 07 92 00 – JOINT SEALANTS
 - i. Section 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS
 - j. Section 09 29 00 - GYPSUM BOARD
 - 2. Agenda:
 - a. Scheduling of masonry operations.
 - b. Review of staging and material storage locations.
 - c. Coordination of work by other trades.
 - d. Protection of completed Work.
 - e. Establish weather and working temperature conditions to which Architect and Contractor must agree.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. General: Do not deliver cement, lime, and similar perishable materials to the site until suitable storage is available. Store such materials in weatherproof structures and ensure that materials are in good condition when brought for use. Protect masonry units and manufactured products of all types from wetting by rain or snow and keep covered when not in use.
- B. Masonry Face Units: Handle all masonry units carefully in transit and on the site, so as to keep units whole, with edges sharp, and faces clean and undamaged. Deliver all masonry units on cubes; or handle units individually and properly stack same.
- C. Aggregates: Deliver, store and handle aggregate materials so as to prevent contamination with earth or other foreign materials.
 - 1. Store cement, lime, sand and similar products under cover and from direct contact with earth or floor slabs.
- D. Manufactured items: Deliver manufactured products in original containers plainly marked with product identification and manufacturer's name.
 - 1. Store metal accessories and the like under cover and from direct contact with ground, and in manner to prevent rust.
- E. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or which show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.13 ENVIRONMENTAL CONDITIONS

- A. Hot and cold weather requirements shall be in accordance with the recommendations of the TMS 402/602 sections: S-23, S-30 to S-32, S-78, S-33.
 - 1. The recommended hot weather requirements for 100 degrees Fahrenheit (37.8 degrees Celsius) shall be enforced for this project when ambient temperatures are above 90 degrees Fahrenheit (32.2 degrees Celsius) under all wind conditions including zero velocity.
 - 2. Cold weather requirements shall be enforced when ambient temperatures fall below 40 degrees Fahrenheit (4.4 degrees Celsius).

1.14 COORDINATION

- A. Coordinate work with that of other trades which require placement and building-in of, as work progresses, anchor bolts, wood blocking, curtain wall and anchorage items.
- B. Coordinate work of this Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- C. Examine all Drawings as to requirements for the accommodation of work of other trades. Provide all required recesses, chases, slots, and cutouts. Place anchors, bolts, sleeves and other items occurring in the masonry work. Take every precaution to minimize future cutting and patching. Closely coordinate the location and placement of such items.

1.15 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering brick masonry products which may be incorporated in the work include the following or approved by architect equal:
 - 1. Endicott Clay Products, Endicott, NE
 - 2. Interstate Brick, West Jrdan, UT
 - 3. Belden Brick Company, Canton, OH.
 - 4. Watsontown Brick Company, Watsontown, PA.
 - 5. Cloud Ceramics, Concordia, KS.

2.2 BRICK UNITS

- A. General:
 - 1. Provide corner-brick with two faces to match brick wall finish.
- B. Facing brick: ASTM C216, Type FBX Grade SW, in size, texture and color to match existing adjacent brick.
 - 1. Brick size: Nominal 4"X4"X8".
 - a. Specified Manufacturer: To establish a standard of quality, design, and function desired, Drawings and specifications have been based on the following brick and mortar materials:
 - 1) Field Color: Glen Gery: Smooth red, Modular Solid.
 - b. Substitution of specified brick will require review process to obtain acceptance from Architect, local authorities having jurisdiction and Owner. Scheduling delays to obtain substitution for specified brick are the shared responsibility of the General Contractor and Subcontract at no additional cost to Owner and without extension in project schedule.
 - 2. Brick shall be color blended to match existing adjacent masonry, Up to 2 different blends may be required.
 - 3. Under the base bid, the Masonry Trade Contractor is required to submit one product for each "Brick Type", matching the quality, grade, texture, and color range of those specified herein. Bricks submitted as "equal" to those specified, shall be evaluated by the Architect relative to characteristics, color range, surface texture, density, and compressive strength. Bricks considered "not equal" to bricks specified shall be rejected. The General Contractor shall take into consideration submittal review time in scheduling of the work. Delays resulting from failure to submit an acceptable brick product are the joint responsibility of the Masonry Trade Contractor.

2.3 CONCRETE MASONRY UNITS

- A. Acceptable concrete masonry manufacturers: Subject to compliance with the requirements specified herein, Fabricators offering concrete masonry products which may be incorporated in the work include the following, or approved by architect equal:
1. Foster-Southeastern, Inc., Holbrook, MA.
 2. Adolf Jandris and Sons, Inc.; Gardner, MA.
 3. Westbrook Concrete Block Company, Westbrook, CT
 4. Park Avenue Cement Block Co. Cranston RI.
 5. D'Agostino Building Blocks, Schenectady, NY.
 6. Anchor Concrete Products, Inc.; Brick, NJ.
 7. Trendstone, Trenwyth Industries, Inc.; Emigsville, PA.
- B. Load bearing hollow and solid, normal weight concrete masonry units: Conform to ASTM C90, Class 1 (normal weight). 2-core, 58 percent solid,
1. Plain-faced units of nominal thickness indicated on the Drawings, various nominal dimensions as indicated on the drawings with light gray color and uniform medium-fine texture, sound, true to plane and line, and free from chips, cracks, and other defects.
 - a. Fire resistance rating of 2 hours minimum.
 - b. Recycled content: Use maximum available percentage of recycled materials. Concrete masonry units incorporated into the work shall contain not less than 3 percent of recycled content.
 2. Aggregate: sand and gravel: conform to ASTM C 33.
 3. Minimum allowable compressive strength for an individual unit of not less than 1700 psi (net area); and not less than 1,900 psi. (net area) for average of 3 units; when tested in accordance with ASTM C 140. Oven dry density: 125 pounds per cubic foot.
 4. Moisture content for average of 3 units, when delivered, not exceeding 35 percent of the total absorption, when tested in accordance with ASTM C 140.
 5. Provide hollow and solid load bearing concrete masonry units conforming to ASTM C90-06b. Provide concrete masonry having the following characteristics:
 - a. Size, Standard Units: Provide units with nominal face size by thickness indicated for 3/8-inch joints unless indicated otherwise. Provide thicknesses indicated, or if not indicated, as necessary to create a properly supported, structurally safe wall built within the height to width limitations required by codes and recommended by the National Concrete Masonry Association Shapes: Provide special shaped units for lintels, corners, jambs, headers, control joints and other conditions. Never expose cores.
 - 1) All interior exposed CMU corners shall be radiused.
 6. Grade: Provide grade N for all work unless otherwise indicated.
 7. Weight: Provide normal weight units, except provide units with weight as standard with manufacturer for all units in fire-rated assemblies.

8. Concrete Masonry Units for Fire Resistive Construction: Provide concrete block for construction of fire-rated masonry block construction as listed by Underwriters' Laboratories, Inc. of Minimum Equivalent Thickness(es) defined and required by governing code. Provide half-blocks, lintel blocks, beam "U" blocks, other special blocks, and required special cutting. Provide jamb blocks, end blocks, control joint blocks, and lintel blocks with exposed ends closed.
- C. Concrete Building Brick: ASTM C55 and characteristics indicated below for grade, type, size and weight classification.
 1. Grade: N.
 2. Size: modular, 3-5/8" x 3-5/8" x 11-5/8".
 3. Weight classification: Same as for concrete block.
- D. Concrete masonry grout blocks: Open end high strength concrete masonry units and slot type strength concrete masonry units for use at reinforced concrete masonry construction where indicated on the Drawings. Conform to all requirements specified above for standard concrete masonry units, and the following additional requirements:
 1. Plain-faced units of nominal thickness indicated on the Drawings, various sizes with light gray color and uniform medium-fine texture, sound, true to plane and line, and free from chips, cracks, and other defects.

2.4 MORTAR

- A. Prepackaged mortar (ready mix) complying with ASTM C1714, or site-mixed portland cement mortar complying with ASTM C270 may be used.
 1. Admixtures are not permitted except where expressly specified herein or as otherwise approved by Architect for specific field conditions.
 2. Color and texture: Match existing adjacent brick surfaces.
- B. Mortar materials for site mixed mortar:
 1. Portland Cement: Comply with ASTM C150, Type I, free from water soluble salts and alkalies. Provide cement that exhibits no efflorescence when tested in conformance with standard efflorescence test, ASTM C67, modified to use 2-inch by 7-inch by 2-1/2-inch mortar samples consisting of a mixture of 1 part by weight of cement under test and 2 parts of sand mixed to a flow of 100 percent with water. Provide cement color as necessary to provide mortar colors selected by Architect. Use Type III as necessary for laying masonry in cold weather.
 2. Aggregates for brick mortar: Clean sand, washed uniformly well graded, conforming to ASTM C144, except for joints 1/4 inch and down use aggregate with 100 percent passing a No. 16 sieve.
 3. Aggregates for grout: Conforming to ASTM C 144 for fine aggregate and ASTM C404, size 8 or 89.
 4. Aggregate for concrete masonry mortar: Clean, washed uniformly well graded sand conforming to ASTM C 144, with the following gradation, and having a fineness modulus between 2.15 and 2.35:

Sieve Size	Percentage Passing
#4.....	100%

#8.....	95 to 100%
#16.....	70 to 100%
#30.....	40 to 75%
#50.....	10 to 35%
#100.....	2 to 15%
#200.....	0 to 5%

5. Mortar pigments: Commercial alkali-resistant, non-fading mortar pigments, oxides of iron where feasible, synthetic type, equal to products of
 - a. Davis Colors, Beltsville MD.
 - b. Solomon Grind-Chem Service, Inc., Springfield, IL.
 - c. Landers Segal Color, Inc., Passaic New Jersey.
6. Lime: Approved brand of plastic hydrated lime, conforming to ASTM C207, Type "S".
7. Water: Clean and fresh without contaminants.

C. Prepackaged mortar (ready mix)

1. General: complying with ASTM C1714 factory blended consisting of:
 - a. Portland cement: Comply with ASTM C150, Type I.
 - b. Hydrated lime: Type S, complying with ASTM C207.
 - c. Aggregate: Provide clean, sharp, well graded aggregate free from injurious amounts of dust, lumps, shale, alkali, surface coatings, and organic matter, and complying with ASTM C144.
 - d. Admixtures: Prepackaged mortar mixes contain manufacturer's own proprietary admixtures; additional field admixtures are strictly prohibited.
 - e. Water: Provide water free from deleterious amounts of acids, alkalis, and organic materials. Water shall be potable.
 - f. Pigments: Chemically inert synthetic iron oxide pigments, lightfast, weather resistant, complying with ASTM C-979.
 - 1) Mortar Color: As selected by Architect from manufacturer's full range of standard colors.

D. Mortar types:

1. Mortar for masonry below grade or in contact with earth: ASTM C270 type M using the property specification.
2. Mortar for load bearing masonry: ASTM C270 type M or S using the property specification.
3. Mortar for non-load bearing masonry above grade: ASTM C270 type N using the property specification.
4. Mortar for non-load bearing masonry below grade where indicated: ASTM C270 type S using the property specification with added aluminum tristearate, calcium stearate, or ammonium stearate to a quantity of 3 percent of Portland cement weight..

2.5 GROUT MIXES

- A. Prepackaged grout (ready mix) complying with ASTM C1107, or site-mixed Portland cement grout complying with ASTM C476 may be used.
 - 1. Grout for setting equipment, anchor bolts, elevator guide rails, structural steel elements and miscellaneous metals: Non-metallic high-strength controlled expansion grout of flowable consistency, having a compressive strength of 6,500 pounds per square inch (44.8 MPa) at 28 days; slump 8 to 10 inches.
 - a. Basis of Design: Five Star Products, Inc., Fairfield CT, product "Five Star Grout".
 - b. L&M Construction Chemicals, Omaha NE, Product: "Crystex".
 - c. Master Builders, Cleveland, OH, product "Masterflow 713".
 - d. Sika Corporation, Lyndhurst, NJ, product "SikaGrout 212".
 - e. Sonneborn Building Products, Minneapolis, MN, product "SonogROUT 10K".
 - f. Symons Corporation, DesPlaines, IL, product "Symons Multi-Purpose Grout".
 - 2. Grout for engineered masonry (core fill): Course grout having a compressive strength of 2,000 to 2,250 psi at 28 days; slump 8 to 10 inches.
 - 3. Grout for bond beams and lintels: Fine grout having a compressive strength of 2,500 to 3,000 psi at 28 days; slump 8 to 10 inches.
- B. Non-shrink grout: Pre-mixed, non-metallic, non-corrosive, non-staining, product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with CE-CRD-C621.

2.6 REINFORCEMENT AND ANCHORAGE MATERIALS

- A. Single wythe longitudinal reinforcement for concrete masonry unit walls and partitions: in overall width 1-5/8 inches less than the overall wall thickness, as manufactured by Heckman, Hohmann, Wire Bond, or approved by architect equal.
 - 1. Multi wythe longitudinal reinforcement for concrete masonry unit walls and partitions: in overall width 1-5/8 inches less than the overall wall thickness, with moisture drip as manufactured by Heckman, Hohmann & Barnard, Wire Bond, or approved by architect equal.
 - 2. Interior partitions: Truss design, 9 gage ASTM A 641 class 1 galvanized wire without a moisture drip
 - 3. Reinforcing steel, additional to rods which are embedded in concrete: Solid steel reinforcing bars, conforming to ASTM A 615, Grade 60, hot dipped galvanized in accordance with ASTM 123, B2 finish, of sizes indicated on the Drawings.
 - 4. Reinforcing steel, additional to rods which are embedded in concrete: Solid steel reinforcing bars, conforming to ASTM A 615, Grade 60 of sizes indicated on the Drawings.
 - 5. Provide preformed reinforcing sections at intersections of masonry walls and partitions and whenever walls and partitions change direction.
- B. ADJUSTABLE MASONRY-VENEER ANCHORS FOR CONNECTING MASONRY TO METAL STUDS

- C. General: provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 200-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
- 1. Engineered Screw-Attached, Masonry-Veneer Anchors for deep cavity construction; anchor type, spacing, and attachment shall be designed and submitted under Delegated Design per Section 1.7. Single screw veneer tie, with projecting tabs having holes for inserting vertical legs of wire tie formed to fit anchor section.
 - a. Basis of Design Product: Subject to compliance with requirements, provide Hohmann & Barnard, Inc.; Thermal 2-Seal Wing Nut Anchor, the following, or approved by architect equal:
 - 1) Heckmann; Pos-I-Tie® ThermalClip®
 - 2) BLOK-LOK; 2-Seal™ Wing Nut Anchor
 - b. Anchor: Custom length dual-diameter barrel with factory-installed EPDM extra-large washers to seal both the face of the insulation and air barrier. Projecting thermal wings are steel reinforced and coated with highly flame-resistant plastic to create a thermal break and fabricated with a 5/8-inch hex head.
 - 1) Barrel: Type 304 stainless steel.
 - 2) Screw: Carbon steel.
 - c. Wire Ties: Pintle type wire ties fabricated from 0.188-inch- diameter (3/16-inch), hot-dip galvanized steel wire (2X-Hook).

2.6 CAVITY WALL INSULATION AND FASTENERS

- A. Insulation plate and fastener: 3-inch diameter metal insulation plate, 0.017 thick galvalume coated steel, .265 ID. hole with corrosion resistant fasteners used for fastening rigid insulation to concrete or steel at locations referenced on the detail drawings where the use of veneer anchors with insulation retention fasteners is not feasible to retain insulation.
- B. Cavity wall insulation behind masonry (or as otherwise noted): Rigid mineral wool insulation for exterior wall cavities: mineral wool fiber insulation board, conforming to ASTM C612, Type IVB having a nominal density of 4.4 pounds per cubic foot of insulation.
 - 1. Non-Combustible as tested per ASTM E-136.
 - 2. Flame Spread Classification: Class A (less than 25, per testing by NFPA 255, ASTM E-84 or UL 723), with flame spread rating of 0 and smoke developed rating of 0.
 - 3. Thermal Resistance: ASTM C518 (C177), R-value of 15 minimum at 3-1/2 inches thick.
 - 4. Thickness: 3-1/2 inches thick.
 - 5. Size: 16 inches x 48 inches (406 mm x 1219 mm).
 - 6. Acceptable products include the following or approved by architect equal:
 - a. Roxul, Inc., Milton, Ontario, product "CavityRock®".
 - b. Owens Corning, Wabash IN, product "Thermafiber®, Rainbarrier®".

- c. Johns Manville, Inc., Denver CO. product: "Cladstone™ 45 Water & Fire Block Insulation".

2.7 FLASHING MATERIALS

- A. Stainless Steel Sheet Metal Flashing: Stainless steel, type 302/304, 26 gauge, No. 2D-matte, mill rolled finish.
 - 1. 042000-01: One piece through wall flashing with a 45-degree exposed hemmed edge designed to extend beyond the masonry face a minimum of 3/16 inch to maximum 3/8 inch. Interior formed vertical leg to extend 8 inch minimum above exposed to exterior through wall flashing, onto sheathing.
 - 2. Flashing type 042000-02: 12-inch wide splice lap backer.
 - 3. Flashing 042000-03, Drip Edge Flashing: Fabricated sheet metal flashing with 45 degree exposed hemmed edge designed to extend beyond the masonry face a minimum of 3/16 inch and into cavity wall construction.
 - 4. Flashing 043000-04, Reglet Counterflashing: Fabricated sheet metal flashing from with 45 degree hemmed edges and designed to extend 1 inch into raked masonry joint.
- B. Membrane Flashing:
 - 1. Flashing 042000-05, Membrane flashing, Flexible self-sealing, self-healing, fully adhering composite flexible flashing, .8 mm (32 mils) of self-adhesive rubberized asphalt integrally bonded to .2 mm (8 mils) of cross-laminated, high-density polyethylene film to provide a min. 1 mm (40 mil) thick membrane. Membrane shall be interleaved with silicone-coated release paper until installed. Provide with manufacturer recommended surface conditioners, termination mastics and pre-formed corners. Through wall flashing membrane to be continuous without joints or seams. Where joints are required due to product manufacturers length limits, provide and install Flashing 042000-02, 12 inches wide at splice lap.
 - 2. Acceptable Products, or approved by architect equal:
 - a. Basis of Design: W. R. Grace, product: Perm-A-Barrier flashing.
 - b. Carlisle Waterproofing, product: CCW-705-TWF
 - c. Henry® Company, product: Blueskin® TWF
 - 3. Minimum performance characteristics.
 - a. Water Vapor Transmission: ASTM E 96, Method B – 0.05 perms (2.9 ng/m²sPa) maximum
 - b. Water Absorption: ASTM D570 – Max. 0.1% by weight
 - c. Puncture Resistance: ASTM E154 – 80 lbs (356 N) minimum MD
 - d. Tear Resistance:
 - 1) Initiation – ASTM D1004 – minimum 58 N (13.0 lbs.) M.D.
 - 2) Propagation – ASTM D1938 – minimum 40 N (9.0 lbs.) M.D.
 - e. Lap Adhesion at minimum application temperature: ASTM D1876 – 60 lbs/ft (875 N/m) width.
 - f. Low Temperature Flexibility – ASTM D1970 – Unaffected to -43°C (-45° F)

- g. Tensile Strength: ASTM D412, Die C Modified – 1200 psi (8300 kPa minimum)
 - h. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C – Min. 200%
 - 4. Surface primer: Latex based; water dispersed liquid for substrate as recommended by wall flashing manufacturer.
 - 5. Termination mastic: Rubberized asphalt-based mastic with 200 grams/liter max VOC content for use in sealing flashing membrane terminations and punctures, as recommended by wall flashing manufacturer and shall be compatible with Air Barrier.
- C. Solder for Sheet Metal Flashings:
 - 1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Through wall termination bar: 1/8" X 1", 1/4" inch holes spaced 8" O.C., Type 304 stainless steel. Used at top of flashing for securement

2.8 SURFACE SEALER

- A. Penetrating aqueous silane/siloxane breathable water repellent, dries clear, shall not darken or alter light reflection of substrate when properly applied to a dry untreated surface.
 - 1. Basis of Design (Specified manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Conproco, Dover, NH, Product: "Conpro Shield MX"
 - 2. Acceptable Manufacturers: Subject to compliance with requirements, products that might be incorporated into the Work include the following or approved by architect equal:
 - a. Conproco, Dover, NH.
 - b. Prosoco, Kansas City, KS.
 - c. The Euclid Chemical Company, Cleveland, OH.
 - 3. Characteristics:

a. Physical state and appearance:		Milky White
Liquid		
b. pH:		9
c. Odor:		Slight
d. Solids by weight:		11%
e. Solvent System:		Aqueous
f. Volatile organic content – VOC:	ASTM D3920	<50 gms./liter
g. Active Ingredients: Siloxane based		
h. Density of liquid coatings:	ASTM D1475	8.4 lbs./gal.
i. Accelerated weathering -QUV:	ASTM G154	2000 hours UB-
B cycled with condensation – no effect		
j. Accelerated weathering – carbon-arc	ASTM G152	Pass-no effect

k.	Water penetration and leakage reduction, no staining or leakage	ASTM E514	100%
l.	Water vapor transmission	ASTM E96	100%
m.	Resistance to salt spray	ASTM B117	Pass-no effect
n.	Moisture absorption compared to control 94%	ASTM C140	Reduction
o.	NCHRP 244 Series II Reduction in chlorine ion intrusion: 82%		

2.9 ACCESSORIES

- A. Compressible filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self-expanding, continuous in length, and in width to fill the joint to a point 3/4 inch back from each face of wall or partition.
- B. Compressible filler for joints at tops of non-load bearing masonry partitions, and for expansion joints in masonry walls: Closed cell Neoprene or PVC foam board, soft grade, 25 percent thicker than joint width, continuous in length, and in width to fill the joint to a point 3/4 inch back from each face of wall or partition.
- C. Building paper (to maintain joints open for subsequent application of sealant and backer rod): N°. 15 asphalt saturated felt.
- D. Weeps for veneer: 3 3/8", flexible, ultraviolet resistant honeycomb polypropylene weep, equal to:
 - 1. Hohmann & Barnard, product, "Model QV Quadro-Vent",
 - 2. Heckman, product, "#85 Cell Vent".
 - 3. Wire Bond, product, "Model 3601 Cell Vent".
 - a. Color to be selected by Architect from manufacturers standard color selection samples.
- E. Mortar netting: High Density Polyethylene (HDPE) course geotextile fabric having a 90 percent open weave mesh, with stepped topped edging, shaped in a manner to catch and hold mortar droppings and preventing blockage of weep hole vents, weep vents thickness of netting based on air cavity width of wall type assembly shown on drawings by 4 feet long by 10 inches high.
 - 1. Hohmann & Barnard, Inc. product "Mortar Trap™".
 - 2. Mortar Net USA, Ltd., product: "Mortar Net, Wall Defender".
 - 3. Wire-Bond, Inc., product: "# 3611D Cavity Net DT™".
- F. Cavity air space drainage material: A non-woven plastic mesh installed full height behind brick where shown to provide continuous drainage.
 - 1. Archovations, Inc, product: "CavClear® Masonry Mat".
 - 2. Keene Building Products, product: "Keene Cav-Air-Ator®".
 - 3. Advanced Building Products, Inc., product: Mortairvent® CW.
- G. Sealant for metal through-wall flashing: Joint Sealer Type PE (Polyether), Low modulus type, Single-component non-sagging gun-grade, low-odor, neutral curing polyether, sealant, conforming to FS TT-S-000227E, Type II, Class A, and ASTM

C 920, Type S, Class 25, Grade NS, use NT, T, M, G, A and O with a minimum movement capability of ± 25 percent, equal to the following:

1. STS Coatings, product "GreatSeal PE-150" Sealant.
 2. Chem Link, product "MetaLink".
 - ~~3. BASF, product MasterSeal® NP 150~~
 4. York Manufacturing, product: "PE-150 Liquid Tape".
- H. Cleaning solution: Non-acidic, not harmful to masonry work or adjacent materials.
- I. Sealant at metal flashing laps: Non-curing Butyl Sealant, High solids non-skinning, non-drying synthetic butyl elastomer sealant. Provide one of the following or approved by architect equal:
- a. Tremco, product, "TremPro JS 773".
 - b. C.R. Laurence, product, "PTI 707".
 - c. Pecora Corp. product, "BC-158".

2.10 MIXING MORTARS AND GROUT

- A. General: Mix mortar and grout in accordance with the requirements of ASTM C270, and ASTM C476 as applicable.
1. Control batching procedure to ensure proper proportions by measuring materials by volume. Amount of mixing water and mortar consistency shall be controlled by mason.
 2. Control batch sizes to allow for use within manufacturer's recommended pot life.
 3. Retempering shall be permitted only within the first two hours of initial mix or shorter times as directed by manufacturers.
 4. Discard all mortar and grout which exceeds the time limits allowed by the manufacturer. Discard mortar that has partially set.
- B. Maintain sand uniformly damp immediately before mixing process.
- C. Add mortar color and admixtures in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.
- D. Do not use anti-freeze compounds to lower the freezing point of mortar or grout.
- E. Pouring grout shall be fluid consistency (as fluid as possible for pouring without separation of constituent parts) to a slump of 8 to 11 inches.

2.11 SOURCE QUALITY CONTROL

- A. Preconstruction testing: Except for testing by the Unit Masonry Trade Subcontractor, required as part of this Section, or Section 01 45 29 – TESTING LABORATORY SERVICES, the Owner shall employ and pay a qualified independent testing laboratory to perform the following preconstruction testing indicated as well as other inspecting and testing services required by referenced unit masonry standard or indicated herein for source quality control:
1. Clay unit masonry tests: For each different clay masonry unit indicated, units shall be tested per ASTM C 67. Test each type and grade of brick for

compression, water absorption and efflorescence per ASTM C67. If coefficient of variation of compression samples tested exceeds 12 percent, obtain compressive strengths by multiplying average compressive strengths by $(1 - 1.5) \times (0.01 \times \text{coefficient of variation}) - 0.12$

2. Concrete Masonry Unit Tests: For each different concrete masonry unit indicated, units shall be tested for strength, absorption, and moisture content per ASTM C 140.
3. Mortar efflorescence: Refer to ASTM C1400-1 "Standard Guide for Reduction of Efflorescence Potential in New Masonry Walls". Mortar mixes which show efflorescence shall not be used in the Work.

Mortar composition and properties shall be field evaluated per ASTM C 780 for compressive strength, consistency, mortar aggregate ratio, water content, air content, and splitting tensile strength.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the work of this Section.
- B. Verify built-in and other items provided by separate Sections of the work are properly sized and located.
- C. Verify foundation walls supporting masonry is constructed within tolerances required by code
- D. Beginning of installation means acceptance of site conditions.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other Sections.
- B. Foundations:
 1. Do not commence installation until foundations are clean, rough, and level.
 2. Prepare foundation tops, remove all laitance and foreign material.
 3. Verify that the foundation elevation is such that the bed joint thickness shall not vary from specified thickness, and that the foundation edge is true to line with masonry not projecting over more than 1/4".
- C. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
- D. Protect surfaces of windows, door frames, louvers and vents as well as similar finish products with painted and integral finishes from mortar droppings and stains.

3.3 INSTALLATION - GENERAL

- A. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.

- B. Establish lines, levels and coursing indicated. Protect from displacement. Refer to acceptable tolerances according to TMS 402/602.
- C. Maintain masonry courses to uniform dimension according to TMS 602. Form vertical and horizontal joints of uniform thickness.
- D. Isolate masonry partitions from vertical structural framing and where indicated on the Drawings. Maintain joints free from mortar, ready to receive sealant and joint bead back-up.
- E. Provide compressible filler at tops of interior masonry partitions abutting structural above.

3.4 COURSING, BONDS AND JOINTS BRICK MASONRY vs CMU

- A. Coursing, joints and bond pattern: 1/3 running bond at brick masonry, running bond at CMU except as otherwise indicated on the Drawings.
- B. Joints:
 - 1. Exposed to view masonry: except as specified below, fill all joints with mortar, strike off flush, and when mortar is thumb print hard tool joints with a non-staining tool. Joints shall be free of drying crack.
 - a. Horizontal joints
 - 1) Exterior joints at brick and interior joints at CMU: tool joints concave, weathered to drain with top of joint recessed approximately 1/16 inch behind face of brick.
 - 2) Exterior joints at CMU where air barrier is to be installed: Strike joints flush.
 - 3) Interior joints (all): Tool joints concave where exposed to view otherwise strike off flush.
 - b. Vertical joints (all): Tool joints flush at exterior surface of CMU where air barrier is to be installed and concave at brick masonry and interior surface of CMU.
 - 2. Concealed from view masonry, including masonry which shall be concealed by flashings and similar materials: Fill joints with mortar and strike joints flush. Concave tool exterior joints below grade.

3.5 CONTROL JOINTS

- A. Locate control joints where shown on Drawings, at corners adjacent to openings in masonry, changes in wall height, inside corners and intersections with structural walls as approved by Architect.
 - 1. Do not continue horizontal joint reinforcement through control joints.
- B. Form vertical control joints with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
 - 1. Size control joints in accordance with the requirements of Section 07 92 00 - JOINT SEALANTS.

3.6 LAYING MASONRY - GENERAL

- A. Build the masonry walls and partitions in the various combinations and thickness as indicated on the Drawings.
- B. Erect all masonry work in compliance with the line and level tolerances specified herein. Hold uniform joint sizes. Replace, non-conforming masonry work at no additional cost to the Contract. Refer to acceptable tolerances according to TMS 402/602
- C. Lay out coursing before setting to minimize cutting closures or jumping bond, Avoid the use of less-than-half-size units.
- D. Laying masonry units:
 - 1. Lay solid masonry units in full bed of mortar, with full head joints; uniformly joined with other work.
 - 2. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
 - 3. Interlock intersections and external corners.
 - 4. Cut all exposed masonry with a motor-driven carborundum blade saw to ensure straight and clean, unchipped edges.
 - a. Lay no unit having chipped edges or face defects where such unit would be exposed to view. Remove any such unit, if installed, and replace with an undamaged unit, and bear all costs therefore.
 - 5. Do not spread any more mortar than can be covered before surface of mortar has begun to dry.
 - 6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove entirely, clean off mortar, and reset with fresh mortar.
 - 7. Except for cleaning down and repointing, finish all masonry as the walls and partitions are carried up.
- E. Build-in reinforcement and anchorage items as the work progresses, grouting for secure anchorage.
 - 1. Where steel reinforcing rods have been cast into concrete slabs, and left with upturned ends, carefully place masonry units down over the upturned ends of the rods, and fill cells of masonry units with specified grout.
 - 2. Embed prefabricated horizontal joint reinforcing as the work progresses, with a minimum cover of 5/8" (16 mm) on exterior face of walls and 1/2" (13 mm) at other locations. Lap units not less than 6" (152 mm) at ends. Use prefabricated L and T units to provide continuity at corners and intersections. Cut and bend units as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- F. Except as indicated otherwise, isolate masonry from overhead structure:
 - 1. Isolate masonry partitions from vertical structural framing members with a control joint.
 - 2. Isolate top joint of masonry partitions from horizontal structural framing members and slabs, decks or blocking with compressible joint filler.

- G. Provide control joints as indicated on the Drawings, keep clean of mortar droppings.
- H. Provide complete protection against breakage and weather damage to all masonry work, including substantial wood boxing around door jambs, over the tops of walls and wherever necessary to protect work at all stages of completion. Protect masonry when not roofed over, at all times when masons are not working on the walls. Apply tarpaulins or waterproof paper, properly weighted, or nailed, to assure their remaining in place to protect masonry from all possible hazards.
- I. Point and fill all holes and cracks in new mortar joints with additional fresh mortar; do not merely spread adjacent mortar over defect or use dead mortar droppings. Do all pointing while mortar is still soft and plastic. If hardened, chisel defect out and refill solidly with fresh additional mortar, and tool or rake joints as specified herein.
- J. Protect all masonry from rain prior to, and during the installation thereof. If the temperature is in excess of 80 degrees Fahrenheit at time of installation, lightly moisten contact surfaces of masonry units by brushing with water.
- K. Cold/Hot Weather Procedures: Refer to TMS 402/602, Cold weather construction section.
 - 1. No masonry work shall be laid in temperatures below 40 degrees Fahrenheit without the submittal to and review by the Architect of cold weather procedures.
 - 2. In ambient temperatures below 40 degrees Fahrenheit make provisions to adequately protect the masonry materials and the finished work from frost, including heating of masonry materials.
 - a. Heat enclosed work areas as necessary to adequately protect the work of this Sub-Bid. Such additional temporary heat and protection measures required is in addition to the protection furnished by General Contractor under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONSTRUCTION, which occurs from November 1st to March 31st.
 - 3. No frozen work shall be built upon nor shall anti-freeze admixtures be permitted in the mortar mix.
 - 4. Any completed work found to be affected by frost shall be taken down and rebuilt at no additional expense to the Owner.

3.7 FLASHING

- A. Provide flashing where indicated on the Drawings, as specified herein and all conditions which may be considered similar to those indicated on the Drawings.
 - 1. Install metal through-wall flashing with hemmed 45-degree edge extending beyond face of masonry not less than 3/16 inch or maximum of 3/8 inch. Ensure through-wall flashing is in proper position in wythe without forming pockets. Solder joints. Pitch all flashing towards exterior.
 - 2. Apply surface conditioner over dirty and dusty surfaces, over surfaces having irregular or rough texture, and those conditions where recommended by wall flashing manufacturer.
 - 3. Extend metal flashing to back up wall, turn up a minimum of 8 inches and terminate as follows:

- a. Masonry - terminate metal flashing into horizontal joint of masonry, extending to 1/2" of interior face of wall, turning back 1" on itself.
 - b. Metal stud and gypsum sheathing - terminate metal flashing on top of air barrier membrane over sheathing and set into Type PE sealant, secure top edge of flashing to studs with type S-12 low profile head screws and install termination bar and sealant.
4. Form end dams at all horizontal terminations; turn metal flashing, fold and solder at corners, bends, jambs and interruptions. Install flashing drip edge with hemmed 45 degree edge extending beyond face of masonry. Prior to removing release paper, trim bottom edge of through-wall flashing back 1/2 inch to 3/4 inch from outside face of masonry. Flashing shall not be permanently exposed to sunlight. Adhere to top surface of drip edge.
5. Apply flashings to substrates, when properly positioned, remove release paper and adhere to substrate, press firmly into place.
6. At membrane through wall flashing, overlap adjacent pieces 2 inches (50 mm) and roll all seams with a steel hand roller, or blunt object.
7. At horizontal terminations of membrane flashing, turn-up ends a minimum of 2 inches (50 mm), cut and make careful folds to form a pan and seal with flashing mastic.
8. Do not allow the rubberized asphalt surface of the flashing membrane to come in contact with polysulfide sealants, creosote, uncured coal tar products or EPDM.
9. Seal all punctures with an elastic cement mastic recommended by flashing manufacturer.
- B. Build-in counter flashing as indicated in the Drawings and as specified herein.
 1. Clean surface of masonry smooth and free from projections that might puncture or otherwise damage flashing membrane.
 2. Carefully fit flashing around projections, neatly fold and bed in compatible mastic or mortar so as to direct moisture to the outside. Form flashing to required profiles without wrinkles or buckles and install in such a manner as to direct moisture to the outside.

3.8 CAVITY WALL CONSTRUCTION

- A. Install all insulation in advance of the masonry wall construction allowing sufficient time for field review and testing.
- B. Install continuous row of "mortar netting" at base of wall and over all wall openings directly onto flashing. Install multiple thickness of "mortar netting" to match cavity widths.
 1. Install mortar netting against back of outside wythe with dovetail section facing up. Cut netting to prevent contact with wall ties, conduit, plumbing and or other materials that bridge or intrude into cavity.
 2. Remove excess mortar as work progresses. Do not permit mortar to drop or accumulate into cavity air space or to plug weeps.
- C. Anchorage for brick veneer: Install specified wall ties as shown on Drawings, if not shown, install one wall-tie/anchor for every 16 inches on center both horizontally and vertically of veneer wall area

1. Place additional wall ties around perimeter of openings and within 12 inches of ends of walls.
 2. Place wall ties starting with the fourth course of brick masonry or 16 inches of concrete foundation walls.
 3. Place wall ties within 8 inches from top of walls.
 4. Attach metal ties to metal anchors previously screw attached through sheathing to each metal stud.
- D. Install rigid mineral wool insulation in core of cavity walls, applying horizontally to exterior face of backup. Cut insulation to ensure that all insulation boards are butted and that the entire surface of the backup masonry is completely covered by insulation.
1. Stagger vertical joints. Butt edges and ends tight to adjacent board and to protrusions. Place rigid insulation retention fasteners.

3.9 WEEP VENTS

- A. Provide weep holes in head joints in first course of veneer immediately above all through-wall flashing, shelf angles, lintels and bottoms of walls.
- B. Install specified pre-fabricated weeps in head joints.
1. Space weep holes: 24 inches on center maximum.
 2. Install pre-fabricated weeps flush with exterior plane of brick masonry.
- C. Keep weep holes and area above flashing free of mortar droppings.

3.10 ENGINEERED MASONRY

- A. Lay masonry units with cells vertically aligned and clear of mortar and unobstructed.
- B. Refer to the Drawings for locations where vertical steel reinforcing rods shall be required in masonry walls. Reinforce masonry unit cores with reinforcement bars and grout.
- C. Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters. Splice reinforcement in accordance with Division 3 - Concrete.
- D. Wet masonry unit surfaces in contact with grout just prior to grout placement.
- E. Grout spaces less than 2 inches in width with fine grout using low lift grouting techniques. Grout spaces 2 inches or greater in width with course grout using high or low grouting techniques.
- F. When grouting is stopped for more than one hour, terminate grout 1 1/2 inch below top of upper masonry unit to form a positive key for subsequent grout placement.
- G. Low lift grouting: Place first lift of grout to a height of three concrete masonry unit courses, and rod for grout consolidation. Place subsequent lifts in 8-inch increments and rod for grout consolidation.

3.11 BUILDING-IN WORK

- A. As work progresses install built-in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates and other items to be built-in the work.
 - 1. Protect surfaces of prefinished built-in items.
- B. Install built-in items plumb and level; take care not to distort alignment of such items.
- C. Bed anchors of metal frames in adjacent mortar joints. Fill frame voids solid with grout except where joints are indicated to receive caulking and sealant. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
 - 1. Rake joints to receive sealant to a uniform depth of 3/4 inch for installation of caulking and sealant.
- D. Do not build-in organic materials subject to deterioration.

3.12 REINFORCEMENT AND ANCHORAGE

- A. Reinforce horizontal joints with continuous masonry joint reinforcement, spaced 16 inches vertically commencing one course above supporting concrete slab.
- B. Place masonry joint reinforcement in first and second horizontal joint above and below openings. Extend 16 inches each side of opening.
- C. Place joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Install preformed units (or optional field-formed units) at corners, reveals, and offsets in exterior masonry, at intersections of all masonry walls and partitions, and wherever walls and partitions change directions.
- F. Do not bridge control and expansion joints in the wall system.
- G. Anchor ends of walls to structure with anchors spaced 24 inches, except as otherwise shown.
- H. Embed anchors in concrete. Attach to structural steel members. Embed anchorages in every second block. Embed anchorages in sixth brick joint.
- I. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

3.13 FIELD QUALITY CONTROL

- A. Field inspection shall be performed under the provisions of Division 1 – GENERAL REQUIREMENTS (Section 01 45 00 - QUALITY CONTROL, or Section 01 45 29 – TESTING LABORATORY SERVICES, as applicable).
- B. Testing frequency: Tests and evaluations listed in this article shall be performed during construction for each 5000 square feet of wall area or portion thereof.

- C. Prism Test Method: For each type of wall construction indicated on Drawings, masonry prisms shall be tested per ASTM E447, Method B: and as follows:
 - 1. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.
- D. Evaluation of Quality Control tests: In absence of other indications of noncompliance with requirements, masonry shall be considered satisfactory if results from source quality control tests comply with minimum requirements indicated.

3.14 PROTECTION OF WORK

- A. Loading: Do not apply loading for at least 12 hours after building masonry walls and partitions. Do not apply concentrated loads for at least 3 days after building masonry columns, walls or partitions.
- B. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 - 2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to un-constructed wythe and hold cover in place.
- C. Stain prevention: Provide protection and prevent grout, mortar, and soil from staining the face of exposed masonry and building finishes. Protect base of walls from rain-splashed mud and mortar splatter.
 - 1. Remove immediately all grout, mortar, and soil that come in contact with such masonry.
- D. Protect finishes of built-in and adjacent work including but not limited to precast masonry, curtain wall frames and other related items.

3.15 TOLERANCES

- A. Refer to TMS 402/602 "Tolerances" referenced sections for minimum requirements.
- B. Maximum variation from true surface level for exposed to view walls and partitions:
 - 1. Unit-to-unit tolerance: 1/16 inch.
 - 2. Surface, overall tolerance: 1/4 inch in 10 feet in any direction and 1/2 inch in 20 feet or more.
 - a. Where both faces of single wythe wall or partition will be exposed to view, request and obtain decision from the Architect as to which face will be required to conform to the specified surface level tolerance.
- C. Maximum variation from plumb: For lines and surfaces of walls do not exceed 1/4 inch in 10 feet, 3/8 inch in any story up to 20 feet maximum. At expansion joints and other conspicuous lines, do not exceed 1/4 inch in 20 feet.
- D. Maximum variation from level: For lines of sills, tops of walls and other conspicuous lines, do not exceed 1/8 inch in 3 feet, or 1/4 inch in 10 feet and 1/2 inch in 30 feet.

- E. Maximum variation of linear building line: For position shown in plan relating to columns, walls and partitions, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet.
- F. Maximum variation in specified height: 1/2 inch per story.
- G. Maximum variation of joint thickness: 1/8 inch in 3 feet.
- H. Maximum horizontally projected unsupported masonry unit: 1-1/8 inches

3.16 CLEANING

- A. Progress Cleaning:
 - 1. General: Maintain site free of waste materials, debris, and rubbish resulting from the work of this Section.
 - a. Remove from work areas surplus and waste materials resulting from the work of this Section. Remove on a continual on-going basis throughout the term of construction.
 - 2. During the progress of the work, keep the exposed surfaces of masonry clean at all times, and protected against damage. As each segment of the masonry is erected, dry-brush the surfaces free from mortar spots and droppings.
- B. Prior to performing the final cleaning work, examine all face joints in exposed masonry to locate cracks, holes or other defects in the mortar; and point up all such defects and fill with mortar as specified herein. Where necessary, in the opinion of the Architect, cut out defective joints in masonry and replace with new materials, exercising extreme care to match original work.
- C. At a time approved by the Architect, perform final cleaning operations on all masonry as specified herein and as recommended by applicable BIA Technical Notes.
 - 1. Perform the final cleaning work only when the ambient temperature is above 40 degrees Fahrenheit and rising.
 - 2. Do not use wire brushes or other abrasive tools in the cleaning operations.
 - 3. Perform final cleaning operations from the top down. If masonry cleaning work is performed after windows, doors, frames, and other work has been installed, provide complete protection for said items; be fully responsible for any damage due to the cleaning operations.
 - 4. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
 - 5. Perform final cleaning of masonry units by scrubbing with stiff bristle fiber brushes and clear water, changing the water frequently.
- D. Provide suitable protective coverings for all other surfaces and materials during the final cleaning procedures and bear full responsibility for correcting any damage caused by these operations.

End of Section

SECTION 05 12 00

STRUCTURAL STEEL

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods and services referenced in or related to this Section shall also be bound by the documents identified in Division 00 Procurement and Contracting Requirements and Division 01 General Requirements.

1.2 SUMMARY

- A. Work Included: This Section includes fabrication and erection of structural steel work, as shown on drawings including schedules, notes, and details showing size and location of members, typical connections, and types of steel required.
 - 1. Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on Drawings.
 - 2. Miscellaneous Metal Fabrications are specified elsewhere in Division 5, Section 05 50 00, METAL FABRICATIONS.
 - 3. Refer to Division 3, Section 03 30 00, CAST-IN-PLACE CONCRETE for anchor bolt installation in concrete.
- B. Related Sections include the following:
 - 1. Section 01 43 39, MOCK-UPS.
 - 2. Section 01 45 00, QUALITY CONTROL.
 - 3. Section 01 45 29, TESTING LABORATORY SERVICES.
 - 4. Section 01 45 90, PROGRAM OF STRUCTURAL TESTS AND INSPECTIONS.
 - 5. Section 03 30 00, CAST-IN-PLACE CONCRETE.
 - 6. Section 04 20 00, UNIT MASONRY; Masonry work.
 - 7. Section 05 31 00, STEEL DECK.
 - 8. Section 05 50 00, METAL FABRICATIONS; Miscellaneous metals.
 - 9. Section 07 00 01, WATERPROOFING, DAMPPROOFING, & CAULKING
TRADE CONTRACT REQUIREMENTS.
 - 10. Section 07 11 13, BITUMINOUS DAMPPROOFING.
 - 11. Section 07 26 00, VAPOR RETARDERS.
- C. Alternates: Not Applicable.
- D. Items To Be Installed Only: Not Applicable.
- E. Items To Be Furnished Only:
 - 1. Furnish the following items for installation under designated Section:
 - a. Anchor bolts: Section 03 30 00, CAST-IN-PLACE CONCRETE
 - b. Leveling Plates: Section 03 30 00, CAST-IN-PLACE CONCRETE

1.3 SUBMITTALS

- A. Refer to Section 01 33 00, SUBMITTAL PROCEDURES for submittal provisions and procedures.
- B. Product data or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
 - 1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
 - 2. Torque controlled high-strength bolts (each type), including nuts and washers. Include Direct Tension Indicators if used.
 - 3. Structural steel primer paint.
 - 4. Shrinkage-resistant grout.
- C. Shop drawings prepared under supervision of a licensed **Structural Engineer registered in Massachusetts**, including complete details and schedules for fabrication and assembly of structural steel members, procedures, diagrams, and design of connections not specifically shown on the drawings.
 - 1. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols and show size, length, and type of each weld.
 - 2. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.
 - 3. Submit erection drawings for approval showing phasing of erection prior to start of any erection work.
 - 4. Structural Drawings shall not be used as erection drawings.
 - 5. Provide electronic copy and minimum of one full-size paper copy of each shop drawing. Refer to 01 33 00, SUBMITTALS, for additional submittal requirements.
- D. Electronic Submittals: Refer to Section 01 33 00 for Submittal Procedure. In addition, provide Engineer (1) fullsize paper print of each shop drawing, in addition to the electronic submittal. Paper copy will be retained by the Engineer and electronic copy will be returned. Review cycle will not commence until paper copy of shop drawing has been received.
- E. Test reports conducted on shop- and field-bolted and welded connections. Include data on type(s) of tests conducted and test results.
- F. Certified copies of each survey conducted by a licensed Land Surveyor, showing elevations and locations of base plates and anchor bolts to receive structural steel and final elevations and locations of major members. Indicate discrepancies between actual installation and contract documents.

- G. The Contractor shall maintain records of test results of welding procedures and records of welders employed, date of qualification, and identification symbol or mark. Such records shall be available for examination by the SER and testing Agency or certified copies submitted upon request to the SER and the Testing Agency.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:
 - 1. American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges".
 - a. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence:

"This approval constitutes the owner's acceptance of all responsibility for the design adequacy of any detail configuration of connections developed by the fabricator as a part of his preparation of these shop drawings."
 - 2. AISC "Specifications for Structural Steel Buildings", including "Commentary".
 - 3. "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Structural Connections.
 - 4. American Welding Society (AWS) D1.1 "Structural Welding Code - Steel".
 - 5. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".
 - 6. The Massachusetts State Building Code.
 - 7. AISC Quality Certification Program: The structural steel fabricator shall be AISC Certified, Category 1.
- B. Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with AWS "Qualification" requirements.
 - 1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
 - 2. If re-certification of welders is required, retesting will be Contractor's responsibility.
- C. No steel shall be erected without approved shop drawings. Any steel installed without prior approved shop drawings will be rejected and steel shall be removed and replaced.

1.5 TESTING AND INSPECTION

- A. Inspection, Testing, and Quality Control: A program of Inspection and Testing of structural steel work will be established by the Structural Engineer of Record (SER) who will direct the implementation of tests as carried out by an independent testing agency. All costs for inspection and testing shall be borne by the Owner.

- B. The materials and workmanship to be furnished under this Section shall be subject to inspection and testing in the mill, shop, and field by the SER and/or Testing Agency. Such inspection and testing shall not relieve the contractor of his responsibility to provide his own inspection and quality control and to furnish materials and workmanship in accordance with the requirements of the contract documents.
- C. The Contractor and Testing Agency shall examine the contract documents and become thoroughly acquainted with detailed inspection and testing requirements as outlined by the SER.
- D. The Contractor shall cooperate with and facilitate inspection and testing by the SER and /or Testing Agency. The Contractor shall, at his own expense, furnish the SER and/or the Testing Agency upon request, with the following:
 - 1. A complete set of reviewed erection drawings, detailed shop drawings, schedules, and corrective work procedures at the fabricating shop or shops in the field.
 - 2. Cutting list, order lists, material bills, and shipping lists.
 - 3. Information as to time and place of all rollings and shipment of material to shops.
 - 4. Representative sample pieces requested for testing.
 - 5. Assistance for testing materials and proper facilities for inspection of the work, in the mill, shop, and field.
- E. The Testing Agency shall inspect and test all welded and bolted work.
 - 1. Shop-Bolted Connections: Inspect or test in accordance with AISC Specifications.
 - 2. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:
 - a. Certify welders and conduct inspections and required tests. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
 - b. Perform visual inspection of all welds.
 - c. Perform tests of welds as follows. Inspection procedures listed are to be used at Contractor's option.
 - 1) Liquid Penetrant Inspection: ASTM E 165.
 - 2) Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not acceptable.
 - 3) Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
 - 4) Ultrasonic Inspection: ASTM E 164.

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3. Field-Bolted Connections: Inspect in accordance with AISC specifications.
 - a. For Direct Tension Indicators, comply with requirements of ASTM F 959. Verify that gaps are less than gaps specified in Table 2.
 4. Field Welding: Inspect and test during erection of structural steel as follows:
 - a. Certify welders and conduct required inspections and tests. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
 - b. Perform visual inspection of all welds.
 - c. Perform tests of welds as follows:
 - 1) Liquid Penetrant Inspection: ASTM E 165.
 - 2) Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not acceptable.
 - 3) Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
 - 4) Ultrasonic Inspection: ASTM E 164; 100% of Moment Connections shall be ultra-sonically inspected.
- F. Weldments and bolted connections that are required by the SER and/or the Testing Agency to be corrected shall be corrected without delay at the Contractor's expense. The SER of the Testing Agency shall require drawings showing proposed corrective work to be submitted for review.
- G. The Contractor shall notify the SER and/or the Testing Agency five (5) days prior to the shipment of any structural steel so that a paint inspection can be made. At these inspections the dry mill thickness of the paint film will be checked and steel containing mill scale that can easily be removed with the blade of a pocket knife will be subject to re-cleaning and repainting at the expense of the contractor.
- H. Any material or workmanship which is rejected by the SER and/or the Testing Agency either in the mill, shop, or field shall be replaced promptly by the Contractor.
- I. The fact that steel work has been accepted at the shop shall not prevent its final rejection at the job site, even after it has been erected, if found to be defective in any way.
- 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products in accordance with Section 01 60 00, PRODUCT REQUIREMENTS.
 - B. General Contractor shall provide and pay for all dumpster services during the entire construction period. Suppliers and Sub-Contractors to bring all rubbish and debris to the dumpster location daily. No costs are to be assessed to the suppliers or Sub-Contractors by the General Contractor for this service.

- C. General Contractor, Sub-Contractors, and suppliers are all individually to furnish their own staging, scaffolding, and hoisting equipment necessary to get workers, material, and equipment from the point of delivery at the project site to the point of use or installation within the building and project site. All crane and rigging services required are the responsibility of each individual trade.
- D. Deliver materials to site at such intervals to ensure uninterrupted progress of work.
- E. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.
- F. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. If bolts and nuts become dry or rusty, clean and re-lubricate before use.
 - 1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures.

PART 2- PRODUCTS

2.1 MATERIALS

- A. All steel is to consist of a minimum of 95% recycled steel with over 80% post-consumer and 15% pre-consumer recycled content in compliance with LEED requirements.
- B. Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.
- C. Structural Steel Shapes: ASTM A992.
- D. Plates and Bars: ASTM A36
- E. Cold-Formed Steel Tubing: ASTM A 500, Grade B.
- F. Hot-Formed Steel Tubing: ASTM A 501.
- G. Steel Pipe: ASTM A 53, Type E or S, Grade B; or ASTM A 501.
 - 1. Finish: Black, except where indicated to be galvanized.
- H. Anchor Bolts: ASTM F1554 (Grade 55), non-headed type unless otherwise indicated.
- I. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
 - 1. Quenched and tempered medium-carbon steel bolts, nuts, and washers, complying with ASTM A 325, or ASTM F1852, torque controlled.

- a. Where indicated as galvanized, provide units that are zinc coated, either mechanically deposited complying with ASTM B 695, Class 50, or hot-dip galvanized complying with ASTM A 153.
2. Quenched and tempered alloy steel bolts, nuts, and washers, complying with ASTM A 490, or ASTM 2280, torque controlled.
- J. Electrodes for Welding: Comply with AWS Code.
- K. Structural Steel Primer Paint (steel not scheduled to receive spray-on fire proofing or intumescent coating): Tnemec Company Series V10 #1009 Gray metal primer, or Sherwin Williams Steel Spec Structural Steel Primer B50AV11 Gray metal primer, or approved equal compatible with finish paint systems listed under Section 09 91 23 Interior Painting Schedule.
- L. Structural Steel Primer Paint (steel scheduled to receive intumescent coating): Alkyd primer compatible with intumescent coating systems listed under Section 07 81 23 Intumescent Fireproofing.
- M. Non-metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with CE-CRD-C621.
- N. Thermal Break Pad: Fiberglass-Reinforced Laminate Composite with the following minimum properties:

1. Tensile Strength	ASTM D638	11,000 psi
2. Flexural Strength	ASTM D790	25,000 psi
3. Compressive Strength	ASTM D695	38,900 psi
4. Compressive Modulus (1/2")	ASTM D695	291,194 psi
5. Shear Strength	ASTM D732	15,000 psi
6. Oxygen Index	ASTM D2863	21.8%
7. Coefficient of Thermal Expansion	ASTM D696	2.2
8. Thermal Conductivity	ASTM C177	1.8 BTU/Hr/ft ² /in/°F
9. Density		107.83 lb/ft ³

2.2 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
 2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
- B. Connections: Weld or bolt shop connections, as indicated. Bolt field connections, except where welded connections or other connections are indicated.

1. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.
 2. Provide unfinished threaded fasteners for only bolted connections of secondary framing members to primary members (including purlins, girts, and other framing members taking only nominal stresses) and for temporary bracing to facilitate erection.
- C. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or ASTM A 490 Bolts".
- D. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
- E. Assemble and weld built-up sections by methods that will produce true alignment of axes without warp.
- F. Steel Wall Framing: Select members that are true and straight for fabrication of steel wall framing. Straighten to provide uniform, square, and true members in completed wall framing.
- G. Holes for Other Work: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on final shop drawings.
- H. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.
- O. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
- P. Corrective Work: Structural steel members or assemblages having fabrication errors, which exceed permissible tolerances, shall be corrected only if permitted by the SER. All corrective work shall be in accordance with AISC and AWS requirements. When requested by the SER or the Testing Agency, the Contractor shall submit to the Architect and/or SER for approval, drawings showing details of proposed corrective work and shall receive approved drawing prior to performing the corrective work. All corrective work shall be solely at Contractor's expense.
- Q. Architecturally Exposed Structural Steel: Shop fabricate and assemble AESS to the maximum extent possible. Locate joints at concealed locations, if possible. Comply with the following:
- a. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale and roughness.
 - b. Grind sheared, punched, and flame-cut edges of AESS to remove burrs and provide smooth surfaces and edges.
 - c. Fabricate AESS with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
 - d. Fabricate AESS with exposed surfaces free of seams to maximum amount possible.
 - e. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
 - f. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.

- g. Fabricate AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
- h. Seal-weld open ends of hollow structural sections with 3/8-inch closure plates for AESS.
- i. Provide continuous welds of uniform size where AESS is welded.
- j. Remove backing bars or run-off tabs, back-gouge welds and grind smooth for AESS.
- k. Grind butt and groove welds flush to adjacent surfaces within a tolerance of plus 1/16-inch, minus 0 inch for AESS.
- l. Make fillet welds oversize and grind to uniform profile with smooth face and transition.
- m. No external materials shall be welded to the steel that require removal in the field (Example- nuts for safety cables).

2.3 SHOP PAINTING

- A. General: Shop-paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel that is partially exposed on exposed portions and initial two (2) inches of embedded areas only.
 - 1. Do not paint surfaces to be welded or high-strength bolted with friction-type connections.
 - 2. Do not paint surfaces scheduled to receive sprayed-on fireproofing.
 - 3. Do not paint top flanges of beams that receive shear studs.
 - 4. Apply two (2) coats of paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
 - 5. Primer at steel scheduled to receive intumescent coating is to be compatible with intumescent coating.
- B. Surface Preparation: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
 - 1. For non-galvanized, non-Architecturally Exposed Structural Steel: SP-2 "Hand Tool Cleaning" or SP-3 "Power Tool Cleaning."
 - 2. For non-galvanized Architecturally Exposed Structural Steel: SP-6 "Commercial Blast Cleaning."
 - 3. For galvanized structural steel scheduled to receive a primer: SP-1 "Solvent Cleaning", the SP-7 "Brush-off Blast Cleaning" after galvanizing. The SP-7 shall be performed lightly so as to only profile the surface for the subsequent paint applications. Do not remove the zinc coating in this process.
 - 4. For galvanized structural steel not scheduled to receive a primer: SP-1 "Solvent Cleaning."
- C. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 2.0 mils. Use painting methods that result in full coverage of joints, corners, edges, and exposed surfaces.

- D. Galvanizing, where indicated, shall be hot dipped galvanizing after fabrication in accordance with ASTM Specification A123 and neutralized ready for paint where applied. Galvanized members embedded or attached to concrete shall be dipped in a 0.2% chromic acid solution.
- E. Hot-dipped galvanized steel scheduled for field applied finish paint:
 - 1. Touch-up all breaks on hot-dipped surfaces caused by cutting, welding, drilling, or undue abrasion with zinc rich paint. Apply zinc rich paint in two coats to a total dry film thickness of not less than 3 mils.
 - 2. Provide factory-applied polyamide epoxy primer, 2.0 mils dry film thickness minimum, "Primergalv" by Duncan Galvanizing or approved equal compatible with finish paint system. Apply primer within 12 hours after galvanizing at the galvanizer's plant in a controlled environment meeting applicable environmental regulations, and as recommended by coating manufacturer. Engage the services of a galvanizing facility which will assume single-source responsibility for galvanizing and primer coating.
 - 3. Touch-up finish in conformance with manufacturer's recommendations. Provide touch-up such that repair is not visible from a distance of 6 feet.

2.4 SOURCE QUALITY CONTROL

- A. General: The Contractor shall maintain his own quality control and inspection of all shop and field work. Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
 - 1. Promptly remove and replace materials or fabricated components that do not comply.
- B. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.
 - 1. Connection design not specifically shown on the contract drawings is included herein as part of this subcontractor's work.

PART 3- EXECUTION

3.1 ERECTION

- A. Surveys: Employ a licensed Land Surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with Architect.
- B. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

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- C. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.
- D. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
 3. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
 4. For proprietary grout materials, comply with manufacturer's instructions.
- E. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- F. Level and plumb individual members of structure within specified AISC tolerances.
- G. Splice members only where indicated and accepted on shop drawings.
- H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.
1. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 2. Do not enlarge unfair holes in members by burning or by using drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- I. Gas Cutting: Do not use gas-cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to SER. Finish gas-cut sections equal to a sheared appearance when permitted.
- J. Architecturally Exposed Structural Steel: Erect AESS members with nylon slings or other methods that will not damage AESS surfaces.
1. Erect AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
 2. Do not thermally cut during erection.
- K. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

3.2 AFFIDAVIT

- A. The General Contractor shall, upon the completion of the steel work, submit to the SER an affidavit certifying that he has supervised the steel construction and that it is in accordance with the structural plans and specifications.

END OF SECTION

SECTION 05 31 00

STEEL DECK

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods and services referenced in or related to this Section shall also be bound by the documents identified in Division 00 Procurement and Contracting Requirements and Division 01 General Requirements.

1.2 SUMMARY

- A. Work Included: This Section includes the following:
 - 1. Steel roof deck.
 - 2. Steel form deck.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 01 43 39, MOCK-UPS.
 - 2. Section 01 45 90, PROGRAM OF STRUCTURAL TESTS AND INSPECTIONS.
 - 3. Section 03 30 00, CAST-IN-PLACE CONCRETE.
 - 4. Section 04 20 00, UNIT MASONRY; Masonry work.
 - 5. Section 05 12 00, STRUCTURAL STEEL; Structural steel.
 - 6. Section 07 92 00, JOINT SEALANTS.
- C. Alternates: Not Applicable.
- D. Items To Be Installed Only: Not Applicable.
- E. Items To Be Furnished Only: Not Applicable.

1.3 SUBMITTALS

- A. Refer to Section 01 33 00, SUBMITTAL PROCEDURES for submittal provisions and procedures.
- B. Manufacturer: The designations of deck used on the drawings are those from the catalog of United Steel Deck, Inc. The designations are used for convenience only, and other manufacturers who make the same profile of deck and conform to the design standards may be acceptable.
- C. Product data for each type of deck, accessory, and product specified.
- D. Shop drawings showing layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

- E. Electronic Submittals: Refer to Section 01 33 00 for Submittal Procedure. In addition, provide Engineer (1) fullsize paper print of each shop drawing, in addition to the electronic submittal. Paper copy will be retained by the Engineer and electronic copy will be returned. Review cycle will not commence until paper copy of shop drawing has been received.
- F. No fabrication shall take place until the shop drawings have been reviewed.
- G. All welds shall be indicated by AWS Welding Symbols.
- H. The General Contractor shall check the shop drawings and shall indicate in colored pencil his corrections for modifications for the other trades, holes, and necessary field dimensions before forwarding them to the Architect/SER for review.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise indicated:
 - 1. American Iron and Steel Institute (AISI), "Specification for the Design of Cold-Formed Steel Structural Members".
 - 2. American Welding Society (AWS), D1.3 "Structural Welding Code - Steel Sheet".
 - 3. Steel Deck Institute (SDI), "Design Manual for Composite Deck, Form Decks, and Roof Decks".
 - 4. The Massachusetts State Building Code.
- B. Qualification of Field Welding: Use qualified welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS
- C. Welded decking in place is subject to inspection and testing. Owner will bear expense of removing and replacing portions of decking for testing purposes if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work.
- D. FM Listing: Provide steel roof deck units that have been evaluated by Factory Mutual System and are listed in "Factory Mutual Guide" for "Class I".

1.5 TESTING AND INSPECTION

- A. A program of Inspection and Testing of steel decking work will be established by the Structural Engineer of Record (SER) who will direct the implementation of tests as carried out by an independent testing agency. All costs for inspection and testing shall be borne by the Owner.
- B. The materials and workmanship to be furnished under this Section shall be subject to inspection in the shop and field by the SER and/or the testing agency. Such inspection shall not relieve the Contractor of his requirements to furnish materials and workmanship in accordance with requirements of the Contract Documents.

- C. Access shall be provided for inspection of all facilities by the SER and/or the testing agency and the fabricator shall, when requested, aid the inspectors in carrying out their duties.
- D. The testing agency will report test results promptly and in writing to Contractor and Architect/SER.
- E. Remove and replace work that does not comply with specified requirements.
- F. Additional testing will be performed to check compliance of corrected work with specified requirements.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products in accordance with Section 01 60 00, MATERIAL AND EQUIPMENT.
- B. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- C. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
- D. All deformed or damaged panels shall be removed from the site and replaced at no additional expense to the Owner.

PART 2- PRODUCTS

2.1 STEEL DECK

- A. All steel is to consist of a minimum of 95% recycled steel with over 80% post-consumer and 15% pre-consumer recycled content in compliance with LEED requirements.

- B. Steel Roof Deck:

- 1. Roof decking to be furnished and installed shall be formed of 1-1/2 in deep 22 gauge fluted, Type B, and 3 in. deep 20 gauge fluted, Type NI wide rib formed galvanized steel sheets. All decking shall conform to ASTM A 245 or A 446 and shall be hot-dipped galvanized in accordance with ASTM A 93 or A 361.
 - 2. The formed roof decking shall have section properties not less than the following:

<u>Type Deck</u>	<u>Section Modulus</u>	<u>Moment of Inertia</u>
B – 20 Gauge	0.25 in. ³	0.22 in. ⁴

- 3. The above values are per foot of width and shall be determined by computing in accordance with the American Iron and Steel Institute's "Specifications" for the design of light gage cold-formed steel structural members.

- C. Non-Composite Form Deck:

- 1. Non-Composite steel form deck to be furnished and installed shall be formed of galvanized steel sheets. All decking shall conform to ASTM A 563.

2. The non-composite form decking shall have section properties not less than the following:

<u>Type Deck</u>	<u>Section Modulus(S_p)</u>	<u>Moment of Inertia(I_p)</u>
UFS – 24 Gauge	0.065 in. ³	0.020 in. ⁴
UF1X – 22 Gauge	0.125 in. ³	0.070 in. ⁴

3. The above values are per foot of width and shall be determined by computing in accordance with the American Iron and Steel Institute's "Specifications" for the design of light gage cold-formed steel structural members.

2.2 ACCESSORIES

- A. General: Provide accessory materials for steel deck that comply with requirements indicated and recommendations of the steel deck manufacturer.
- B. Mechanical Fasteners: Manufacturers self-drilling, self-threading screws.
- C. Side Lap Fasteners: Manufacturer's standard, corrosion-resistant, hexagonal washer head; self-drilling, carbon steel screws, No. 12 minimum diameter.
- D. Rib Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Roof Deck Accessories: Steel sheet, 0.0359 inch (0.91-mm) thick minimum ridge and valley plates, finish strips, and reinforcing channels, of same material as roof deck.
- F. Washers: Manufacturer's standard uncoated-steel sheet weld washers, shaped to fit deck rib, 0.0598 inch (1.5 mm) thick with 3/8-inch (9.5 mm) minimum diameter pre-punched hole.
- G. Sump Pans: Manufacturer's standard size, single piece steel sheet 0.071-inch (1.8-mm) thick minimum, of same material as deck panels, with 1-1/2-inch (38-mm) minimum deep level recessed pans and 3-inch (76 mm) wide flanges. Cut holes for drains in the field.
- H. Steel Sheet Accessories: ASTM A 446, G 60 (ASTM A 446M, Z 180) coating class, galvanized according to ASTM A 525 (ASTM A 525M).
- I. Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3- EXECUTION

3.1 EXAMINATION

- A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.

3.2 PREPARATION

- A. Do not place deck panels on concrete supporting structure until concrete has cured and is dry.

- B. Locate decking bundles to prevent overloading of supporting members.

3.3 INSTALLATION - GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary of SDI Publication No. 28, manufacturer's recommendations, and requirements of this Section.
- B. Install temporary shoring before placing deck panels when required to meet deflection limitations.
- C. Place deck panels on supporting framing and adjust to final position with ends accurately aligned and bearing on supporting framing before being permanently fastened. Do not stretch or contract side lap interlocks.
- D. Place deck panels flat and square and fasten to supporting framing without warp or deflection.
- E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to the decking.
- F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.
- G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
- H. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's instructions.

3.4 ROOF DECK INSTALLATION

- A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 3/4 inch, nominal.
 - 2. Weld Spacing: Weld edge ribs of panels at each support. Space welds an average of 12 inches apart, with a minimum of two welds per unit at each support.
 - 3. Weld Washers: Install weld washers at each weld location where recommended by deck manufacturer.
- B. Side Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding 36 inches, using one of the following methods:
 - 1. Mechanically fasten with self-drilling No. 12 or larger carbon steel screws. Fasten with 1-1/2-inch long minimum welds.
- C. End Bearing: Install deck ends over supporting framing with a minimum end bearing of 1-1/2 inches, with end joints lapped 2 inches.

- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking, and weld flanges to top of deck.
- E. Space welds not more than 12 inches apart with at least one weld at each corner.
- F. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's recommendations. Weld to substrate to provide a complete deck installation.
- G. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's instructions to ensure complete closure.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces with galvanized repair paint according to ASTM A 780 and the manufacturer's instructions.
- B. Provide final protection and maintain conditions to ensure steel decking is without damage or deterioration at time of Substantial Completion.

END OF SECTION

Section 05 40 00
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Design, engineer, furnish and install metal framing and support system for the following applications:
 - 1. Load bearing formed steel stud exterior wall framing behind brick masonry veneer and metal wall panel assemblies.
 - 2. Framing for exterior aluminum curtain walls.
 - 3. Framing at roof between structural steel parapet supports.
 - 4. Framing infill at exterior side of structural steel beam locations.
 - 5. Z-furring metal stud framing standoff attachment clips at fireproofed steel and otherwise called for on the drawings.
 - 6. Coordinate work of this Section with Section 23 00 00- HVAC for required stud spacing and locations of vertical ductwork in exterior walls.
 - 7. Continuous flat strap for fastening of through wall flashing termination bars.
 - 8. All tracks, connections, bracing, bridging, accessory angles, furring, backing strips and accessories to provide framing and support of materials specified in this Section and framing and support not included in other Sections.
 - 9. Mock-up wall components.
- B. Coordinate work of this Section with the work of the various trades responsible for applying materials and other items to cold-formed metal framing work.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 04 20 00 - UNIT MASONRY: Veneer masonry assembly supported by wall stud metal framing.
- C. Section 05 12 00 - STRUCTURAL STEEL FRAMING: Structural building framing.
- D. Section 05 31 00 - STEEL DECKING: Metal floor decking, metal roof decking.
- E. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking and curbing.
- F. SECTION 07 27 13 – MEMBRANE AIR BARRIERS
- G. Section 07 53 23 – EPDM ROOFING
- H. Section 07 62 00 - SHEET METAL FLASHING AND TRIM: Head and sill flashings.
- I. Section 07 81 00 – APPLIED FIREPROOFING.
- J. Section 07 84 10 – FIRESTOPPING.
- K. Section 07 92 00 - JOINT SEALANTS.

- L. Section 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS.
- M. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Light weight, non-load bearing metal stud framing.
- N. Section 09 29 00 – GYPSUM BOARD: Exterior wall sheathing.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI - Cold-Formed Steel Design Manual.
 - 2. ASTM A123 - Zinc Coatings on Iron and Steel Products.
 - 3. ASTM A645 - Steel Sheet, Pressure Vessel Plates, Five Percent Nickel Alloy Steel, Specially Heat Treated.
 - 4. ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 5. ASTM A780 - Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - 6. ASTM C1513 Standard Specification For Steel Tapping Screws For Cold-Formed Steel Framing Connections
 - 7. ASTM C955 Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
 - 8. AISC: Specifications Guide for Cold Formed Steel Structural Members.
 - 9. AWS A 2.0 - Standard Welding Symbols.
 - 10. AWS D 1.3 - Light Steel Welding Code.
 - 11. SSPC Steel Structures Painting Manual.
 - 12. SSMA: Cold Formed Steel Details.

1.4 SYSTEM DESCRIPTION

- A. Structural performance: Design, engineer and provide a complete metal framing and support system having deflection limits as specified herein under the full inward and outward lateral load prescribed by applicable codes for this project location. Deflection and structural calculations shall not include any structural benefit from wall veneer materials; metal framing alone shall carry the loads. Where a member supports more than one finish, the most restrictive deflection shall govern.
 - 1. Design wall system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 - 2. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
 - 3. Deflection limits
 - a. Exterior wall framing: Deflection limit for masonry veneer: $L/600$ where L is the length of the steel member. Design wall framing to accommodate

- horizontal deflection without regard for contribution of sheathing materials.
 - b. Interior load-bearing wall framing: Horizontal deflection of $1/360$ of the wall height.
 - c. Ceiling joist framing: Vertical deflection of $1/360$ of the span.
 - B. Loads: Design light gage metal framing and connections to support total loads including dead loads, live loads, earthquake loads, thermal loads, wind loads, and other loads as prescribed by the governing building code by reference standards, and as described herein.
 - 1. Pressures and loads used for design shall satisfy the building code but shall not be less than the minimum values specified below. Where permitted by code, the sum of the dead load, live load, and wind (or earthquake) load may be multiplied by an allowable reduction factor. Other load combinations, and single loads, shall not to be reduced. An allowable stress increase of one third, or any other value, shall not be used in conjunction with a reduced load combination.
 - 2. Wind pressures shall be assumed to act perpendicular to flat surfaces supported by light gage metal framing, regardless of the surface orientation. Wind pressures shall be assumed to act perpendicular to tangents of curved surfaces. At corners and other changes in plane, both surfaces shall be assumed to experience their inward design pressures simultaneously, and their outward design pressures simultaneously. Design for simultaneous occurrence of inward design pressure on one surface, and outward design pressure on the adjoining surface, is not required.
 - 3. Light gage metal framing must also carry dead, wind and earthquake loads and live loads from work specified in other sections supported by light gage metal framing.
 - 4. Wind and snow loading: Masonry veneer wall system shall conform to the 2021 International Building Code with Massachusetts Building Code, Tenth Edition amendments for snow and wind loading.
 - 5. Seismic loads shall be based on the seismic provisions contained in applicable codes.
 - C. Welding: Employ experienced welders who are certified in compliance with AWS Standard Qualification Procedures.
 - D. Engineering: Provide the services of a professional Structural Engineer licensed in the State of Massachusetts, to design, certify and stamp that the work of this section meets or exceeds the performance requirements specified in this section and as required by the 2021 International Building Code with Massachusetts Building Code, Tenth Edition amendments.
- 1.5 SUBMITTALS
- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and limitations on standard framing members and other products furnished hereunder.

2. Provide calculations for loadings and stresses of exterior wall framing under the Professional Structural Engineer's seal. Show how design load requirements and other performance requirements have been satisfied.
 3. Manufacturer's installation instructions: Indicate special procedures, and conditions requiring special attention.
 4. Shop drawings:
 - a. Large scale design details showing component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, and accessories or items required of related work.
 - b. Detail all conditions which deviate from Contract Documents
 - c. Describe method for securing studs to tracks and for bolted and welded framing connections.
 - d. Show Z-furring stud wall attachment clips.
 5. Prior to prefabrication of framing, submit fabrication and erection drawings for approval. All calculations and details are to be submitted for all members and connections.
- B. Submit prior to request for Certificate of Occupancy, to both Architect and local Building Official having jurisdiction, under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, the following
1. All certifications, reports and programs required by the 2021 International Building Code with Massachusetts Building Code, Tenth Edition amendments for work engineered by Contractor's Professional Engineer under the requirements of this Section.

1.6 QUALITY ASSURANCE

- A. Calculate structural properties of framing members in accordance with AISC, MF/SLA and AWS D 1.3 requirements.
1. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 3 years documented experience.
- B. Installer: Company with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein and approved by product manufacturer.
- C. Welders Certificates: Utilize only qualified welders employed on the Work. Submit verification that Welder's are AWS D1.1 and D1.4 qualified within the previous 12 months.
- D. Licensed Professionals: Professional Engineer, registered in the Commonwealth of Massachusetts.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.
- B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- 1.9 SEQUENCING AND SCHEDULING
- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- 1.10 WARRANTY
- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Clark-Western Building Systems, West Chester OH.
 2. Dietrich Industries, Inc., Pittsburgh PA.
 3. Marino-Ware Industries Corp., South Plainfield NJ.
 4. Steel Elements, Gorham NH.
 5. The Steel Network (TSN), Las Vegas NV.
- B. Recycled content of steel: Use maximum available percentage of recycled steel. Steel framing products incorporated into the work shall contain not less than 30 percent of recycled steel.
- C. Steel sheet for framing: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
1. Framing:
 - a. Grade: As determined by structural performance calculation but not less than 18 gauge thickness.
 - 1) Coating: G90 (Z275).

- D. Steel sheet for connectors: ASTM A 570/A 570M, hot rolled or ASTM A 611, cold rolled; cleaned, pretreated, and primed with manufacturer's baked-on, lead- and chromate-free, rust-inhibitive primer complying with performance requirements in FS TT-P-664, of grade as follows:
 - 1. Connectors:
 - a. Grade: As determined by structural design calculation performance but not less than 18 gauge thickness.
 - 1) Coating: G90 (Z275).

2.2 FRAMING MEMBERS

- A. Studs: Manufacturer's standard C-shaped steel studs complying with ASTM C 955. Formed of ASTM A-653/653M steel, G90 (Z275) galvanized, channel shaped with lipped flanges, punched web, size as shown on Drawings, thickness and grade as determined by structural design calculations but in no case less than 18 gauge.
- B. Tracks: Manufacturer's standard U-shaped steel track complying with ASTM C 955. Formed of ASTM A-653/653M steel, same designation, coating, and thickness as studs except as otherwise noted, channel shaped, solid web, depth compatible with studs, size, thickness and grade as determined by structural design calculations but in no case less than 18 gauge.
 - 1. Track at exterior walls: Provide specified track with 4 inch high vertical legs at all locations not scheduled to receive floor mounted millwork or casework.
- C. Joists and Rafters: Manufacturer's standard C-shaped steel joists, of web depths indicated, complying with ASTM C 955. Formed of ASTM A 653/653M steel, G90 (Z275) galvanized, channel shaped with lipped flanges, solid web, size as shown on Drawings, thickness and grade as determined by structural design calculations.
- D. Drift and Vertical Deflection Clips: Manufacturer's standard bypass and head clips capable of isolating wall stud from upward and downward vertical displacement of primary structure using mechanical fasteners.
 - 1. Provide clips with step bushings. Mechanical attachment to structure and screw attachment to stud web using step-bushings to permit frictionless vertical movement. 68 mils (1.72 mm) minimum thickness. Size of clips shall be as determined by structural design calculations performed by clip manufacturer and reviewed by specified Engineering Licensed Professional stamping Shop Drawings. Clips shall be fabricated/designed for the following conditions:
 - a. Exterior head of wall.
 - b. Exterior head of wall pre-assembled with track.
 - c. By-pass structural pour stop at floor slab.
 - d. By-pass floor slab or structure.
 - e. By-pass structure.

2.3 ANCHORS AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.

- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Mechanical Fasteners for steel: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws.
 - 1. Head Type: Low-profile head beneath insulated metal wall panel and sheathing, manufacturer's standard elsewhere.
- E. Mechanical Fasteners for aluminum: Type 304 stainless steel, self-drilling, self-threading steel drill screws.
 - 1. Head Type: Manufacturer's standard.
- F. Welding Electrodes: Comply with AWS standards.

2.4 MISCELLANEOUS MATERIALS

- A. Liquid zinc coating, for touch-up of welds, scratches, and abrasions in galvanized steel: Low VOC organic zinc-rich coating containing 92% metallic zinc, by weight in the dried film (ASTM D520, Type III) and conforming to SSPC Paint 20, Type II, Level 1. Liquid zinc coating shall be recognized under the Component Program of Underwriter's Laboratories, Inc. as an equivalent to hot-dip galvanizing, conforming to MIL-P-21035B and SSPC Paint 29, Type II, Level I, for repair of hot-dip galvanizing and meeting the requirements for Zinc-Rich Paints.
 - 1. VOC limit: 250 g/L or less.
 - 2. Specified manufacturer and product: ZRC Worldwide, Marshfield MA, product "ZRC-221".

2.5 PRE-ERECTION FABRICATION

- A. Framing components may be pre-assembled into panels prior to erecting. Fabricate panels square with framing members fitted, reinforced, and braced to suit design requirements; attach components in a manner to prevent racking.
- B. Fit and assemble in largest practical sections for delivery to site, ready for installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect previous work, related work, and conditions under which this work is to be performed and notify Contractor in writing of all deficiencies and conditions detrimental to the proper completion of this work.
- B. Beginning of installation means acceptance of existing substrates, previous work and conditions.

3.2 ERECTION - GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to ASTM C 1007, unless more stringent requirements are indicated.
- C. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding or screw fastening, as indicated on approved Shop Drawings, or where not indicated, as standard with fabricator. Wire tying or clip fasteners of framing members is not permitted.
 - a. Where welding is indicated or required on approved Shop Drawings: Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to approved Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
- D. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.
- E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- F. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- H. Accurately align and attach runners in strict compliance with manufacturer's recommendations and approved shop drawings. . Allow for main structure deflection at top runner to avoid transferring load stud system.
 - 1. Frame wall openings with additional framing members at perimeter of openings as needed.
 - 2. Align holes in framing members to facilitate electrical conduit and piping work.
 - 3. Provide all needed connections and accessories provide a complete structural system.
 - 4. Provide all needed members for proper fastening interior gypsum wallboard.
- I. Bracing: Provide continuous 1-1/2 inch cold-rolled channel horizontal bracing within 10 to 12 inches of tops of stud. Connect bracing to each stud as indicated on approved shop drawings. Provide additional bridging and bracing as recommended by manufacturer, as necessary, and as indicated on approved shop drawings.

Provide kick-back bracing perpendicular to plane of framing system and securely anchored to building structure needed to create a complete structural system meeting specified performance requirements.

- J. Continuous strap location for fastening of through wall flashing termination bar shall be coordinated with other trade and subcontractors.
- K. Accurately align framing members on each elevation, floor to floor, for curtain wall openings.
- L. Touch-up damaged metal coatings, with galvanize repair paint.

3.3 ERECTION OF STUDDING

- A. Install components in accordance with manufacturer's instructions and in accordance with
- B. Align floor and ceiling tracks; locate to wall and partition layout. Secure in place as indicated on approved engineered shop drawings, at maximum 24 inches on center.
- C. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom tracks. Space studs as indicated on approved shop drawings; not more than 2 inches from abutting walls and at each side of openings.
- D. Construct corners using minimum three studs. Double stud wall openings, door jambs.
- E. Erect load bearing studs one piece full length. Splicing of studs is not permitted.
- F. Erect load bearing studs, brace, and reinforce to develop full strength, to achieve design requirements.
- G. Install intermediate studs above and below openings to align with wall stud spacing.
- H. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing. Install double deep leg deflection track or specified clip system for vertical deflection of primary building structure.
- I. Attach cross studs, furring channels to studs for attachment of fixtures anchored to walls.
- J. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- K. Touch-up field welds and damaged galvanized and primed surfaces with primer.

3.4 ERECTION (WIND LOAD ONLY)

- A. Handling and lifting of prefabricated panels shall be done in a manner as to not cause distortion in any member.
- B. Tracks shall be securely anchored to the supporting structure as shown on the plans.

- C. At track butt joints, abutting pieces of track shall be securely anchored to a common structural element or they shall be butt-welded spliced together.
- D. Studs shall be plumbed, aligned and securely attached to the flanges or webs of both upper and lower tracks.
- E. Jack studs or cripples shall be installed door heads and elsewhere to furnish support and shall be securely attached to supporting members.
- F. Wall stud bridging shall be attached in a manner to prevent stud rotation. Bridging rows shall be spaced according to the following schedule. Wall up to 10 foot height; one row at mid-height. Wall exceeding 10 feet in height; bridging rows spaced not to exceed 5 feet on-center.

3.5 ERECTION (AXIAL LOAD-BEARING)

- A. Handling and lifting of prefabricated frame panels shall be done in a manner as to not cause distortion in any members.
- B. Tracks shall be securely anchored to the supporting structure as shown on the plans, and as designed and detailed on approved shop drawings.
- C. Complete uniform and level bearing support shall be provided for the bottom track.
- D. At track butt joints, abutting pieces of track shall be securely anchored to a common structural element or they shall be butt welded or spliced together,
- E. Studs shall be plumbed, aligned and securely attached to the flanges or webs of both upper and lower tracks.
- F. Framed wall openings shall include headers and supporting studs as shown on the plans, and as designed and detailed on approved shop drawings.
- G. Jack studs shall be installed above door heads and elsewhere to furnish support and shall be securely attached to supporting members.
- H. Temporary bracing shall be provided until erection is completed.
- I. Wall stud bridging shall be installed in a manner to provide resistance to both minor axis bending and rotation. Bridging rows shall be equally spaced not to exceed 4 feet on-center.
- J. Provide stud walls at locations indicated on plans as "sheer walls" for frame stability and lateral load resistance. Such stud walls shall be braced as indicated on plans and specifications.
- K. Splices in axially loaded studs are not be permitted.

3.6 TOLERANCES

- A. The following allowable installed tolerances are allowable variations from locations and dimensions indicated by the Contract Documents and shall not be added to allowable tolerances indicated for other work.
 - 1. Allowable variation from true plumb, Level, and Line: 1/8 inch in 20 feet.
 - 2. Allowable variation from true wall thickness: 1/8 inch in 20 feet.

3. Allowable variation from true plane of adjacent surfaces: 1/8 inch in 10 feet.

End of Section

Section 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this Section consists of miscellaneous metals, and ornamental iron where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.
- B. Furnish and install:
 - 1. Reinstallation of existing metal wall panels, steel corner guards at New Grinding booth in Welding & Metals Technology D325.
- C. Furnish the following items for installation under related sections:
 - 1. Anchors, bolts, inserts, and sleeves, required to attach miscellaneous metals for embedment into concrete under Section 03 30 00 - CAST-IN-PLACE CONCRETE.
 - 2. Loose steel lintels at door, window, ductwork and similar openings in interior masonry partitions; installed under Section 04 20 00 - UNIT MASONRY.
 - 3. Anchor bolts, with nuts and washers; inserts; and sleeves; required to attach miscellaneous metal items to masonry, for installation under Section 04 20 00 - UNIT MASONRY.
- D. Perform all drilling and cutting in miscellaneous metal items required for the attachment of other items.
- E. Perform all shop painting for all surfaces of exposed to view galvanized and non-galvanized metals, and post-erection touch-up of shop prime coat, using the same material as shop-prime coating.
- F. Perform application of liquid zinc touch-up to all welds of galvanized steel items furnished hereunder.
- G. No attempt is made in this Section to list all elements of miscellaneous metal required on this project or to describe how each element and component will be installed. It is the responsibility of the Filed subcontractor to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings.

1.2 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Subcontractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.3 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Installation of anchors into concrete, pouring concrete stair treads and landings.
- C. Section 04 20 00 - UNIT MASONRY: Building in of lintels into masonry walls.
- D. Section 05 40 00 – COLD FORMED METAL FRAMING: Framing systems for exterior partitions.
- E. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.
- F. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Non-loadbearing metal framing systems for interior partitions and ceilings.
- G. Section 09 91 00 - PAINTING: Applied finish coatings other than those specified herein.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM A 36 - Structural Steel.
 - 2. ASTM A 53 – Pipe, Steel, Black and Hot-Dipped, Zinc-coated, Welded and Seamless Steel Pipe.
 - 3. ASTM A 108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
 - 4. ASTM A 123 - Zinc Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
 - 5. ASTM A 153 - Zinc-Coating on Iron and Steel Hardware.
 - 6. ASTM A 167 - Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - 7. ASTM A 276 –Stainless and Heat- Resisting Steel Bars and Shapes.
 - 8. ASTM A 283 - Carbon Steel Plates, Shapes, and Bars.
 - 9. ASTM A 307 - Carbon Steel Externally Threaded Standard Fasteners.
 - 10. ASTM A312/A312M - Seamless and Welded Austenitic Stainless Steel Pipes
 - 11. ASTM A 325 - Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - 12. ASTM A 361 - Zinc Coated (Galvanized) Iron or Steel Roofing sheets.
 - 13. ASTM A 385 – Providing High Quality Zinc Coatings.

14. ASTM A 380 – Standard Practice for Cleaning, Descaling and Passivation of Stainless Steel Parts, Equipment and Systems.
15. ASTM A 386 - Zinc Coating on Assembled Steel Products.
16. ASTM A 446 - Zinc Coated (Galvanized) Steel Sheets of Structural Quality, Coils and Cut Lengths.
17. ASTM A 480 – General Requirements Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
18. ASTM A 500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
19. ASTM A 501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
20. ASTM A 525 - Specification for Sheet Steel, Zinc Coated (Galvanized).
21. ASTM A 575 Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
22. ASTM A576 Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
23. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
24. ASTM A 666 - Stainless and Heat Resisting Chromium-Nickel Steel Sheet Strip, Plate and Flat Bar for Structural and Architectural Applications.
25. ASTM A 780 – Repair of Hot-Dip Galvanizing.
26. ASTM A 967 – Chemical Passivation Treatments for Stainless Steel Parts.
27. ASTM A 992– Standard Specification for Structural Steel Shapes.
28. ASTM A1011/A1011M - Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
29. ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus.
30. ASTM F 593 - Stainless Steel Bolts, Hex Cap Screws.
31. ASTM F 594 - Stainless Steel Nuts.
32. AGAI - Inspection Manual for Hot-Dipped Galvanized Products.
33. American Iron and Steel Institute (AISI), "Specification for the Design of Cold-Formed Steel Structural Members".
34. Steel Deck Institute (SDI), "Design Manual for Composite Deck, Form Decks, and Roof Decks".
35. AISC - Code of Standard Practice for Steel Buildings and Bridges.
36. AISC - Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.
37. AWS - Standard Code for Arc and Gas Welding in Building Construction.
38. IPA (Industrial Perforators Association) - Voluntary Standard Tolerances.
39. MIL-P-21035B - Paint High Zinc Dust Content, Galvanizing Repair (Metric) (superseding DOD-P-21035A)
40. NAAMM, applicable publications.
41. SSPC referenced standards.

42. NAAMM publication AMP 500 – Metal Finishes Manual
43. NAAMM publication AMP 510 – Metal Stairs Manual.
44. NAAMM publication AMP 521 – Pipe Railing Manual
45. NAAMM publication AMP 555 – Code of Standard Practice for The Architectural Metal Industry.
46. NAAMM publication AMP 555 – Code of Standard Practice for The Architectural Metal Industry.
47. SSPC standards referenced herein, including:
 1. SSPC-SP1, Surface Preparation – Solvent Cleaning,
 2. SSPC-SP2, Surface Preparation – Hand Tool Cleaning.
 3. SSPC-SP3, Surface Preparation – Power Tool Cleaning
 4. SSPC-SP8, Surface Preparation - Pickling.
 5. SSPC-Paint 20, Zinc-Rich Coating (Type 1) Inorganic and (Type II) Organic.
 6. SSPC-Paint 29, Zinc Dust Sacrificial Primer Performance.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 1. Coordinate work of this Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
 2. Be responsible for establishing locations and levels for all work of this Section, except such parts as may be delivered to others and set by them. In such cases assist them in properly locating said parts.
- B. Pre-Installation Meetings: At least two weeks prior to commencing fabrication work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
 1. Required attendees: Architect, Contractor, Installer's Project Superintendent, and representatives of other related trades as directed by the Architect or Contractor.
 2. Agenda:
 1. Scheduling of metal fabrications operations.
 2. Review of staging and material storage locations.
 3. Coordination of work by other trades.
 4. Installation procedures for ancillary equipment.
 5. Protection of completed Work.
- C. Pre-installation meetings specified under related specifications:
 1. Installer of the Work of this Section is required to attend pre-installation conference specified under Section 04 20 00 – UNIT MASONRY
- D. Sequencing:

1. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Subcontract, have been received and approved by the Architect.
2. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.
3. Field Measurements
 1. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 2. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

E. Scheduling:

1. Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's complete product data and specifications for all prefabricated items, shop primer paints, liquid zinc coating, and hydraulic cements, to be furnished hereunder.
 1. For epoxy anchoring systems: Furnish ICC-ES Code approvals and performance data that includes recommended loading for each application.
 2. Shop Drawings, bearing registration stamp of a Professional Structural Engineer registered in Commonwealth of Massachusetts.
 1. General requirements:
 - 1) Include large scale details of items of all metal fabrications to be furnished hereunder, showing proposed methods of anchorage to surrounding structure and conditions.
 - 2) Indicate on the shop drawings all erection marks for various places of miscellaneous metals, and ensure that the actual field pieces bear corresponding marks.
 - 3) Indicate shop built components, and field-built components.
 - 4) Indicate and detail all field installation connections.
 - 5) Indicate weld types and length.
 - 6) Indicate blocking locations.
 2. Include large scale details of railings.
 3. Include large scale details of metal fabrications supporting work of other trades.
 3. Selection Samples:
 1. Sample card indicating Manufacturer's full range of colors of shop applied finishes available for selection by Architect.

4. Verification Samples: Accepted samples will be used to establish the quality standard for fabrication, workmanship and finish.
 1. Factory/shop finishes: 3 inch by 6 inch samples of factory-applied coatings and colors proposed for use for approval prior to coating application.
 2. Provide minimum 24 by 24 inch (or equivalent for shapes) of fabricated and finished ornamental metal components, demonstrating the quality of fabrication work, and finish.
 5. Certificates:
 1. Certificate of Compliance from Galvanizer: Submit notarized Certificate of Compliance with application for payment for galvanizing, signed by galvanizer, indicating compliance with requirements of specifications. Include scope of services provided, and quantity and itemized description of items processed.
 2. Welders certificates as specified under Article entitled "QUALITY ASSURANCE".
 6. Delegated Design Submittals: Provide calculations for loading and stresses for the work of this section, bearing the Professional Structural Engineer's seal. Show how design load requirements and other performance requirements as required by the Massachusetts State Building Code have been satisfied.
 1. Work scope requiring loading and stress calculations includes, but is not limited to the following:
 - 1) Railing and guard systems.
 - 2) Metal fabrications supporting work of other trades.
 - 3) Access ladders.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Special Inspections: Submit prior to request for Certificate of Occupancy, to both Architect and local Building Official having jurisdiction, the following:
 1. All certifications, reports and programs required by Chapter 17 of the Massachusetts State Building code for work engineered by Subcontractor's Professional Engineer under the requirements of this Section.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
1. Galvanizer's tagging: The galvanizer shall mark all lots of material with a clearly visible stamp or tag indicating the name of the galvanizer, the weight of the zinc coating, and the applicable ASTM Specification Numbers.
- B. Qualifications:
1. Welders: Utilize only qualified welders employed on the Work. Submit verification that Welder's are AWS D1.1 and D1.4 qualified within the previous 12 months.
 2. Licensed Professionals: Provide the services of a Professional Structural Engineer, registered in the Commonwealth of Massachusetts to design and

certify that the work of this section meets or exceeds the performance requirements specified in this section and as required by Massachusetts State Building Code.

1. Prepare Shop Drawings for under direct supervision of a same Engineer experienced in design of this work.

1.8 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed subcontract, have been received and approved by the Architect.

B. Storage and Handling Requirements:

1. Handle and store materials under cover in a manner to prevent defacement, deformation, or other damage to the materials and to shop finishes, and to prevent the accumulation of foreign matter on the metal work. All such work shall be repaired and cleaned prior to erection.

1.9 WARRANTIES

- ##### A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

PART 2 - PRODUCTS

2.1 MATERIALS

- ##### A. General: All materials shall be new stock, free from defects impairing strength, durability or appearance, and of best commercial quality for each intended purpose. Unless specifically called for otherwise, work shall be fabricated from the following:
1. Steel shapes, plates and bars: ASTM Designation A 36.
 2. Steel shapes, wide flange beams: ASTM A 992.
 3. Steel pipe: ASTM A 53, Grade A, seamless pipe, black finish unless otherwise noted.
 4. Cold-finished steel bars: ASTM A 108.
 5. Steel plates to be bent or cold-formed: ASTM A 283, Grade C.
 6. Stainless steel pipe: ASTM A 312/A 312M, Grade TP304.
 7. Structural steel tubing, square and rectangular shapes: ASTM A500, Grade B.
 8. Steel tubular shapes: ASTM A 501.
 9. Galvanized carbon steel sheets: ASTM A 526, with G90 zinc coating in accordance with ASTM A 525.
 10. Stainless steel tubing: ASTM A 554, Grade MT304.
 11. Stainless steel castings: ASTM A743, Grade CF 8 or CF 20.
- ##### B. Recycled content of Ferrous Metals: Use maximum available percentage of recycled steel. Steel incorporated into the work shall contain not less than 25 percent of recycled steel.

- C. Steel materials: to be hot dip-galvanized: Provide steel chemically suitable for metal coatings complying with the following requirements: Carbon below 0.25 percent, silicon below 0.24 percent, phosphorous below 0.05 percent, and manganese below 1.35 percent. Notify galvanizer if steel does not comply with these requirements to determine suitability for processing.
- D. Metal surfaces, general: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
- E. Welding rods: AWS E70XX grade, or select in accordance with AWS specifications for the metal alloy to be welded and in accordance with the recommendation of the welding rod manufacturer.
 - 1. Where stainless steel is welded to mild steel, select rods to minimize dilution effects on the stainless steel component.

2.2 FASTENERS

- A. General: Provide all fasteners and attachments as required for work specified herein and as indicated on the Drawings.
 - 1. In general,
 - 1. Provide all fasteners and attachments of the same material and finish as the metal to which it is applied unless otherwise noted.
 - 1) Provide Type 304 stainless-steel fasteners for exterior use.
- B. Steel Bolts, Nuts and Washers: ASTM A307, galvanized to ASTM A153 for galvanized components.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel Type 304 bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- D. Anchor Bolts: ASTM F 1554, Grade 36.
 - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- E. Eyebolts: ASTM A 489.
- F. Machine Screws: ASME B18.6.3.
- G. Lag Bolts: ASME B18.2.1.
- H. Wood Screws: Flat head, ASME B18.6.1.
- I. Plain Washers: Round, ASME B18.22.1.
- J. Lock Washers: Helical, spring type, ASME B18.21.1

2.3 ACCESSORIES

- A. Adhesive for attaching anchors and for direct pinning: high-modulus, high strength, moisture tolerant, epoxy adhesive, two-component 100 percent solids, epoxy resin complying with ASTM C 881.
 - 1. Minimum performance properties (as cured at 70 degrees F. and 50 percent relative humidity):
 - 1. Minimum Compressive Strength, tested per ASTM D-695:
 - 1) at 3 days: 11300 psi (31.0 MPa).
 - 2) at 7 days: 11800 psi (44.8 MPa).
 - 3) at 28 days: 12200 psi (58.6 MPa).
 - 2. Shear Strength, tested per ASTM D-732 at 14 days: 6200 psi (43 MPa)
 - 3. Minimum Flexural Strength tested per ASTM D-790 at 14 days: 10700 psi (74 MPa).
 - 4. Minimum Bond Strength tested per ASTM C-882 at 14 days:
 - 1) Plastic Concrete to Hardened Concrete 2200 psi (13.8 Mpa).
 - 2) Plastic Concrete to Steel 2000 psi (13.8Mpa).
 - 5. Maximum Water Absorption, tested per ASTM D-570: 24 hour 0.27%
 - 6. Minimum Tensile properties tested per ASTM D-638: Tensile Strength 6900 psi (48 Mpa).
 - 2. Products which may be considered as equal include the following, or approved equal:
 - 1. Sika Corporation, Lyndhurst NJ, product: "Sikadur 32 Hi-Mod Gel.
 - 2. Simpson Strong Tie, Pleasanton, CA, product "SET High Strength Epoxy".
 - 3. Symons Corporation, Des Plaines, IL, product "Rescon Gel anchor 304".
- B. Grout: Ready mixed, non-metallic high-strength controlled expansion grout of flowable consistency, conforming to ASTM C 1107 with minimum compressive strength of 8,000 pounds per square inch (55.2 MPa) at 28 days.
 - 1. Products which may be considered as equal include the following, or approved equal:
 - 1. Five Star Products, Inc., Fairfield CT, product "Five Star Grout."
 - 2. L&M Construction Chemicals, Omaha NE, Product: "Crystex."
 - 3. BASF Construction Chemicals, Cleveland, OH, product "Masterflow 713".
 - 4. Sika Corporation, Lyndhurst, NJ, product "SikaGrout 212".
 - 5. ChemMasters, Madison, OH, product "Conset".
- C. Metal paste filler: 2 component epoxy, high strength, structural adhesive putty:
 - 1. Products which may be considered as equal include the following, or approved equal:
 - 1. Abatron, Inc. Gilberts IL, product: "Ferrobond-P".
 - 2. Dynatron/Bondo Corp., Atlanta, GA, product: "Bondo Plastic Filler".
 - 3. U.S. Chemical & Plastics Company., Massillon OH, product "Metal filled epoxy".

- D. Liquid zinc coating, for touch-up of welds, scratches, and abrasions in galvanized steel: Low VOC organic zinc-rich coating containing 92% metallic zinc, by weight in the dried film (ASTM D520, Type III) and conforming to SSPC Paint 20, Type II, Level 1. Liquid zinc coating shall be recognized under the Component Program of Underwriter's Laboratories, Inc. as an equivalent to hot-dip galvanizing; conforming to MIL-P-21035B and SSPC Paint 29, Type II, Level I, for repair of hot-dip galvanizing and meeting the requirements for Zinc-Rich Paints.
 - 1. VOC limit: not more than 250 g/L.
 - 2. Specified manufacturer and product: ZRC Worldwide, Marshfield MA, product "ZRC-221".
- E. Primer for non-galvanized steel surfaces, modified alkyd rust-inhibitive, high solids primer:
 - 1. Products which may be considered as equal include the following, or approved equal:
 - 1. Benjamin Moore product: "Metal Primer KP14-70", Gray Primer.
 - 2. Rust-Oleum: 6100, Gray Primer.
 - 3. Sherwin Williams: Kem Flash 500 Primer, Gray Primer E61A750.
 - 4. Tnemec: V10-1009 Gray Primer.

2.4 SCAFFOLDS AND STAGING

- A. General: Subcontractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 - 1. Scaffolding and staging required for use by this Subcontractor pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-Trade requiring such scaffolding.
 - 2. Each Subcontractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed Subcontractor.
 - 4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each workday to prohibit access to the scaffolding by unauthorized individuals.

2.5 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed subcontractor shall be furnished, installed, operated and maintained in safe conditions by this Subcontractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

2.6 FABRICATION - GENERAL

- A. Metal surfaces shall be clean and free from mill scale, flake, rust and rust pitting; well formed and finished to shape and size, true to details with straight, sharp lines, and angles and smooth surfaces. Curved work shall be to true radii. Exposed sheared edges shall be eased.
- B. Shop fabricate items wherever practicable, accurately fitting all parts and making all joints tight. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- C. Do all cutting, punching, drilling, and tapping required for attachment of anchor bolts and other hardware and for attachment of work by other trades. All such work shall be done prior to hot-dip galvanizing of the various components.
- D. Grind all edges of bars and plates completely free from nicks and machine marks, prior to galvanizing and/or shop priming.
- E. Grind all exposed-to-view welds completely smooth and flush to the surface plane of the base metals. Perform welding work prior to galvanizing in all cases, except where field welding is necessary, in which case, completely coat all such welds with two coats of specified liquid zinc coating, after performing grinding operations.
 - 1. Finish welds on exposed to view components to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- F. Use screws and bolts only where welding cannot be performed, of sufficient size to ensure against loosening from normal usage of miscellaneous metal items furnished hereunder.
 - 1. Countersink all screw heads and bolt heads as far as practicable. Use not less than two screw, bolts, or other anchorage items, at each connection point.
 - 2. Draw up all threaded connections tightly, after buttering same with pipe joint compound, to exclude water.
- G. Provision for Thermal Movement: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Design, fabricate and install for temperature change range of 120 degrees F, ambient temperature and 180 degrees F, material surfaces.
- H. Carefully coordinate the installation of metal fabrications with the work of trades responsible for the installation of interfacing work, and for the installation of work into the various assemblies furnished hereunder, and permit the installation of the related materials to be made at the appropriate times.
- I. Fit and assemble metal fabrications in largest practical sections for delivery to site, ready for installation.
 - 1. Galvanized assemblies: Where size of assembly is too large for galvanizing kettle, galvanize components prior to fabrication and assemble after galvanizing.

2.7 FABRICATION - STAINLESS STEEL FABRICATIONS

- A. Weld and form edges, ends, and joints, by electric process, with all welded joints ground and polished smooth. Perform all welding so that no mark of any kind shall be noticed on the finished surfaces. Welds and adjoining components shall be homogenous, non-porous, free from pits, cracks, imperfections, or discoloration.
 - 1. Hammer and peen flush with adjoining surface wherever materials have been depressed or sunken by a welding operation, and, if necessary, re-weld and grind to eliminate low spots.
 - 2. Excessive distortions caused by welding will not be acceptable and shall be cause for rejection and removal from Project Site.

2.8 FINISHES - HOT-DIP GALVANIZING

- A. Surface preparation prior to galvanizing: Pickle steel prior to galvanizing in conformance with SSPC-SP8. Remove all rust, dirt, weld flux, weld spatter, and other foreign matter.
- B. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.
 - 1. Basis-of-Design: "Duncan Galvanizing, Everett, MA, product "Duragalv."
 - 2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for bolts, nuts, washers, and other rough hardware. Provide thickness of galvanizing specified in referenced standards.
 - 3. Wherever possible, perform galvanizing after assembly of items.
 - 4. Galvanized items shall be straightened to remove all warpage and distortion caused by the galvanization process.
 - 5. Fill vent holes after galvanizing (if applicable), and grind smooth.
 - 6. Touch-up all breaks on hot-dip surfaces caused by cutting, welding, drilling or undue abrasion with liquid zinc coating as specified herein above. Apply liquid zinc by brush or spray on all damaged areas in two coats to a total dry film thickness of not less than 3 mils. Apply first coat within two hours after damage to hot-dip film to prevent undue oxidation of exposed surface. On all welds remove weld spatter by power wire brushing or equivalent before applying liquid zinc coating. Repair material should extend at least 3 inches beyond all edges of the damaged galvanized area as possible to assure continuity of galvanic protection.
 - 7. Touch-up of galvanized surfaces with aerosol spray, silver paint, bright paint, brite paint, or aluminum paints is not acceptable.

2.9 FINISHES - SHOP APPLIED COATINGS

- A. Schedule: Shop applied coatings as indicated on Drawings, and as additionally specified and scheduled in this Section.
- B. For non-galvanized steel surfaces:
 - 1. Surface preparation prior to priming: Thoroughly clean all steel of all loose mill scale by power wire brushing or sandblasting. Remove all rust, dirt, weld flux, weld spatter, and other foreign matter by wire brushing or scraping (power wire-brushing, if necessary). Grind smooth any sharp projections.

2. Shop apply specified primers thoroughly and evenly on the surfaces and worked into the joints and other open areas on the surfaces. Surfaces inaccessible after assembly shall be given two coats. Dry film thickness of primer shall be not less than 2.4 mils per coat.
- C. For hot-dipped galvanized steel items scheduled for shop applied coating:
1. Touch-up all breaks on hot-dip surfaces caused by cutting, welding, drilling or undue abrasion with liquid zinc coating as specified above under the Article entitled "Hot Dip Galvanizing", herein above.
 2. Finish: Provide factory-applied architectural coating over hot-dip galvanized steel matching approved samples.
 1. Basis-of-Design: Duncan Galvanizing, Everett, MA, product "Colorgalv 10".
 2. Primer coat shall be factory-applied. Apply primer within 12 hours after galvanizing and within 3 hours of surface preparation at the same facility where the galvanizing is done in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Primer must meet or exceed the criteria for the following categories as stipulated by the coatings manufacturer:
 - 1) Abrasion Resistance: ASTM D4060 (CS17 Wheel, 1,000 grams load) 1kg load, 200 mg loss.
 - 2) Adhesion: ASTM D4541, 1050 psi.
 - 3) Corrosion Weathering: ASTM D5894, 13 cycles, 4,368 hours; rating 10 per ASTM D714 for blistering and rating 7 per ASTM D610 for rusting.
 - 4) Direct Impact Resistance: ASTM D2794, 160 in. lbs.
 - 5) Flexibility: Method: ASTM D522, 180 degree bend, 1 inch mandrel, passes.
 - 6) Pencil Hardness: ASTM D3363, 3B.
 - 7) Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 2000 hours; passes, no cracking or delamination.
 - 8) Dry Heat Resistance: Method: ASTM D2485, 250 degrees F.
 3. Finish coat shall be factory-applied high performance architectural finish. Apply finish coating at the galvanizer's plant, in a controlled environment meeting applicable environmental regulations and as recommended by the finish coating manufacturer. Finish must meet or exceed the criteria for the following categories as stipulated by the coatings manufacturer:
 - 1) Abrasion Resistance: ASTM D 4060, CS17 Wheel, 1,000 cycles 1kg load, 87.1 mg loss.
 - 2) Adhesion: ASTM D4541, 1050 psi.
 - 3) Direct Impact Resistance: ASTM D2794, greater than 28 in. pounds.
 - 4) Indirect Impact Resistance: ASTM D2794, 12-14 in. pounds.
 - 5) Dry Heat Resistance: ASTM D2485, 200 degrees F.
 - 6) Salt Fog Resistance: ASTM B117 9,000 hours, rating 10 per ASTM D714 for blistering.
 - 7) Flexibility: ASTM D522, 180 degree bend, 1/8 inch mandrel, passes.
 - 8) Pencil Hardness: ASTM D3363, 2H.

- 9) Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 1000 hours, no blistering or delamination.
- 10) Xenon Arc Test: ASTM D 4798, pass 300 hours.
4. Coatings shall be certified VOC compliant and conform to applicable regulations and EPA standards. Apply the galvanizing, primer and coating within the same facility and provide single-source responsibility for galvanizing, priming and finish coating. Blast cleaning of the galvanized surface is not acceptable.
3. Engage the services of a galvanizing facility which will assume single-source responsibility for galvanizing and finish coating.
 1. Touch-up finish in conformance with manufacturer's recommendations. Provide touch-up such that repair is not visible from a distance of 6 feet.
- D. Field touch-up: Shall be the responsibility of the installing contractor and shall include the filling, and touch-up of exposed job made bolt or screw holes, refinishing of raw surfaces resulting from job fitting, repair of job inflicted scratches and marks, and final cleaning up of the finished surfaces.
 1. Touch-up finishes shall be fully compatible with, and exactly match shop applied finish, color, texture and sheen.

PART 3 - EXECUTION

3.1 ERECTION - GENERAL

- A. General: Accurately set all work to established lines and elevations, and rigidly fasten in place with suitable attachments to the construction of the building. At the completion of the work, check all work, re-adjust as required, and leave in perfect condition. Grind all exposed to view welds smooth to the touch.
- B. Setting bearing and leveling plates:
 1. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
 2. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- C. Miscellaneous framing and supports: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and additional requirements indicated on Shop Drawings.
 1. Anchor supports for operable partitions, and similar products, securely to and rigidly braced to building structure.

3.2 FIELD WELDING

- A. Field weld components indicated on approved shop drawings in accordance with AWS D1.1. Weld profile, quality, and finish shall be consistent with approved samples and mock-ups.
 - 1. Welds ground smooth: For groove welds, the weld shall be made flush to the surfaces of each side and be within + 1/16", -0" of plate thickness.
 - 2. Contouring and blending of welds: Where fillet welds are indicated to be ground contoured, or blended, oversize welds as required; grind to provide a smooth transition and to match profile on approved mockup.
 - 3. Continuous Welds: Where noted on the drawings, provide continuous welds of a uniform size and profile.
 - 4. Minimize Weld Show Through: At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material.
- B. Immediately after welding, touch-up welds, burned areas and damaged surface coatings.
 - 1. Thoroughly remove all spatter by power wire-brushing (or if inaccessible, wire brushing) per SSPC, surface preparation specification SP2 or SP3. Allow surface to cool to ambient temperature. Clean surface with solvent wipe to remove oils, grease and dirt in accordance with SSPC surface preparation specification SP1.
 - 2. Apply one coat of liquid zinc to attain a minimum of 1.5 mils dry film thickness. Coating should extend at least two inches beyond either side of weldment to ensure complete coverage of welded area.

3.3 FIELD BOLTING

- A. Accurately drive all bolts into holes, protecting the bolt heads so as not to damage the thread during the driving. Ensure that bolt heads and nuts rest squarely against the metal. Where structural members have sloping flange faces, provide approved beveled washers at the bolted connections to afford square seating for bolt heads or nuts. Nick bolt threads for unfinished bolts to prevent the nuts from backing off.
 - 1. Bolt Head Orientation: All bolt heads shall be oriented as indicated on the contract documents. Where bolt-head alignment is specified, the orientation shall be noted for each connection on the erection drawings. Where not noted, the bolt heads in a given connection shall be oriented to one side.
- B. Use an approved calibrated manual or power torque wrench to obtain the proper torque and tension as recommended by the bolt manufacturer for all ASTM A 325 bolts.

3.4 TOUCH-UP

- A. Touch-up all welds, burned areas, scratches, abrasions, on galvanized metals, using specified liquid zinc coating.
- B. Touch-up all welds, scratches, abrasions, and other surface damaged on shop-primed or painted metals, using the same coatings as specified under shop applied finishes, herein above.

3.5 SUPPLEMENTAL SCHEDULES

- A. General: Items listed herein below provide further description of those already indicated in the Drawings. This list does not represent a complete list of miscellaneous metal components or types required to complete the Work.
 - 1. Carefully review all Drawings and furnish and install metal fabrications required by the various trades, whether or not specifically listed herein, such as miscellaneous clip angles, miscellaneous steel bracketing, and other miscellaneous metal items as indicated on the Drawings, reasonably implied therefrom, or reasonably necessary for the thorough completion of the work.
- B. Lintels: As scheduled on Structural Drawings.
 - 1. Provide lintels 12 inches longer than masonry openings. Where lintel abuts column, provide structural clip connection.
 - 2. Lintels occurring in exterior walls shall be galvanized in conformance with the requirements of ASTM A 143, and ASTM A 123.
- C. Beam penetration core drilling and reinforcements:
 - 1. Required at locations where penetration is a minimum of two inches in diameter.
 - 2. Drilling and reinforcement as indicated on structural drawing details.

End of Section

Section 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this Section consists of rough carpentry where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.
- B. Furnish and install the following:
 - 1. Fire retardant treated plywood backer panels for mounting of electrical panelboards, telephone/data backboards, HVAC and fire control equipment and other equipment.
 - 2. Various wood blockings, edgings, nailers, curbs, cants, grounds, furring, sheathing, framing members including wood preservative or fire-retardant treated as indicated, for receipt of various finishes and surfacing materials, not described herein above.
 - a. Blocking at roof drains (not pressure treated).
 - b. Blocking at pipe/curb penetrations through roof (not pressure treated).
 - c. Blocking at Roof edge (pressure treated where in contact with masonry).
 - d. Plywood wall covering at electrical rooms, Night Life Storage D327, and Tool Crib D326.
 - e. CDX-EXT plywood.
 - f. Wood blocking at jamb, head, sills of all entrance aluminum framed curtainwall, hollow metal doors; interior window trim (the blocking associated with the windows is under the window and demolition contract) not pressure treated unless in contact with masonry, concrete or ground.
 - g. Door hold-open devices, all wall door stops, all hardware and other attached items.
 - h. Blocking for all specialty items such as millwork, cabinets, welding booths, accessories, lockers, recessed display enclosures, and all other in-wall blocking required for other trades.
 - 1) Blocking for items, including but not limited to, toilet accessories that are furnished by Owner and installed by Contractor.
 - 2) Blocking for furniture, fixtures, and equipment that require attachment to a wall.
 - i. Refer to Drawings for locations of fire-retardant treated wood blocking and plywood.
 - 3. Fire-retardant treated wood framing and plywood top at curb beneath metal lockers.
 - 4. Multi-panel metal welding booth systems with fume extraction arms, safety welding curtains, welding machine support shelves, and all associated support hardware and brackets in the quantities and configurations shown on the drawings.
 - 5. Rough installation hardware, including bolts, screws, spikes, nails, clips, and connection assemblies, as needed for installation of the rough carpentry work.

- 6. High-impact surface mounted vinyl corner guards and retainer clips.
- C. Install the following furnished under the designated Sections:
 - 1. Metal door frames furnished under Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES.
 - a. Place frames and erect in correct positions within specified tolerances. Additionally provide temporary bracing at locations where frames are indicated to be built-into masonry.
 - 2. Concealed anchorage devices for handicap handrails in toilet rooms: Section 10 28 13 - TOILET ACCESSORIES.
- D. Furnish the following for installation by others:
 - 1. PT plywood at perimeter of HVAC units where indicated on the drawings, installed by Section 07 53 23 – EPDM ROOFING.
- E. Coordinate work of this Section with the work of the various trades responsible for applying finish materials and other items to rough carpentry work. Furnish and install furring, blocking, and shims, and other usual items of normal rough carpentry work as required by the various trades for the proper completion of the project.
 - 1. The applicable requirements specified in Part 1 - GENERAL and Part 3 - EXECUTION of the individual specification sections furnishing materials to be installed under this Section, shall be included in and made a part of this Section.
- F. No attempt is made in this Section to list all elements of rough carpentry required on this project or to describe how each element will be installed. It is the responsibility of the Contractor to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings.

1.2 RELATED REQUIREMENTS

- A. Section 01 22 00 - UNIT PRICES: Administrative and procedural requirements for unit prices.
- B. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- C. Section 04 20 00 - UNIT MASONRY: Building-into masonry hollow metal door frames, placed and braced under this Section 06 10 00 - ROUGH CARPENTRY.
- D. Section 05 50 00 – METAL FABRICATIONS: blocking for attachments.
- E. Section 06 20 00 - FINISH CARPENTRY: Wood interior and exterior trim.
- F. Section 06 40 00 - ARCHITECTURAL WOODWORK: Solid surface counters and support brackets.
- G. Section 07 21 00 - THERMAL INSULATION: Thermal insulation between framing, and vapor barrier.
- H. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing hollow metal framing.

- I. Section 09 05 06 – COMMON WORK RESULTS FOR FLOORING: Cement-based underlayment applied over plywood subfloor.
- J. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal framing for drywall construction work.
- K. Section 09 29 00 - GYPSUM BOARD: Wallboard construction work, having taped and compounded joint finish. Cement board underlayment and backer board work.
- L. Section 09 30 13 – CERAMIC TILING: Requirements for preparation of subfloor.
- M. Section 09 00 06 – RESILIENT FLOORING: Requirements for preparation of subfloor.
- N. Section 09 91 00 - PAINTING: Applied primer and finish coatings to exposed to view rough carpentry work.
- O. Section 10 28 13 - TOILET ACCESSORIES: Providing anchorage devices and mounting templates for toilet accessories.
- P. Section 10 51 13 – METAL LOCKERS: Providing and installing metal locker units.
- Q. Section 12 24 00 – WINDOW SHADES: Providing and installing mechanical roller shades and blinds.
- R. Section 12 30 00 - CASEWORK: Providing and installing manufactured plywood cabinets and counters
- S. Division 22 – Plumbing: Providing and installing of wall mounted valve assemblies.
- T. Division 23 – HVAC: Providing and installing of wall mounted control panels.
- U. Division 26 - ELECTRICAL: Providing and mounting electrical panels and equipment.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. APA - applicable grades and specifications.
 - 2. APA PRB-108 Performance Standards and Policies for Structural-Use Panels.
 - 3. ANSI A250.11 (formerly SDI 105) - Recommended Erection Instructions for Steel Doors and Frames.
 - 4. ASTM D 3201 - Test Method for Hygroscopic Properties of Fire-Retardant Wood.
 - 5. AWPA Standards and references for preservative treated wood including Standards UC1, UC2, UC3A, UC3B, UC4A, and P5
 - 6. AWPA Standard UCFA – Fire Protection as Required by Codes Above Ground Interior Construction.
 - 7. AWPA Standard UCFB – Fire Protection as Required by Codes Above Ground Exterior Construction.
 - 8. AWPA M4 – Care Of Preservative Treated Wood Products.
 - 9. FSC (Forest Stewardship Council): “FSC Certification Program”

10. NER-643: ACQ Preserve® and ACQ Preserve Plus® Wood Preservative Treatment, ICBO Evaluation Service.
11. MIL L-1914OE - Lumber and Plywood, Fire Retardant Treated.
12. PS-56 - Structural Glued Laminated Timber.
13. SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
14. SPIB Grading Rules, current edition.
15. UL - Building Materials Directory
16. US. Department of Commerce Voluntary Product Standard PS1 for Construction and Industrial Plywood.
17. US. Department of Commerce Voluntary Product Standard PS2 for Wood-Based Structural-Use Panels.
18. US. Department of Commerce Voluntary Product Standard PS-20 - American Softwood Lumber Standard.
19. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber
20. American Lumber Standards Committee, National Lumber Grades Authority for Canadian Lumber, and applicable grading rules and standards of the various lumber associations whose species are being used for grades specified.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work of this Section with the respective trades responsible for locating anchorages installed into blocking which is provided under this Section.
2. Coordinate work of this Section with the work of the various trades responsible for applying finish materials and other items to rough carpentry work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for products specified herein.
2. Certifications:
 - a. Written certification from the respective treatment plants indicating types of wood preservative treatment and fire-retardant treatment used, treatments method, applications instructions, and conformance to the requirements specified herein.
 - 1) Provide certification that fire retardant treatment materials do not contain ammonium phosphate.
 - 2) Provide report from ICC Evaluation Service on fire retardant treated wood flame spreading, strength, corrosion, and hygroscopic properties.

- 3) Provide report from ICC Evaluation Service on pressure preservative treated wood strength, corrosion, anti-fungi, and anti-insect properties.
- b. Urea-formaldehyde Resins: Written documentation certifying that all composite wood and agrifiber products used on this Project contain no added urea-formaldehyde.
 - 1) Written certification from Millworker, that only "no added urea-formaldehyde" manufactured composite panel products are incorporated into the Work, including all concealed components. Composite panel products include but are not limited to particle board (PB), Medium Density Fiberboard (MDF) and similar manufactured products.
 - 2) Written certification from Millworker that laminating adhesives used in product fabrication on or off site do not contain any added urea-formaldehyde resins.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
 1. All lumber shall:
 - a. Be new, dressed four sides (S4S), clear and free from warping and other defects.
 - b. Have a moisture content not exceeding 19 percent when delivered to the project.
 - c. Be in accordance with the grading rules of the lumber manufacturer's association under whose jurisdiction the lumber is produced and bear the mark of grade and mill identification.
- B. Certifications:
 1. Plywood: Conform to the requirements of Product Standard PS-1, and bear applicable APA grade trademarks.
 - a. Plywood for electrical boards treated for retardance, meet Class I or a flame spread rating of 25 or less and bear U.L. label "Classified FRS".

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
- B. Store all materials in an elevated dry location, protected by waterproof coverings.

1.8 WARRANTIES

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. This is a phased occupied project; refer to Division 1 specifications for more details. The parts and labor warranty period for all material and equipment installed under this contract shall commence upon substantial completion of the final phase of the building project scheduled to be in August of 2016. Equipment installed under previous phases must be maintained and serviced by the contractor throughout the project up until owner acceptance or Substantial Completion,

whichever comes last. Service intervals shall be as recommended by the various equipment manufacturers with all maintenance materials included.

PART 2 - PRODUCTS

2.1 BOARD AND SHEET MATERIALS

- A. Lumber for blocking, nailers and curbs as indicated or required: Hem-Fir, Douglas Fir, Eastern Spruce, Eastern Hemlock, or Southern Pine, surfaced dried stud or utility grade. Wood members shall be of sizes indicated on the Drawings or of the same size as the members being braced.
 - 1. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
 - 2. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
- B. Furring: Nominal 1 by 3 inches or 1 by 4 inches Douglas Fir, Eastern Spruce, Eastern Hemlock, or Southern Pine, surfaced dried construction grade.
- C. Plywood and sheet products:
 - 1. For substrate beneath gypsum board: Square edge APA graded C-D-X EXT, touch-sanded, 1/2 inch thick, fire retardant treated (FRT), except as otherwise indicated on the Drawings
 - 2. For electric panel board mountings and similar uses: APA graded B-D INT, Group 2 species, touch-sanded, fire-retardant treated, 3/4 inch thick, except as otherwise indicated on the Drawings.
 - 3. For unspecified interior concealed from view locations: APA graded C-D PLUGGED INT, Group 2 species, thickness as indicated on the Drawings.

2.2 WOOD TREATMENTS

- A. Treated wood products shall be produced by a single treatment plant, fully licensed by the chemical manufacturers, and conforming to the requirements specified herein.
 - 1. Toxicity and Environmental Quality:
 - a. Products containing chromium will not be permitted.
 - b. Products containing arsenic will not be permitted.
 - c. Fire-retardant-treated wood products shall be free of halogens, sulfates, ammonium phosphate and formaldehyde.
 - 2. Dye wood or otherwise color code all treated wood at treatment plant to clearly distinguish the different treatments in the field.
 - 3. Kiln dry all treated lumber and plywood to the following maximum moisture content after treatment.
 - a. Lumber: 19 percent.
 - b. Plywood 15 percent.
 - c. Discard pieces with defects which might impair quality of work.
 - 4. Quality marks: Each piece of lumber and plywood shall be permanently affixed with a quality mark, containing the following information:

- a. Identification of the inspection agency.
 - b. Standard to which material was treated.
 - c. Identification of the treating plant.
 - d. Fire retardant treated wood shall include: stamp signifying a FR-S rating
 - e. Preservative treated wood shall include: Retention and end use for which product is suitable.
- B. Fire retardant treated wood. Designated as "FRT"
- 1. Chemical Manufacturer: Subject to compliance with the requirements specified herein, Products which may be incorporated in the work include:
 - a. Arch Wood Protection, Atlanta, GA., product, "Dricon FRT Wood".
 - b. Osmose, Inc., Griffin GA., product "FirePro".
 - c. Hoover Treated Wood Products, Inc., Thomson, GA product "PyroGuard".
 - d. Viance, LLC., Charlotte, NC, product: "D-Blaze FRT".
 - 2. Fire retardant treated wood shall comply with the following requirements:
 - a. All fire-retardant lumber and plywood must have an Underwriters Laboratories stamp signifying a FR-S rating certifying a 25 or less flame spread and smoke developed value, when tested in accordance to ASTM E-84, or UBC Standard No. 42-1.
 - b. Corrosion rates: Less than one mil per year for carbon steel, galvanized steel, aluminum, copper and red brass in contact with the fire retardant treated wood when tested in accordance with Federal Specification MIL-L-19140E Paragraph 4.6.5.2.
 - c. The fire retardant treated wood must have an equilibrium moisture content of not more than 25 percent when tested in accordance with ASTM D 3201 procedures at 95 percent relative humidity and 80 degrees Fahrenheit.
 - d. Fire retardant chemical: Registered for use as a wood preservative by the U.S. Environmental Protection Agency.
 - e. Testing: Fire performance and strength properties for both lumber and plywood, of the fire retardant treated wood shall be recognized by issuance of a ICC Evaluation Service Report. Fire retardant chemical must not damage the middle lamella of the wood structure when exposed to 170 degrees Fahrenheit and 90 percent relative humidity for 23 days.
- C. Pressure preservative treated wood. Designated as "PT"
- 1. Chemical Manufacturer: Subject to compliance with the requirements specified herein, Products which may be incorporated in the work include:
 - a. Osmose, Inc., Griffin GA., product "NatureWood".
 - b. Universal Forest Products, Inc., Grand Rapids MI., product "ProWood ACQ".
 - c. Viance, LLC., Charlotte, NC., product "Preserve"
 - 2. Treatment: Ammoniacal Copper Quaternary Compound (ACQ), arsenic-free and chromium-free chemical "ACQ Preservative" in accordance with AWPA

Standards. Apply the preservative in a closed cylinder by pressure process in accordance with AWPAC Standard C15.

- a. Minimum preservative retention for floor plates, framing, lumber and plywood above ground use: 0.25 pounds per cubic foot (4.0 kg/m³) of ACQ chemical, in accordance with AWPAC UC1, UC2, UC3A, and UC3B, or NER-643 as appropriate.
 - b. Minimum preservative retention for framing, lumber and plywood in contact with water, ground, concrete and masonry: 0.40 pounds per cubic foot (6.4 kg/m³) of ACQ chemical, in accordance with AWPAC UC4A, UC4B, UC4C, or NER-643 as appropriate.
 - c. Minimum preservative retention for lumber and plywood in permanent wood foundations: 0.60 pounds per cubic foot (9.6 kg/m³) of ACQ chemical, in accordance with AWPAC UC4B, or NER-643.
3. Fixation of Chemical: Treated wood shall not be shipped from treatment plant until fixation of the preservative has occurred in the wood.

2.3 MULTI-PANEL METAL WELDING BOOTH SYSTEM

- A. 4-foot x 4-foot x 8-foot tall, prefinished metal framed welding stations with sheet metal side and back panels, walk-in front, sliding safety curtain, fully articulating fume extraction arm, and welding machine support shelf. Side and back panels shall extend to within 12-inches of the floor. Side panels shall share frames where possible. Framing connections shall be welded where possible and bolted connections will be allowed as required for shipping.
 1. Metal Frame: prefinished 13-gauge, 2-inch square tubing, adjustable feet for levelling.
 2. Siding and Back Panels: 12-gauge sheet metal
 3. Finish: Powder coat, color as selected by architect from manufacturer's standard colors.
 4. Sliding Safety Curtain:
 - a. Strip Width: 6"
 - b. Overlap: 67%
 - c. Color: Welding Amber (ultra-light and blue light radiation filtering)
 - d. Mounting: steel grommet reinforced holes, stainless steel curtain rings, rod fastened to booth frame
 5. Fume Extraction Arms: Fully articulated with 360-degree movement and self-hold in place at any position
 - a. Arm Diameter: 6-inches
 - b. Arm Length: 5 feet
 - c. Hood Diameter: 13-inches
 - d. Construction: metal
 - e. Mounting bracket: metal, by arm manufacturer
 - f. Connection to building exhaust system by Section 23 00 00
 6. Welding Machine Support Shelf:
 - a. Construction: 12-gauge steel
 - b. Size: 14-inches wide x 26-inches long

- c. Mounting: field bolted to welding booth frame at height indicated on drawings.
- 7. Manufacturers:
 - a. Basis of Design: Air Cleaning Specialties, 11088 Gravois Court, Saint Louis, MO 63128 Inc., Fumextractors, FX-WB-Custom with FX-TA-0605, 11088 Gravois Court, Saint Louis, MO 63128
 - b. Acceptable Substitutions:
 - 1) IAP- AirProducts, 580 Technology Drive, Sparta, TN 38583, (888)372-0050
 - 2) Approved equal

2.4 HIGH-IMPACT SURFACE MOUNTED CORNER GUARDS

- A. Corner guard system for wall protection.
- B. Components:
 - 1. 2"x2" wide by 4'-0" high snap-on vinyl cover
 - 2. Surface mounted continuous aluminum retainer.
- C. Material:
 - 1. Vinyl Cover: Snap on cover of .080" thickness made from chemical and stain-resistant unplasticized polyvinyl chloride (uPVC).
 - 2. Aluminum Retainer: .070" thick, 6063-T5, with mill finish
- D. Accessories:
 - 1. Injection molded top and bottom caps in color to match the covers.
 - 2. Fasteners provided by manufacturer.
- E. Finishes:
 - 1. Vinyl colors shall be selected from the manufacturer's full range of standard colors. Surface shall be pebble grain
- F. Acceptable manufacturers:
 - 1. InPro, Muskego, WI, www.inpro.com, model 160 High Impact Corner Guard
 - 2. Construction Specialties, Lebanon, NJ, www.c-sgroup.com, model SSM-20
 - 3. Approved equal

2.5 ACCESSORIES

- A. Adhesives:
 - 1. General: Provide adhesives approved which are Low-VOC or non-VOC, non-flammable, water-proof after cured, and odor free.
 - 2. Adhesive for lamination and fabrication of wood and plywood items: Exterior adhesives containing no urea formaldehydes, having a VOC limit of 70 g/L.
 - 3. Adhesive for subfloors and underlayment: High strength, waterproof and non-freezing adhesive complying with AFG-01 "Frozen Lumber Test" and ASTM 3498, and having a VOC limit of 50 g/L.

- B. Nails (interior and exterior): Galvanized common nails, of size and type to suit application and as required by state and local building codes.
- C. Screws:
 - 1. Screws for interior applications: Flat head electroplated-galvanized wood screws of the appropriate sizes.
 - 2. Screws for exterior applications:
 - a. For ACQ pressure preservative treated wood: Flat head type 304 or 316 stainless steel only, wood screws, of the appropriate sizes. Aluminum, galvanized steel, and coated metal fasteners are prohibited.
 - b. For general application (non-pressure preservative treated wood): Flat head hard aluminum, or stainless steel, wood screws, of the appropriate sizes.
- D. Anchor bolts, expansion bolts and lag screws: Hot-dipped galvanized steel, of the following types:
 - 1. For lumber having actual thickness of 1-1/2 inches or greater to masonry and concrete: Anchor bolts or expansion bolts, as most applicable for the specific receiving surface material, 3/8-inch minimum diameter, spaced as shown on drawings, and staggered as far as practicable. Countersink all bolt heads, and provide head washers of matching material.
 - 2. For lumber having actual thickness of greater than 7/8-inch but less than 1-1/2 inches to masonry and concrete: Anchor bolts or expansion bolts, as most applicable for the specific receiving surface material, at least 1/4-inch diameter of the most appropriate lengths for the specific application, spaced as shown, and staggered as far as practicable. Countersink all bolt heads, and provide head washers of matching material.
 - 3. For lumber having actual thickness of 7/8-inch and less: Anchor bolts or expansion bolts, at least 1/4-inch in diameter; or screws, of the most appropriate sizes; in lengths most suitable for the specific application, countersunk, spaced, and staggered.
- E. Protection paper: Canadian red-rosen paper or kraft paper.
- F. Building paper: ASTM D 226, Non-perforated, No. 15 (73 kg/sq m) asphalt-saturated building felt.
- G. Self-leveling Concrete Underlayment: high flow, fiber-reinforced, self-leveling underlayment equal to Ardex "K 22 F".
 - 1. Install prior to plywood subfloor installation to provide a level surface.

PART 3 - EXECUTION

3.1 PREPARATION

- A. All materials shall be inspected before use, with all checked, split and otherwise deficient stock rejected, or used only for miscellaneous blocking, furring or other incidental use. The Contractor shall be responsible for replacing all lumber which, due to warpage, twist, splitting, or checking, results in unsatisfactory work. Such replacement shall be required at any time, whether before or after application of finish material under other Sections.

- B. Verify exact locations of toilet accessories, door stops and similar items with Architect prior to installation of blocking for accessories.

3.2 INSTALLATION - GENERAL

- A. Closely coordinate the installation of the rough carpentry work with the work of other trades responsible for the installation of interfacing or overlaying materials, so as not to delay the work of the related trades.
- B. Erect all rough carpentry work plumb, level, and true with tight, close-fitting joints, securely attached and braced to surrounding construction, all in a first class workmanlike manner. Counterbore for bolt heads, nuts, and washers where required to avoid interference with other materials. Bear complete responsibility for structural integrity, connections, and anchorage of all rough carpentry work.
- C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- D. Use as long lengths as practicable for wood nailers, blockings, and curbs, to minimize number of joints, and attach the members with the types, and spacing, of fasteners specified herein.
- E. Install blocking, grounds and furring, as required for proper attachment of the work of other trades, in accordance with the requirements provided by the respective related trades.
 - 1. Spacing for furring and strapping shall not exceed 16 inches on center.
- F. Field cuts of fire retardant treated lumber: Do not rip or mill fire retardant treated lumber. Only end cuts, drilling holes and joining cuts are permitted.
- G. Field cuts of ACQ pressure-treated lumber: Apply solution of copper naphthenate containing a minimum of 2 percent metallic copper in-solution, in accordance with AWWA standard M4. Brush liberally all cuts and holes.
- H. Install concealed from view plywood with specified fasteners spaced not more than 10 inches on centers.
- I. Install fire-treated plywood backer boards with counter-sunk galvanized fasteners, of specified sizes, spaced not more than 12 inches on centers.

3.3 INSTALLATION - ROOF NAILERS AND BLOCKING

- A. General: Provide anchorage for nailers as required for roof and edging to obtain specified wind loading requirements, coordinate with Section 07 53 23 – ETHYLENE PROPYLENE DIENE MONOMER (EPDM) ROOFING.
 - 1. Secure nailers and blocking to metal deck with electro-galvanized screws at not greater than 12 inch on center spacing, extending a minimum of 3/4-inch below deck.
 - 2. Secure nailers and blocking to wood substrates with electro-galvanized screws at not greater than 12 inch on center spacing, extending a minimum of 1-1/2 inch into board substrates and 3/4 inches into sheet materials.
- B. When building up layers of nailers and blocking, fully secure each layer to at least the one below, alternating location of fasteners, spacing at 12 inches on center.

Provide fasteners in lengths to penetrate through more than one substrate layer of blocking. Stagger locations of butt ends of boards, such that no two joints are "lined up".

- C. Ensure finished height of nailers is same as top surface of roof insulation within 1/4-inch, plus or minus.
- D. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
- E. Comply with Division 07, Section 07 53 23 – Ethylene Propylene Diene Monomer (EPDM) Roofing for installation of roof edge wood blocking, nailers, and plywood associated with membrane roofing.

3.4 INSTALLATION – EQUIPMENT BACKBOARDS

- A. Provide panel mounting backboards for HVAC, Fire Prevention, Electrical and telephone/data equipment. Fabricate panels using fire-retardant treated 3/4-inch-thick panels mounted to fire-retardant treated 2 by 4's. Provide a nominal space of 3-1/2 inches behind panels to permit wiring.
 - 1. Install FRT plywood backing panels set vertically with the bottom edge 6-inches above finish floor and top edge at 8'-6" above finish floor.

3.5 INSTALLATION – PLYWOOD SUBFLOOR

- A. Fasten every 8 to 12 inches along the edges and 12 inches apart in the field of each board. Sink the heads of the screws slightly below the surface of the plywood.
- B. Install fasteners directly into the floor framing members below. Do not fasten into existing main floor decking.
- C. Stagger plywood joints. Refer to plywood underlayment and finish flooring manufacturer's recommendations for expansion joint spacing and consult with Architect prior to installation. Coordinate with finish flooring installer.
- D. Protect plywood underlayment from abuse by other trades by use of plywood, Masonite, Ramboard, or other suitable protection course. Remove and properly dispose of immediately prior to finish floor contractor beginning work.

3.6 INSTALLATION – SELF-LEVELING CONCRETE UNDERLAYMENT

- A. Preparation: clean existing floor decking free of all foreign matter prior to installation of concrete underlayment.
- B. Lay a suitable barrier over existing wood flooring to reduce leakage of the underlayment through the structure during placement.
- C. Contractor is fully responsible for proper installation including manufacturer's STRICT instructions.
- D. Feather edges to create smooth transition between adjacent finished surfaces.

3.7 INSTALLATION - METAL DOOR FRAMES

- A. Place in position all steel frames, furnished under Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES, in accordance with the approved shop drawings and frame schedule. Place, erect and level all frames into correct scheduled locations, including those in masonry partitions.
 - 1. During the installation of metal door frames, after the manufacturer's steel shipping bars have been removed, install wood spreaders at door opening, carefully dimensioned to permit square and plumb installation of door frames and doors.
 - a. Provide rigid temporary bracing for frames as required to ensure maintenance of positioning, and remove only after frames have been permanently anchored.
 - b. For doors located in masonry work, maintain frame position with temporary bracing until frames are built-into-place, and grout has sufficiently cured to maintain frame position.
 - c. Spreaders shall remain in place until doors are installed.
 - 2. Coordinate installation of frames with the various trades installing abutting wall construction for anchor placement.
- B. Coordinate installation of frames with installation of hardware under Section 06 20 00 - FINISH CARPENTRY and as furnished under Section 08 71 00 - DOOR HARDWARE.
- C. Install frames in accordance with the manufacturer's recommendations, ANSI/SDI-100, SDI-105, and the Door Hardware Institute (DHI) recommendations.
 - 1. Secure frames with the following number of anchors per jamb.
 - a. For frames 7'-6" in height or less: 3 anchors per jamb.
 - b. For frames 7'-6" in height or less and having doors exceeding 3'-0" feet width, and for cross corridor frames: 4 anchors per jamb.
 - c. For frames greater than 7'-6", up to 10'-0" in height: 4 anchors per jamb.
 - d. For frames greater than 7'-6", up to 10'-0" in height, and having doors exceeding 3'-0" feet width, and for cross corridor frames: 5 anchors per jamb.
 - e. For frames over 10'-0' in height: 5 anchors per jamb.
 - 2. Secure frames, occurring in existing masonry, with expansion bolts and sleeves.
 - 3. Where exposed fastener heads occur in frames, fill with automotive body filler and sand smooth.

3.8 TOLERANCES

- A. Door frames: Maximum diagonal distortion 1/16 inch measured with straight edge, corner to corner.

3.9 CLEANING

- A. Daily clean work areas by sweeping and disposing of scraps and sawdust.

- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

3.10 SCHEDULES

A. Wood treatment schedule:

1. Pressure preservative treat all concealed or exposed-to-view:
 - a. Lumber and plywood which comes in contact with concrete, masonry, or earth.
 - b. Lumber and plywood nailers, blocking and curbing directly related to roofing, flashing, skylights, roof hatches, and roof accessories.
 - c. Lumber and plywood rough-bucks, blocking and nailers directly related to windows, curtainwall and storefront systems.
2. Fire retardant treat all concealed or exposed-to-view:
 - a. Wood blocking, nailers and curbing where indicated or noted on Drawings.
 - b. Equipment backer boards.

B. Wood blocking schedule: The following schedule lists common items for which blocking is required and may not be indicated on the Drawings. It is not the intention of this schedule to list all conditions requiring blocking or limit the extent of blocking required for completion of the Work; provide all wood blocking, edgings, nailers, required for receipt of various finishes and surfacing materials. Securely anchor wood blocking and run continuous between framing.

1. Blocking sizes indicated below are minimum sizes for conditions which not otherwise sized or indicated on Drawings. In case of conflict, sizes identified on Drawings govern.

Items	Nominal size of blocking with fastener notes
Door Frames, having openings exceeding 4 feet in width;	2 by 4 inch, full height of wall framing
Door frames, cross corridors;	2 by 4 inch.
Door stops, wall mounted;	1 by 3 inch.
Grab bars;	2 by 6 inch, with 1/4 inch dia. toggle bolts.
Lavatories;	3/4 inch plywood extending full height from floor to top of wall framing. Install lavatories with 1/4 inch dia. toggle bolts
Mirrors, framed;	2 by 4 inch
Soap dispensers, wall mounted;	1 by 3 inch
Paper towel dispensers, waste receptacles, feminine napkin dispensers;	1 by 3 inch.
Toilet paper dispensers;	2 by 4 inch
Towel bars;	2 by 6 inch, 1/4 inch diameter toggle bolts

Wall mounted railings;	2 by 8 inch
Window treatment (shades, blinds and curtains):	2 by 4 inch
Platform curtain and valence:	2 by 6 inch

End of Section

Section 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install the following:
 - 1. Fiber Reinforced Laminate (FRL) wall protection panels, including all panels. Adhesives, fasteners, moldings and trim where shown and scheduled on the drawings.
 - 2. Solid wood wall caps at partial height partitions.
- B. Install the following furnished under the designated Sections:
 - 1. Wood items having painted finish furnished under Section 06 40 00 – ARCHITECTURAL WOODWORK and installed under this Section 06 20 00 – FINISH CARPENTRY including but not limited to:
 - a. Wood trim, head, jambs, sill, and apron at windows including head and jamb extensions.
 - 2. Steel doors furnished by Section 08 11 13 – HOLLOW METAL DOORS AND FRAMES.
 - 3. Wood doors furnished by Section 08 14 16 - FLUSH WOOD DOORS.
 - 4. Door hardware, thresholds, weatherstripping, seals and gaskets furnished by Section 08 71 00 - DOOR HARDWARE.
- C. No attempt is made in this Section to list all elements of finish carpentry required on this project or to describe how each element will be installed. It is the responsibility of the Construction Manager to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, framing, curbs, nailers, and backer boards.
- C. Section 06 40 00 - ARCHITECTURAL WOODWORK: Furnishing and installing architectural woodwork items.
- D. Section 06 61 16 – SOLID SURFACE FABRICATIONS: Furnishing and installing solid surface countertops, backsplashes, side splashes, curtain wall stools, and solid surface wall caps.
- E. Section 07 92 00 - JOINT SEALANTS: Sealant and backing materials, for joints between casework, countertops and abutting surfaces.
- F. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing hollow metal doors and frames.
- G. Section 08 14 16 - FLUSH WOOD DOORS: Furnishing wood doors.

- H. Section 08 71 00 - DOOR HARDWARE: Furnishing finish hardware, weatherstripping, thresholds, seals and gaskets for installation under this Section 06 20 00.
- I. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal framing for drywall construction work, and attachment.
- J. Section 09 29 00 - GYPSUM BOARD: Drywall construction work having taped and compounded finish.
- K. Section 09 91 00 - PAINTING: Field applied primer (excluding back priming) and finish coatings.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A250.11 (formerly SDI 105) - Recommended Erection Instructions for Steel Doors and Frames.
 - 2. AWI (Architectural Woodwork Institute) Architectural Woodwork Standards.
 - 3. AWI (Architectural Woodwork Institute) Architectural Woodwork Standards for Historic Restoration Work.
 - 4. APA - applicable grades and specifications.
 - 5. FS MM-L-736 - Lumber; Hardwood
 - 6. PS-1 - Construction and Industrial Plywood.
 - 7. PS-20 - American Softwood Lumber Standard.
 - 8. SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
 - 9. SPIB Grading Rules, current edition.
 - 10. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber
 - 11. American Lumber Standards Committee, National Lumber Grades Authority for Canadian Lumber, and applicable grading rules and standards of the various lumber associations whose species are being used for grades specified.
 - 12. AWPA C-20 - Structural Lumber Fire Retardant Treatment by Pressure Processes.
 - 13. AWPA C-27 - Plywood, Fire Retardant Treatment by Pressure Processes.
 - 14. MIL L1914OE - Lumber and Plywood, Fire Retardant Treated.
 - 15. UL Building Materials Directory.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for products specified herein.

2. Certificates: Wood products lacking acceptable documentation for the following will be rejected and their removal required.
 - a. Urea-formaldehyde Resins: Written documentation certifying that all composite wood and agrifiber products used on this Project contain no added urea-formaldehyde.
 - 1) Written certification from Millworker, that only “no added urea-formaldehyde” manufactured composite panel products are incorporated into the Work, including all concealed components. Composite panel products include but are not limited to particle board (PB), Medium Density Fiberboard (MDF) and similar manufactured products.
 - 2) Written certification from Millworker that laminating adhesives used in product fabrication on or off site do not contain any added urea-formaldehyde resins.
 - b. Written certification from the respective treatment plants indicating types of wood preservative treatment and fire-retardant treatment used, treatments method, applications instructions, and conformance to the requirements specified herein.
 - 1) Provide certification that fire retardant treatment materials do not contain ammonium phosphate.
 - 2) Provide report from ICC Evaluation Service on fire retardant treated wood flame spreading, strength, corrosion and hygroscopic properties.
 - 3) Provide report from ICC Evaluation Service on pressure preservative treated wood strength, corrosion, anti-fungi, and anti-insect properties.
3. Shop drawings:
 - a. Large scale design details, minimum 1-1/2 inch to one foot scale, showing profiles, jointing and fastening methods; and complete installation details.
 - b. Provide full scale drawings of wood trim elements showing all profiles and dimensions.
 - c. Provide shop drawings bearing dimensions of actual measurements taken at the project.
4. Samples: Provide samples as requested by Architect for selection of colors and finishes.

1.5 QUALITY ASSURANCE

- A. Quality Standards: All materials and workmanship scheduled to receive transparent finishes shall meet *AWI Architectural Woodwork Standard*, Premium Grade quality standards. All other materials and workmanship shall meet *AWI Architectural Woodwork Standard*, Custom Grade quality standards.
- B. Install work in accordance with the latest version *AWI Architectural Woodwork Standard*, except that standing and running trim joints shall be field mitered and fitted.
- C. Discard lengths of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of

joints or optimum jointing arrangements, or which are of defective manufacture with respect to surfaces, sizes or patterns.

1.6 PRE-INSTALLATION CONFERENCE

- A. Installer of the Work of this Section is required to attend pre-installation conference specified under Section 06 40 00 - ARCHITECTURAL WOODWORK.

1.7 DELIVERY STORAGE AND HANDLING

- A. Do not deliver interior finish carpentry materials to the project until all concrete, masonry, plaster, and other wet work has been completed and dry.
- B. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location maintaining 60 degrees Fahrenheit and a maximum relative humidity of 55 percent.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.9 MOCK-UPS

- A. Mock-ups are required for the restoration and repair of wood trim, handrails, stair treads, wainscoting.
- B. Construct mockup in time to make product and/or assembly modifications without delaying production work.
- C. Construct mock-ups at locations indicated or, if not indicated, at locations directed by the Architect. Mock-ups may be performed on existing surfaces in place. The work shall be of an area in sufficient size for the architect and owner to determine that materials, color, and finish adequately match adjacent surfaces.
- D. All mock-ups shown on drawings will be reviewed and approved by the Architect and Owner. Unaccepted mock-ups shall be replaced or reconstructed in part or in total and the extent of the replacement or reconstruction shall be at the discretion of the Architect and Owner. The contractor shall carry forth mock-up replacement or reconstruction until Architect's acceptance is obtained. Mock-up costs, including as many replacements or reconstruction as necessary to gain Architect's acceptance, shall be included in the Contract Cost and Schedule.
- E. Mock-ups, when approved by the Architect, will be used as datum for comparison with the remainder of the Work for the purposes of acceptance or rejection. Maintain mockup throughout construction period until Substantial Completion or as otherwise directed by Architect.
- F. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 WARRANTIES

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

PART 2 – PRODUCTS

2.1 WOOD MATERIALS, GENERAL

- A. General: Materials, as fabricated and installed, shall comply with specified grades of the latest addition AWI Quality Standards.
- B. Moisture content:
 - 1. Wood for interior use shall have a moisture content between 5 and 10 percent, when delivered to the project.

2.2 BOARD AND PANEL MATERIALS

- A. Interior trim to receive paint (opaque finish): Wood shall be clear without knots or surface defects. and conform to AWI/AWMAC/WI "Architectural Woodwork Standards," latest edition for specified quality grades, (as installed). Acceptable wood species are limited to the following:
 - 1. Yellow Poplar (*Liriodendron tulipifera*), Plain Sawn, clear straight-grained, C-Select or better.
 - 2. Natural Birch" Yellow Birch (*Betula alleghaniensis*), Plain Sawn.
 - 3. Natural Maple (*Acer saccharum*), Plain Sawn.
- B. All new interior wood scheduled to receive transparent finish shall be furnished under Section 06 40 00 and installed under this Section 06 20 00.
- C. All wood required for restoration and repair work shall be furnished and installed under this Section 06 20 00. Wood shall be clear without knots or surface defects. and conform to AWI/AWMAC/WI "Architectural Woodwork Standards," latest edition for specified quality grades, (as installed). Wood species shall match the species, color, and grain of the existing materials to be restored or repaired.
- D. Plywood and panel products:
 - 1. Shelving: 3/4-inch particleboard with plastic laminate finish at all exposed edges; front edge shall receive 3mm thick PVC banding.
 - 2. Engineered panels scheduled for painted finish: Medium Density Fiberboard (MDF) of thickness indicated on the Drawings, conforming to ANSI A208.2 product class MD, fabricated from 100 percent recycled fiber, using formaldehyde free synthetic resin such as methyl diisocyanate (MDI), having a minimum density of 45 pounds per cubic foot (769 kg/m³).
 - a. Flakeboard, Toronto, Ontario, Canada, product: "Superior MDF".
 - b. Roseburg Forest Products, Co., Springfield, OR, product "Medite II".
 - c. Plum Creek Timber Company Inc., Seattle, WA, product "Standard MDF".

- 3. Particle board: Mattformed three-layer medium density wood particle panel, general use grade per ANSI A 208.1 with an minimum density of 48 pounds per cubic foot, fabricated using formaldehyde free synthetic resin such as Rodman Industries, Oconomowoc, WI product: "Rodman Resincore I" or approved equal.
- E. Provide other finish carpentry products, not specifically described, but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

2.3 FIBER REINFORCED LAMINATE (FRL) PANEL

- A. Specified Manufacturer: To establish a standard of quality, design, and function desired, Drawings and Specifications have been based on Panolam Industries International, Inc., Shelton, CT 06484
- B. Acceptable Manufacturers:
 - 1. Pionite FRL
 - 2. Nevamar
- C. Performance Requirements:
 - 1. Thickness: 0.075
 - 2. Surface Burning Characteristics: US Standard UL-723/ASTM E 84 Class A; Canadian Standard ULC-S102 Class A for Surface Burning Characteristics of Building Materials.
 - 3. Sustainability, Indoor Air Quality: GREENGUARD Gold Certification.
 - 4. IMO Certified for marine use.
 - 5. Chemical resistant compliant with SEFA 8 requirements.
 - 6. Wear Resistance (Cycles) NEMA 3.13: 3500 typical.
 - 7. Flexural Strength ASTM D790: 20,148 psi typical. 9. Molding Profiles: Outside corners flat, outside corners round, division bars, inside corners, standard end caps.
 - 8. Adhesive: Construction Adhesive #4319 by Franklin Adhesives and Polymers or equal approved by panel manufacturer
 - 9. Color and Finish:
 - a. FRL-1 As selected by architect from manufacturer's full range of Nevamar or Pionite colors and designs.
 - b. FRL-2 Custom Printed, imagery provided by architect and owner
- D. Trims and Moldings: One piece extruded aluminum moldings, with clear anodized finish, for application between abutting panels, inside and outside corners, and panel edges as recommended by the panel manufacturer.

2.4 ACCESSORIES AND HARDWARE

- A. Glue for lamination and fabrication of wood, plywood, and particle board items: Exterior Grade, phenolic resin glue.
- B. Nails for interior trim items: 6d and 8d coated or galvanized finish nails, except as otherwise specified herein.

- C. Screws: Flat-head wood screws of the appropriate sizes, galvanized finish for interior use.
- D. Bolts, nuts, washers, blind fasteners, lags: Galvanized, of size and type to suite application as indicated in the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of blocking, backing and support framing for all finish carpentry work.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. Prime all wood surfaces of items or assemblies to be in contact with cementitious and masonry materials, prior to installation.

3.3 INSTALLATION – GENERAL CARPENTRY

- A. Comply with installation requirements of AWI (Architectural Woodwork Institute) Quality Standards, Eighth edition for Premium Grade quality work.
- B. Dress and sand woodwork until free from machine and tool marks, abrasions, raised grain, or other defects that will show through the finish on surfaces exposed to view. Wherever possible, carry out sanding on a shop belt sander, not in the field. Sandpaper field joints and leave in perfect condition for finishing.
- C. Make all joints tight, and form to conceal shrinkage. Glue all miters having a dimension of 4 inches or more from heel to point. Joints shall be glued tight and so formed as to conceal shrinkage. Cope trim at returns and miter at corners to produce tight-fitting joints with full surface contact throughout length of joint.
- D. Make a minimum of splices and joints in running trim, and where such splices and joints occur, fasten securely, with all exposed surfaces having smooth, continuous planes. Stagger joints in adjacent or relate members. Use scarf joints for end-to-end joints.
- E. Scribe and cut work to fit adjoining work closely. Refinish cut surfaces in prefinished items.
- F. All nails in interior finished work shall be blind nailed wherever possible. Nail trim with finish nails only, set using appropriate nail punch and fill with matching wood filler. Sand smooth wood filler and make ready for paint. Do not fasten trim with screws or bolts unless otherwise directed, or is to be subsequently covered with smaller trim.
- G. Woodwork shall be properly framed, closely fitted, and accurately set to the required lines and levels and shall be rigidly secured in place. Shim as required using concealed shims to achieve specified tolerances.
- H. Cover exposed edges of plywood shelving with 3/8-inch hardwood edging. Width of edging to match thickness of shelving.

3.4 INSTALLATION - PREFABRICATED PRODUCTS INSTALLED UNDER THIS SECTION

- A. Do not commence installation of products until immediately adjacent surfaces have been completely installed and finished.
- B. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.
- C. Install products absolutely level and in true line, with units securely anchored to the surrounding construction.
- D. Remove all tape and other packing materials; thoroughly clean and polish all exterior and interior surfaces.
- E. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.

3.5 INSTALLATION – FRL

- A. Installation: Install products in strict accordance with manufacturer's instructions and approved submittals.
 - 1. Clean substrate of dirt, dust, waxes, and other bond breaking substances prior to beginning installation. The wall must be finished to level 3 and fully primed.
 - 2. Install panels with bottom edge located to clear top of any rigid wall base. Rubber wall bases may be bonded over the FRL® panels using a polymer or urethane based adhesive.
 - 3. Apply adhesive uniformly using adhesive manufacturers recommended notched trowel to the entire back of panels completely to the edge.
 - 4. Lay FRL® panels in place leaving approximately 1/8 inch vertical installations 3/16 inch for horizontal installations between panel joints.
 - 5. Follow adhesive manufacturer's recommendations for set and application times.
 - 6. Apply pressure to entire panel face with laminate type roller, removing trapped air and ensure proper adhesion between surfaces.

3.6 INSTALLATION - DOORS AND HARDWARE

- A. Install doors in accordance with the manufacturer's recommendations, ANSI/SDI-100, ANSI A250.11, and the Door Hardware Institute recommendations.
- B. Install hardware in accordance with manufacturer's instructions and requirements of referenced organizations, and the requirements of Section 08 71 00 - DOOR HARDWARE.
 - 1. Use the templates provided by hardware item manufacturer.
 - 2. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with the governing regulations.
 - a. Conform to ANSI 117.1 for positioning requirements for the handicapped.
 - b. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute (DHI.)

- c. WDMA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors".
 - d. Coordinate the installation of electrified hardware with division 28 10 00 and make adjustments to hardware to ensure operation.
 - 3. Installation of hardware shall comply with NFPA 80 and NFPA 101 requirements
 - 4. Prefit hardware before finish is applied, remove and reinstall after finish is completed. Install hardware so that parts operate smoothly, close tightly and do not rattle.
 - 5. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
 - C. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant, forming tight seal between threshold and surface to which set. Securely and permanently anchor thresholds, using countersunk non-ferrous screws to match color of thresholds (stainless steel screws at aluminum thresholds).
 - D. Tools for maintenance: All special tools packaged with hardware items shall be saved, tagged/identified as to product use, and turned over to the Owner upon completion of the Work.
 - E. Clean adjacent surfaces soiled by hardware installation.
 - F. Prior to Final Inspection make final check and adjustment of all hardware, clean operating items as necessary to restore proper function and finish of hardware.
- 3.7 TOLERANCES
- A. Maximum variation for wood work from true position of 1/8 inch in 8 feet for plumb and level and with a maximum of 1/16 inch offsets in adjoining surfaces intended to be flush.
 - B. Maximum variation for doors and frames: Maximum diagonal distortion 1/16 inch measured with straight edge, corner to corner.
- 3.8 ADJUSTING
- A. Adjust doors for smooth and balanced movement.
- 3.9 CLEANING
- A. Daily clean work areas by sweeping and disposing of scraps and sawdust.
 - B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
 - C. Remove protective material from pre-finished surfaces.

3.10 PROTECTION

- A. During the operation of finish carpentry, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.
- B. Following installation, protect all work of this contractor from possible damage by other trades. Include protection of countertops, cabinets, and all other finished work that is susceptible to damage.

End of Section

Section 06 40 00
ARCHITECTURAL WOODWORK

PART 1 - GENERAL

- A. Furnish and install the following architectural woodwork items:
 - 1. Wood wall caps.
- B. Furnish the following products to be installed under the designated Sections:
 - 1. Shop-milled and shop-finished wood elements designated for painted finish to Section 06 20 00 – FINISH CARPENTRY for field installation including but not limited to the following:
 - a. No attempt is made in this Section to list all wood elements and products to receive a paint finish. This Section 06 40 00 shall provide all miscellaneous wood trim and other exposed-to-view woodwork and millwork scheduled or otherwise indicated to receive a paint finish, excluding flush wood doors specified under Section 08 14 16.
- C. No attempt is made in this Section to list all elements of architectural woodwork required on this project or to describe how each element will be installed. It is the responsibility of the Contractor to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 06 10 00 - ROUGH CARPENTRY: Concealed wood blocking and nailers.
- C. Section 06 20 00 - FINISH CARPENTRY: Installation of items furnished under this Section.
- D. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal framing for drywall construction work.
- E. Section 09 29 00 - GYPSUM BOARD: Wallboard construction work, having taped and compounded joint finish.
- F. Division 22 - PLUMBING: Plumbing fixtures and piping.
- G. Division 26 - ELECTRICAL: Electrical connections for lighting and data/power outlets.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - References. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM D 523 - Standard Specification for Specular Gloss.
 - 2. AWI (Architectural Woodwork Institute) Architectural Woodwork Standards.
 - 3. APA Grades and Specifications.

4. National Lumber Grades Authority, American Lumber Standards, and Grading Rules and Standards of the various lumber associations whose species are being used, with grade-marks for same.
5. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber; and Product Standard (PS):
 - a. PS-1 - Construction and Industrial Plywood Standard.
 - b. PS-20 - American Softwood Lumber Standard.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. At least two weeks before scheduled delivery of woodwork, conduct a pre-installation conference at the Project site. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
 1. Required attendees: Architect, Contractor, installers of woodwork, woodwork fabricator representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
 - a. Section 06 20 00 - FINISH CARPENTRY
 - b. Section 09 29 00 - GYPSUM BOARD.
 - c. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES.
 - d. Section 09 91 00 - PAINTING.
 - e. Section 22 00 00 - PLUMBING.
 - f. Section 23 00 00 - HEATING, VENTILATING, AND AIR CONDITIONING.
 - g. Section 26 00 00 - ELECTRICAL.
 2. Agenda:
 - a. Scheduling of woodwork operations.
 - b. Review of staging, material storage locations and temporary protection of stored items.
 - c. Ambient conditioning and environmental controls.
 - d. Coordination of related work.
 - e. Protection of installed woodwork.
 3. Delivery and installation of woodwork may only proceed when everyone concerned agrees that required ambient conditions can be maintained.
- B. Sequencing:
 1. Field Measurements: Where possible the woodwork manufacturer shall take field measurements before preparation of shop drawings and fabrication to ensure proper fitting of Work.
 - a. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
 2. Field dimensions which are not controlled by Project conditions: The woodwork manufacturer is responsible for details and dimensions not controlled by Project conditions and shall show on his shop drawings all required field measurements beyond his control.
 - a. The Contractor shall acknowledge the woodwork fabricator's need for accurate field dimensions prior to custom fabrication.

- b. The Contractor and the woodwork manufacturer shall cooperate to establish and maintain these field dimensions.

C. Scheduling:

- 1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

- 1. Certificates: Wood products lacking acceptable documentation for the following will be rejected and their removal required.
 - a. Urea-formaldehyde Resins: Written documentation certifying that all composite wood and agrifiber products used on this Project contain no added urea-formaldehyde.
 - 1) Written certification from Millworker, that only "no added urea-formaldehyde" manufactured composite panel products are incorporated into the Work, including all concealed components. Composite panel products include but are not limited to particle board (PB), Medium Density Fiberboard (MDF) and similar manufactured products.
 - 2) Written certification from Millworker that laminating adhesives used in product fabrication on or off site do not contain any added urea-formaldehyde resins.
- 2. Shop drawings bearing dimensions of actual measurements taken at the project, include at least the following, which are in addition to shop drawing requirements described in AWI Quality Standards:
 - a. 1/4-inch scale elevations and plans of each millwork item.
 - b. Large scale design details of minimum 1-1/2 inch to 1-foot scale, showing abutting materials, installation conditions, clearances. Show woodwork profiles, jointing and fastening methods; details of drawers and doors.
- 3. Selection Samples:
 - a. Plastic laminate chips for initial color selection by Architect.
 - b. Chain of PVC edging materials.
 - c. Provide additional samples as requested by Architect for initial selection of material colors and finishes.
- 4. Verification Samples:
 - a. 12-inch-long samples of solid hardwoods illustrating maximum range of color variations and applied transparent shop finish.
 - b. 12 by 12-inch samples of plastic laminate (of each color required for project).
 - c. 12-inch length samples of plastic edging material (of each color required for project).
 - d. One each of all cabinet hardware. (approved cabinet hardware samples will be returned to Contractor and may become part of the Work).

1.6 QUALITY ASSURANCE

- A. Quality Standards: All work performed under this Section shall be of quality grades, indicated below, as defined in the referenced AWI "*Architectural Woodwork Standards*", as modified herein by this Specification Section.
 - 1. All work having a transparent wood finish: Premium grade.
 - 2. All plastic laminated work: Custom grade.
- B. Qualifications:
 - 1. Fabricator/Installer: AWI member specializing in architectural woodwork of type specified herein having a minimum of 5 years documented experience.

1.7 MOCK-UPS

- A. Mockups: Before fabricating and installing interior architectural woodwork, build mockups for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in the location and size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be fabricated and installed.
 - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 4. Obtain Architect's approval of mockups before starting interior architectural woodwork fabrication.
 - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. Locate mock-ups where directed and include all surfaces and finish materials.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. General: The woodwork manufacturer, woodwork installer and the Contractor are jointly responsible to make certain that woodwork is not delivered until the building and storage areas are sufficiently dry so that the woodwork will not be damaged by excessive changes in ambient humidity and relative moisture content.
 - 2. Concrete, masonry, plaster, tile, and marble setting and polishing and other wet work shall be completed and dry before delivery, storage, and installation of woodwork items.
 - 3. Sequence deliveries to avoid delays and to minimize on-site storage.
- B. Storage and Handling Requirements:
 - 1. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location.

1.9 SITE CONDITIONS

- A. Temperature: Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before, and during installation of architectural woodwork; maintain temperature after installation until Owner's Final Acceptance.
- B. Relative Humidity: Maintain a relative humidity between 25 and 55 percent for a minimum period of 5 calendar days before, and during, installation of architectural woodwork; maintain relative humidity after installation until Owner's Final Acceptance.

1.10 WARRANTIES

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

PART 2 - PRODUCTS

2.1 LUMBER MATERIALS

- A. General requirements: New, dressed four sides (S4S), and free from warping and other defects.
 - 1. Moisture Content:
 - a. Solid hardwood(s) scheduled for transparent finish: Moisture content shall not exceed 8 percent when delivered to Project.
 - b. Typical (hardwood and softwoods): Moisture content of wood shall be between 5 and 10 percent when delivered to the project.
- B. Concealed supports for edge and corner backing shall be kiln dried birch or poplar, meeting AWI Premium Grade Standards.
- C. Blocking and furring at base and walls shall comply with American Softwood Lumber Standard PS 20-70 and with specific grading requirements of SPIB: Kiln dried (KD15), Structural Light Framing, N°. 2 grade, free of warping and large knots.
- D. Internal concealed framing for millwork: Kiln-dried, (KD15), eastern pine, poplar, eastern spruce, or southern pine, conforming to AWI Premium grade.
- E. Fir plywood for concealed from view applications in conjunction with the various millwork items: EWA C-C PLUGGED EXT.

2.2 ACCESSORIES

- A. Glue for lamination and fabrication of wood and plywood items: Exterior Grade, phenolic resin glue.
- B. Bolts, nuts, washers, lags, pins, and screws: Of size and type to suit application chrome finish in exposed-to-view locations.
 - 1. Concealed joint fasteners: Threaded steel.
- C. Sealant, for joints between countertops and dissimilar materials: One component acetoxysilicone rubber, mildew resistant, FS TT-S-001543A, Type Non-Sag, Class A, and FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Class 25,

Grade NS, use NT, G and A with a minimum movement capability of ± 25 percent, and a Shore A hardness of 20, in manufacturer's standard colors as selected by the Architect.

1. Only use sealant and primers that comply with the following limits for VOC content:
 - a. Architectural sealants: 250 g/L.
 - b. Sealant primer: 250 g/L
2. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.
3. Subject to requirements specified herein, the following products are acceptable, or approved equal:
 - a. Dow Corning Corporation, Midland MI; product, "786".
 - b. General Electric Company, Waterford NY; product, "Sanitary 1700".
 - c. Sonneborn Building Products Inc., Minneapolis MN; product, "Sonolastic - OmniPlus".
 - d. Tremco, Beachwood OH; product: "Proglaze"

2.3 FABRICATION - GENERAL

- A. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. Coordinate the fabrication of millwork with that of the various trades responsible for installing materials and items which will be inserted into, or applied to, the millwork surfaces. Obtain and verify templates, dimensions, and instructions from the respective trades before making cut-outs, holes, slots, and other cutting in the millwork.
- C. Shop assemble custom millwork for delivery to site. Deliver in assemblies as large as possible for entrance into the designated areas. Provide for concealed job connections of adjacent units.
- D. Fabricate, install and finish all work so that both sides of countertops, panels, doors, shelves and other millwork are of balanced construction, to prevent warping.
- E. Cap exposed plywood with solid hardwood, matching color of wood veneer panels. Apply veneer over hardwood edging in manner to show no visible lines between wood veneer and hardwood edging.
- F. Fit corners and joints hairline, secure with concealed fasteners.
- G. Finish all solid wood and plywood surfaces smooth, and free from all machine and tool marks that will show through the wood veneer or facing materials.
- H. Make all joints tight, and form to conceal shrinkage. Glue all miters having a dimension of 4 inches or more from heel to point.
- I. Provide shop fabricated counters, shop mitered components, closure trims with ample allowance for field cutting and fitting. Provide additional trim as required for scribing and site cutting.

- J. Finished work shall be free from visible adhesive and pencil marks.

2.4 FABRICATION - MILLWORK

- A. Fabricate millwork in accordance with requirements of specified AWI Grade and the following additional requirements:
1. Cabinets shall be in flush overlay construction, with drawer fronts and hinged doors overlapping openings a minimum of 1/4 inch all four sides.
 2. Fabricate cabinets in integral units, each completely enclosed, without the use of common partitions.
 3. Fabricate plastic laminated millwork with top and bottom fillers and corner panels described as optional for Custom Grade Work in the Quality Standards.
 4. Drawers:
 - a. Drawer sides and backs: Dovetail construction, 1/2-inch-thick solid hardwood of specified species.
 - b. Laminated drawer fronts: High density laminate over 3/4-inch specified core material. Drawer fronts shall be applied to separate drawer body component sub-front.
 - c. Drawer bottoms (plastic laminated millwork): 1/4-inch-thick plywood panel with plastic laminate, housed and glued into front, sides and back.
 - d. Underside of drawer to receive continuous hot melt glue at joint between bottom and back/sides/front for sealing and rigidity.
 - e. Reinforce drawer bottoms as required with intermediate spreaders.
 - f. Drawer box shall be the maximum height that allows for proper operation of drawer and hardware.
 5. Doors: Square edge design, 3/4 inch thick, without any profiling and shall fully overlap the cabinet frame.
 - a. Laminate doors: Fabricate doors with plywood core and front and rear faces high-pressure laminate, of selected color.
 - b. Maintain a maximum 1/8" reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
 6. Base cabinets: Provide full horizontal top frame with glued and doweled joints, 3/4-inch plywood end panels and bottom. Bottom shall be glued and doweled and let into routed end panels. Provide 4-inch-high toe rail, securely screwed to the end panels and to the bottom panel by concealed glue blocks.
 7. Wall cabinets: Provide same finishes as base cabinets, with 3/4-inch thick top and bottom plywood panels. Top and bottom panels shall be glued and doweled and let into routed end panels. Back of case shall be recessed and let into routed end panels and further secured with glue blocks.
 8. Door and drawer spreaders: Provide minimum 3/4-thick full width cabinet body spreaders immediately behind all door/drawer and multiple drawer horizontal joints to maintain exact body dimensions, and close off reveal. Front edge to be match face of adjacent cabinet doors/drawers.

2.5 FABRICATION OF PLASTIC LAMINATE CLAD ITEMS

- A. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.

- B. Except as otherwise specified hereunder, fabricate plastic laminate clad items in strict accordance with the details on the Drawings, the approved shop drawings, and workmanship standards set forth in the AWI Quality Standards Section 400, for specified Quality Grade.
- C. Shop fabricate all plastic laminate clad items. Adhere plastic laminate to plywood backing sheets by cold-press-method. Use of contact cements are not permitted. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Apply laminate backing sheet to reverse side of all laminated, panels, shelving, and tops.
- D. Fit corners and joints hairline. Make all joints and miters tight, secure with concealed fasteners.

2.6 SHOP APPLIED FINISHING

- A. Transparent exposed-to-view finish for millwork: AWI Premium Grade Factory Finish System N° TR-4 "Conversion Varnish" system having a Medium rubbed effect with a sheen of 24° to 28° gloss units per ASTM D523. Finish system shall not substantially increase flame spread.
 - 1. One washcoat, reduced conversion varnish.
 - 2. Colorant: None - natural finish.
 - 3. One coat sealer, conversion varnish.
 - 4. Two coats topcoat: Conversion varnish equal to Sherwin Williams product "V84 series Kem Var".
- B. Concealed surfaces: Thoroughly coat all concealed surfaces of finish woodwork before assembling with two coats of clear wood preservative.
- C. Field Touch-up: Shall be the responsibility of the installing contractor and shall include the filling, and touch-up of exposed job made nail or screw holes, refinishing of raw surfaces resulting from job fitting, repair of job inflicted scratches and marks, and final cleaning up of the finished surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Verify adequacy of blocking, backing and support framing for all finish carpentry work.
 - 2. Examine pre-fabricated woodwork before installation and verify all packing has been removed.
 - 3. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 PREPARATION

- A. Before installing work under this section, woodwork shall be conditioned to average prevailing humidity conditions in areas of installation.

- B. Protect other Work against undue soilage and damage by the exercise of reasonable care and precautions. Clean, repair, or replace any work so damaged and soiled to the acceptance of the Architect.

3.3 INSTALLATION - GENERAL

- A. Install work in accordance with the latest AWI *Architectural Woodwork Standards* in grade specified herein, under the Article entitled "QUALITY ASSURANCE".
- B. Woodwork shall be installed plumb, level, true and straight without distortions.
 - 1. Use concealed shims as required
 - 2. Work shall be installed to a tolerance of 1/8-inch in 8 feet for plumb and levelness, including tops.
 - 3. There shall be no variations in flushness of adjoining surfaces.
- C. Tops and woodwork shall be scribed and trimmed to fit adjoining work.
 - 1. Where cuts occur, refinish surfaces and repair damaged finishes
- D. Secure woodwork to anchors or built-in blocking or blocking directly attached to substrates.
 - 1. Secure woodwork to grounds, furring, stripping, and blocking as required with countersunk, concealed fasteners and blind nailing performing a complete installation.

3.4 INSTALLATION - MILLWORK AND COUNTERTOPS

- A. Install millwork without distortion so that doors and drawers fit openings properly and are accurately and evenly aligned.
- B. Adjust millwork hardware centering the doors and drawers in the openings, and provide unencumbered operation.
- C. Complete the installation of hardware and accessory items as indicated.
- D. Tops: Anchor tops securely to base units and to other support systems as required.

3.5 TOLERANCES

- A. Maximum variation from true position 1/16 inch with a maximum of 1/32 inch offset from true alignment with adjoining surfaces intended to be flush.

3.6 ADJUSTING

- A. To whatever extent work was not completed at shop or prior to installation of woodwork, perform and complete the specified finishing of woodwork.
- B. Repair damaged and defective woodwork where possible eliminating defects functionally and visually.
 - 1. Where not possible to repair damaged or defective work, replace with matching new work.
 - 2. Adjust joinery for uniform appearance.
- C. Adjust doors and drawers for smooth and balanced movement, lubricate hardware for use.

3.7 CLEANING

- A. Daily clean work areas by sweeping and disposing of scraps and sawdust.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area leave area in broom-clean condition.
- C. Clean excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.
- D. Remove protective material from pre-finished surfaces, immediately prior to Final Acceptance.
- E. Carefully clean exposed and semi-exposed wood surfaces, in strict accordance with fabricator's instructions. Touch-up shop-applied finishes to restore damaged or soiled areas, matching adjoining finish.
- F. Wash down plastic laminate with a solution of mild detergent in warm water, applied with soft clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- G. Clean and polish hardware, and bright metal trim components.
- H. Vacuum clean all cabinet and drawer interiors.

3.8 PROTECTION

- A. Protect installed woodwork and maintain specified conditions, in a manner acceptable to both fabricator and installer. Ensure that work of this Section will not be damaged or soiled, and is completely free of defects at the time of final acceptance of Project by the Architect.
- B. Protect stored material from damage by other trades, including vacuuming and cleanup of sawdust in cabinets and drawers.

End of Section

Section 06 61 16

SOLID SURFACING FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install solid surfacing (solid polymer) fabrications, including but not limited to the following:
 - 1. Solid surfacing curtain wall stools, countertops, backsplashes, and side splashes.
 - 2. Solid Surfacing wall caps at partial height partitions at Lab D317A.
 - 3. Prefinished aluminum counter support brackets.
 - 4. Sealant, for joints between countertops, backsplashes and abutting surfaces.
- B. Make all cutouts within solid surfacing items as required to accommodate sinks, and other plumbing fixtures, from templates provided by the respective trades.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking and nailers.
- C. Section 06 40 00 - ARCHITECTURAL WOODWORK: Cabinetry, shelving and other shop fabricated casework. COUNTERTOP SUPPORT BRACKETS FOR SOLID SURFACE COUNTERTOPS.
- D. Section 08 44 13 EXTERIOR ALUMINUM CURTAIN WALL: Curtain wall framing system at exterior wall openings.
- E. SECTION 22 00 01 PLUMBING: Sinks, plumbing fixtures, and solids interceptors.

1.3 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data. Identify available colors, shades, and gloss
 - 2. Shop drawings: Large scale design details of minimum 1-1/2 inch-to-1 foot scale, showing abutting materials, installation conditions, clearances. Show profiles, jointing and fastening methods.

3. Selection samples:
 - a. Solid surfacing samples for initial color selection by Architect.
 - b. Sealant material: Manufacturer's standard strips of sealant, in all available colors, for selections by the Architect.
 - c. Provide additional samples as requested by Architect for initial selection of material colors and finishes.
4. Verification samples:
 - a. 12 by 12 inch samples of solid surfacing materials.

1.4 QUALITY ASSURANCE

- A. Fabricator and Installer; with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
 1. Fabricator and Installer for solid surfacing products shall be trained and certified by solid surfacing manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Concrete, masonry, plaster, tile setting, and other wet work shall be completed and dry before delivery, storage and installation of fabricated solid surface items.
- B. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location.
- C. Sequence deliveries to avoid delays and to minimize on-site storage.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before, during, and after installation of solid surfacing fabrications; maintain temperature until Owner's Final Acceptance.

1.7 FIELD MEASUREMENTS

- A. Field dimensions: The fabricator is responsible for details and dimensions not controlled by Project conditions and shall show on his shop drawings all required field measurements beyond his control.
 1. The Construction Manager shall acknowledge the fabricator's need for accurate field dimensions prior to custom fabrication.
 2. The Construction Manager and the fabricator shall cooperate to establish and maintain these field dimensions.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on LX Hausys HIMACS Solid Surface Price Group C and D.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. LX Hausys HIMACS Solid Surface
 - 2. E. I. du Pont de Nemours and Company, Inc., Wilmington DE, product, "Corian".
 - 3. Aristec Acrylics LLC (Avonite Surfaces), Florence, KY, product "Avonite".
 - 4. Formica Corporation, Cincinnati, OH, product: "Solid Surfacing".
 - 5. Wilsonart International, Inc. Temple TX, product "Gibraltar".

2.2 SOLID SURFACING MATERIALS

- A. Polymer solid surfacing material: Non-porous surfacing material homogeneously composed of natural minerals and high-performance polymer, fabricated sizes and profiles as shown on the Drawings, in colors and finishes as selected by Architect.
 - 1. Solid surfacing material shall be NSF (National Sanitation Foundation) listed under publication 51 - Plastic Materials and Components used in Food Equipment and bear the "component" mark.
 - 2. Colors and patterns shall be as selected by the Architect from full line of Price Groups C and D.
 - 3. Complies with requirements of ANSI Z124.3, Type 6 and WW-P-541E/GEN.
 - 4. Seaming and jointing: Dupont's structural two-part joint adhesive or approved equal to form smooth and inconspicuous seam, without voids.
- B. Sheet thicknesses shall be as specified below or as otherwise indicated on Drawings.
 - 1. Countertops: One-piece monolithic design ½-inch-thick.

2. Countertop edges: Double-rounded edges, using ½-inch build-up strip adhered to countertop with color matched joint adhesive. Top and bottom edges shall be routed using 1/8-inch round-over bit.
 3. Backsplashes: ½-inch-thick in locations and heights as shown on the Drawings. Eased edges.
 4. Plywood backing: 1/2-inch-thick Moisture resistant MDF
- C. Joint Adhesive: color matched two-component seam adhesive as provided by solid surfacing manufacturer.
- D. Adhesive for installation of trim components, neoprene panel adhesive or structural silicone glazing sealant, as recommended by solid surfacing manufacturer.

2.3 ACCESSORIES

- A. Counter support brackets: Equal to "Flush Mount Counter Supports" by Rakks/Rangine Corp, Needham MA.
1. Construction: Fabricated from horizontal aluminum T section and vertical aluminum L section. Vertical leg designed to attach to in-wall wood support blocking.
 - a. Model EH-1212FM for up to 18-inch-deep counters.
 - b. Model EH-1818FM for up to 24-inch-deep counters.
 - c. Model EH-1824FM for up to 30-inch-deep counters.
 2. Factory applied finishes: Exposed aluminum surfaces shall be free of scratches and other serious blemishes and be factory finished with:
 - a. Electrostatically applied, powder paint coating complying with AAMA 2603 (minimum), custom color selected by Architect.
 3. Wood screw fasteners with finish to match bracket finish.
- B. Wire management grommets and covers: 3-inch diameter, as manufactured by Doug Mockett & Company, Manhattan Beach CA., (800) 523-1269, model number "EDP". Provide where shown on Drawings, and if not shown, allow the following numbers of grommets; exact locations to be determined in field.
1. For counters 6 feet or less provide 2 wire grommets and covers.
 2. For counters over 6 feet, provide 1 wire grommet and cover for every 42 inches of counter, or fraction thereof.
- C. Sealant, for joints between countertops and dissimilar materials: One component acetoxy silicone rubber, mildew resistant, FS TT-S-001543A, Type Non-Sag, Class A, and FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Class 25, Grade NS, use NT, G and A with a minimum movement capability of ±25 percent,

and a Shore A hardness of 20, in manufacturer's standard colors as selected by the Architect, equal to one of the following:

1. Dow Corning Corporation, Midland MI; product, "786".
 2. General Electric Company, Waterford NY; product, "Sanitary 1700".
 3. Sonneborn Building Products Inc., Minneapolis MN; product, "Sonolastic - OmniPlus".
 4. Tremco, Beachwood OH; product, "Proglaze".
- D. Bolts, nuts, washers, lags, pins, and screws: Of size and type to suit application chrome finish in exposed-to-view locations.
- E. Fir plywood for backing: EWA C-C PLUGGED EXT.
- F. Concealed supports for edge and corner backing shall be kiln dried birch or poplar.

2.4 FABRICATION

- A. Coordinate the fabrication of solid surfacing products with that of the various trades responsible for installing materials and items which will be inserted into, or applied to, the countertop surfaces. Obtain and verify templates, dimensions, and instructions from the respective trades before making cut-outs, holes, slots, and other cutting in the countertops.
- B. Shop fabricate all solid surfacing items in strict accordance with the details on the Drawings, the approved shop drawings, and recommendations of the solid surfacing manufacturer
1. Prepare countertops for undermount design sinks furnished and installed under Division 22 - PLUMBING.
 2. Prepare solid surfacing fabrications for installation of plumbing fixtures.
- C. Fit corners and joints hairline. Make all field joints and miters tight, secure with concealed fasteners.
- D. Provide shop fabricated counters, shop mitered components, closure trims with ample allowance for field cutting and fitting. Provide additional trim as required for scribing and site cutting.
- E. Route all edges to be butted for a smooth, clean fit. Sand edges with 120 grit sandpaper to rough up surfaces for adhesive bonding. Clean with denatured alcohol.
- F. Prepare and apply adhesive in compliance with manufacturer's written instructions. Clamp all components using manufacturer's approved clamping methods at all

joints and build-up laminations, maintain clamping until adhesive is set. Avoid over-tightening clamps and squeezing out adhesive.

- G. Remove excess adhesive when dry with router. Follow with belt sander using 120 grit, diagonal to joint. After adhesive is leveled and smooth with surface, proceed with final shaping and finishing.
- H. After shaping, smooth finish of cut surfaces equal to manufacturer's original finish. Sand surfaces smooth with wet 400 grit sandpaper. Remove superficial scratches and sander markings, buff with nylon buffing pads as recommended by solid surfacing manufacturer. Wipe surfaces clean and dry with cloths.
- I. Finished work shall be free from visible adhesive and pencil marks.
- J. Field touch-up: Shall be the responsibility of the installer and shall include the filling, and touch-up of exposed job made nail or screw holes, refinishing of surfaces resulting from job fitting, repair of job inflicted scratches and marks, and final cleaning up of the finished surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. General: Install work in accordance with manufacturer's instructions.
- B. Solid surfacing shall be installed plumb, level, true and straight without distortions:
 - 1. Use concealed shims as required
 - 2. Work shall be installed to a tolerance of 1/8 inch in 8 feet for plumb and levelness, including tops.
 - 3. There shall be no variations in flushness of adjoining surfaces.
- C. Tops and trim shall be scribed and trimmed to fit adjoining work.
 - 1. Where cuts occur, refinish surfaces and repair damaged finishes
- D. Secure solid surfacing fabrications to blocking directly attached to substrates.
 - 1. Secure fabrications using concealed fasteners.
 - 2. Anchor tops securely to base units and to other support systems as required.
- E. After installation and leveling of solid surfacing fabrications has been completed; apply a continuous bead of specified sealant to all joints which abut walls or partitions. Tool the sealant to a uniformly dense surface, level with the edges of the casework. Immediately remove all excess sealant from solid surfacing surfaces.

3.2 TOLERANCES

- A. Maximum variation from true position 1/16 inch with a maximum of 1/32 inch offset from true alignment with adjoining surfaces intended to be flush.

3.3 CLEANING

- A. Daily clean work areas by sweeping and disposing of scraps.
- B. Clean excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant and solid surfacing manufacturers.
- C. Wash down exposed surfaces with a solution of mild detergent in warm water, applied with soft clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.4 PROTECTION

- A. Protect installed fabrications in a manner acceptable to fabricator and installer, which shall ensure no damage or deterioration at the time of Final acceptance of Project by the Architect.

End of Section

Section 07 00 02
ROOFING AND FLASHING SUB-BID CONTRACT REQUIREMENTS
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 0 and Division 1 Specification Sections, apply to this Section.

1.2 TIME, MANNER AND REQUIREMENTS FOR SUBMITTING FILED SUB BIDS:

- A. The work of this section is work of a Filed Sub-Bid Contractor and includes the following requirements:
1. Specification requirements for the Subcontract "ROOFING AND FLASHING" include all of the following listed Specification Sections: in their entirety:
 - a. Section 07 53 23 – EPDM ROOFING
 - b. Section 07 62 00 – SHEET METAL FLASHING AND TRIM
 - c. Section 07 71 00 – ROOF SPECIALTIES
- B. Filed sub-bid contract bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the City of Worcester Purchasing Division, City Hall, 455 Main Street, Worcester, MA 01608 at the time and place stipulated in the "Invitation to Bid/Notice to Contractors." Along with the time of the bid opening, the following shall appear on the upper left hand of the envelope:

Name of Filed Sub Bidder: Print Name of Filed Sub Bidder

Project: WTHS TUFTS VET TECH CLINIC RENOVATION

Subcontract Bid for Section: 07 00 02 – ROOFING AND FLASHING

- C. Each Filed Sub bid submitted for work under this Section shall be on forms furnished by the City of Worcester as required by Section 44F of Chapter 149 of the General Laws, as amended. Filed Sub bid forms may be obtained at the Purchasing Division in person, or by written request.
- D. Filed Sub bids filed with the City of Worcester shall be accompanied by a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the City of Worcester in the amount of five (5) percent of the bid. A Filed Sub bid accompanied by any other form of bid deposit than those specified will be rejected.
- E. Additional Requirements:
1. Filed Sub bidder's attention is directed to Massachusetts G.L. Chapter 149 §44H, as amended, which provides in part as follows:
 2. Each Filed Sub-contract bidder shall list in Paragraph E of the "Form for Filed Sub Bids" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that sub-subtrade requires such listing, provided that, in the absence of a contrary provision in the Specifications, any sub-bidder may,

without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the Awarding Authority that he does customarily perform such class of work with persons on his own payroll and is qualified to do so. This Section of the Specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.

Class of Work	Reference Specification	Paragraphs

- F. The work to be completed by the Sub-Contractor for the work of this Section is shown on the following listed Drawings:
- The Work of this Trade Contract is shown on the following Drawings:
AD3.1, AD3.2, AD3.3, A1.0, A2.1, A2.2, A3.0, A3.1, A3.2, A4.1, A4.2, A5.0, A5.1, A6.1, A6.2, A6.11, A6.12, A6.13, A6.14, A8.0, A8.1, A8.2, A8.3, A8.4, A8.5, A8.6, A8.7, A8.8, A9.1, A9.2, A9.3, A10.1, A10.2, A11.1, A11.2, A11.3, A12.1, A12.2, S1.1, S1.2, S3.1, S3.2, S4.1, S4.2
 - Related items which may require coordination or impact work of this trade are shown on the following Drawings:
FP1.1, FP3.1, P1.1, P3.1, P3.2, P3.3, DH3.1, DH4.1, H3.1, H3.2, H4.1, H4.2, H5.1, H5.2, H5.3, H5.4, E0.1, E0.2, ED1.1, ED1.2, ED1.3, EH1.1, EH1.2, EH1.3, EL1.1, EL2.1, EL2.2, EL2.3, EL2.4, EL2.5, EP1.1, EP2.1, EP3.1, EP3.2, EP4.1, EP4.2, EP4.3, EP4.4, EP4.5, EP4.6, FA0.1, FA1.1, FA2.1, FA3.1, FA3.2, SC0.1, SC1.1, SC1.2, SC2.1, TC0.1, TC1.1, TC1.2
 - The complete List of Drawings for the Project is provided in Section 00 01 15.
 - Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section. The listing of Contract Drawings above does not limit Sub-Contractor's responsibility to determine full extent of work of this Section as required by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Sub-Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.4 QUALITY ASSURANCE

- A. Company specializing in work described in the above listed individual specification Sections with minimum 5 years documented experience.

1.5 SEQUENCING

- A. Coordinate work of this Filed Sub-Contractor with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed Sub-Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Roofing and Flashing Filed Sub-Contractor shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work and all other Work requiring such equipment as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 - 1. Scaffolding and staging required pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-Contractor.
 - 2. Roofing and Flashing Filed Sub-Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed Sub-Contractor.
 - 4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each work day to prohibit access to the scaffolding by unauthorized individuals.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed Sub shall be furnished, installed, operated and

maintained in safe conditions by this Filed Sub-Contractor, as referenced under
Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION

3.1

SITE MAINTENANCE

- A. The Roofing and Flashing Filed Sub-Contractor shall furnish and maintain dumpsters to adequately control the disposal of all trash, construction debris, and waste materials resulting from the work of this Filed Sub-Contract.
 - 1. The Roofing and Flashing Filed Sub-Contractor is responsible for all costs to obtain, maintain and disposal of dumpsters.
 - 2. Disposal: Empty dumpsters on frequent regular basis as necessary to prevent overflow spillage. Legally dispose of waste off-site.
- B. Daily clean work areas. Sweep and place into the dumpster(s) furnished by this trade, all pallets, construction debris, unused materials, and other waste materials resulting from the Work of this Filed Sub-Contract.
- C. After completion of the work of this Section, remove equipment, tools, and unused materials, remove all remaining waste materials and construction debris related to the work of this Filed Sub-Contract. Clean all areas completely free from residue and materials installed under this Section.

End of Section

Section 07 11 13
BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install fluid applied bituminous dampproofing:
 - 1. Apply to all structural steel encased below the ground level concrete floors and encased in concrete foundations, including all columns, base plates, and all bracing assemblies.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 03 30 00 – CAST IN PLACE CONCRETE: BELOW SLAB VAPOR RETARDER
- C. Section 05 12 00 – STRUCTURAL STEEL: Structural steel encased in concrete
- D. Section 07 00 01 – WATERPROOFING, DAMPPROOFING AND CAULKING TRADE CONTRACT REQUIREMENTS: Trade Contract requirements for work of this Section.
- E. Section 07 21 00 – THERMAL INSULATION: Rigid insulation below slab on grade.
- F. Section 07 92 00 - JOINT SEALANTS: Requirements for joint sealant and backing materials.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM D1227 - Emulsified Asphalt Used as a Protective Coating for Roofing.
 - 2. ASTM D2823 - Asphalt Roof Coatings.
 - 3. ASTM D449 - Asphalt Used in Dampproofing and Waterproofing.
 - 4. ASTM D4586 - Asphalt Roof Cement, Asbestos-Free.
 - 5. NRCA Roofing and Waterproofing Manual.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for dampproofing.
 - 2. Manufacturer's application instructions including, joint and crack treatment, application temperature range, and any special procedures.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store dampproofing materials in new, sealed, containers showing manufacturer's identification, year of production, net weight, date of packaging, and location of packaging.
- B. Store all materials following manufacturer's recommended storage procedures for humidity and temperature conditions, protect materials from freezing and from high heat, flames or sparks.

1.6 ENVIRONMENTAL CONDITIONS

- A. Do not apply when ambient temperatures may fall below 35 degrees Fahrenheit or by manufacturer for 24 hours before and during application and until membrane has cured.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate and schedule the work of this Section with the related works

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or equal:
 - 1. Karnak Corporation, Clark NJ.
 - 2. Tremco Barrier Solutions, Inc., Reynoldsburg OH
 - 3. W.R. Meadows, Inc., Hampshire IL.

2.2 MATERIALS

- A. Dampproofing at all structural steel encased in concrete or masonry: Solvent based, non-asbestos, bituminous compound equal to Karnak Product: "Number 229AR Elastomeric" complying with ASTM C836.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Verify items which penetrate surfaces to receive dampproofing are rigidly installed.
- B. Do not apply dampproofing to damp, frozen, dirty, dusty or surfaces unacceptable to dampproofing manufacturer.
- C. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. Perform all preparation work on receiving surfaces, including removal of fins, scaling, and projecting rough spots, and removal of all loose mortar, dirt, oil, and other foreign matter from the substrate.
- B. Protect adjacent surfaces not designated to receive dampproofing.
- C. Cracks and joints in substrate surface must be properly sealed as recommended by the dampproofing manufacturer.
- D. Identify exact limits of dampproofing.

3.3 APPLICATION

- A. Perform the application of the dampproofing in strict accordance with the manufacturer's installation instructions, and as specified herein.
- B. Apply primer when so required by manufacturer's instructions.
- C. Trowel, spray or brush apply as applicable to specified product, in one coat leaving no pinholes, defects or undercoated areas. Apply at coverage rate recommended by the manufacturer but not less than 4 to 6 gallons per 100 square feet.
- D. After application of dampproofing is completed, carefully inspect the entire dampproofed surface for defects therein and patch all defects discovered.

3.4 PROTECTION

- A. Protect dampproofing film and allow to cure for at least 48 hours before installation of rigid insulation.

End of Section

Section 07 21 00
THERMAL INSULATION

PART 1 – GENERAL

1.1 SUMMARY

- A. The work of this Section consists of building insulation where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes but is not limited to the following scope.
- B. Furnish and install the following:
 - 1. Rigid extruded polystyrene insulation at foundation walls and slab edge.
 - 2. Low pressure, low expansion polyurethane foamed-in-place insulation / air barrier sealant: applied to seal gaps, cracks, cavities and joints in the building envelope, roof drains, and other similar penetrations in exterior walls and roof.
 - 3. Fiberglass batt insulation at exterior stud wall cavities.
- C. Furnish the following items for installation under related sections:
 - 1. Mineral wool board insulation at curtain wall base between insulated metal panel and brake metal closure for installation under Section 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing partitions, walls and related insulation.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, nailers.
- D. Section 04 20 00 – UNIT MASONRY: Veneer masonry assembly supported by wall stud metal framing.
- E. Section 07 92 00 – JOINT SEALANTS: Requirements for sealant and back-up materials furnished and installed by this Section.
- F. Section 08 44 13 – Glazed Aluminum Curtain Walls: Installation of mineral wool board insulation furnished by this Section.
- G. Section 09 81 00 - ACOUSTICAL INSULATION: Acoustical batt insulation between framing members.
- H. Section 09 29 00 - GYPSUM BOARD: Installation of wallboard over insulation in framing system.
- I. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Ductwork and piping insulation.

1.3 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
1. ASTM C 203 - Breaking Load and Flexural Properties of Block Type Thermal Insulation.
 2. ASTM C 518 - Thermal Transmission Properties by Means of the Heat Flow Meter.
 3. ASTM C 553 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 4. ASTM C 578 - Preformed Cellular Polystyrene Thermal Insulation.
 5. ASTM C-612 - Mineral Fiber Block and Board Thermal Insulation.
 6. ASTM C665 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 7. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.
 8. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750°C.
 9. ASTM E 84 - Surface Burning Characteristics of Building Materials.
 10. ASTM E 96 - Water Vapor Transmission of Materials.
 11. All applicable federal, state and municipal codes, laws and regulations for thermal insulation.
 12. NFPA 285 (National Fire Protection Association): Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
- B. Definitions:
1. The term "R-Value" referred to herein refers to the thermal resistance of the insulation alone and does not allow consideration of air spaces or other factors.

1.4 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.

1.5 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 - a. Rigid board insulation materials are combustible and may constitute a fire hazard, do not expose insulation materials to open flames or other ignition sources, comply fully with manufacturer's recommendations and the requirements of local authorities having jurisdiction, for delivery, handling, storage and installation.
 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in packages containing water marks, or show evidence of mold.

1.7 WARRANTIES

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Substitutions: To establish a minimum standard of quality, design and function desired, the Schedule of Materials in this Section indicates manufacturers of each product, other manufacturers will be considered for acceptance per the following:
1. Contractor must provide appropriate product data with bid for the Architect to consider the substitutions as "equal" to the manufacturer and product specified.
 2. Contractor must include unit prices showing any add or deduct costs for all recommended substitutions which have a greater or lesser cost than furnishing and installing the specified manufacturer and product.

2.2 MATERIALS

- A. Rigid extruded polystyrene foundation wall and slab edge insulation: Closed cell foam board, square edge, self-extinguishing, conforming to ASTM C 578, Type IV, with a compressive strength of 25 pounds per square inch when tested in accordance with ASTM D 1621.
1. Panel size: 48 by 96 inches beneath slab, and 24 by 96 inches at verticals.
 2. Minimum R-value: 5 per inch thickness.
 3. Thickness as indicated on Drawings.
 4. Acceptable products include but are not limited to:

- a. Dow Chemical Corp., product, Styrofoam Brand "Square Edge"
 - b. Owens Corning, product "Foamular 250".
 - c. Pactiv, Corp. product "GreenGuard Type IV 25 PSI Insulation Board".
 - d. DiversiFoam Products, product "CertiFoam 25 SE".
- B. Fiberglass batt insulation conforming to ASTM C-665 Type I, unfaced, comprised of inorganic fibers bonded with formaldehyde-free thermosetting resin.
 1. Acceptable Manufacturers:
 - a. CertainTeed Corporation, Valley Forge, PA.
 - b. Johns Manville Building Insulation, Denver, CO.
 - c. Owens Corning Fiberglas Corp., Toledo, OH.
 - d. (Goldline brand) Schuller International, Inc., Denver, CO.
 - e. USG Corp./USG Interiors Inc., Chicago, IL.
 2. Surface burning characteristics when tested per ASTM E84:
 - a. Flame Spread: 25 or less
 - b. Smoke Developed: 50 or less.
 3. Thickness and R-values:
 - a. Ceiling Construction: nominal 10 inch thick with R-30 thermal rating.
- C. Foamed-in-place insulation for air barrier sealant: Low Pressure Polyurethane foam sealant. Acceptable products include the following or approved equal:
 1. Fomo Products, Inc., product: "Handi Foam" or "Handi-Seal".
 2. Dow Chemical Company, product: "Great Stuff Pro".
 3. Premier industrial Supply, product: "XtraFoam".
 4. Convenience Products, Division of Clayton Corp., product: "Touch 'n Foam No Warp".
 5. Henry Company, product: "NailTite NT-100".
- D. Rigid mineral wool board conforming to ASTM C612, Type IVB having a nominal density of 4.4 pounds per cubic foot of insulation.
 1. Non-Combustible as tested per ASTM E-136.
 2. Flame Spread Classification: Class A (less than 25, per testing by NFPA 255, ASTM E-84 or UL 723), with flame spread rating of 0 and smoke developed rating of 0.
 3. Thermal Resistance: ASTM C518 (C177), R-value of 15 minimum at 3-1/2 inches thick.
 4. Thickness: 3-1/2 inches thick.
 5. Size: 16 inches x 48 inches (406 mm x 1219 mm).
 6. Acceptable products include the following or approved by architect equal:
 - a. Roxul, Inc., Milton, Ontario, product "CavityRock®".
 - b. Owens Corning, Wabash IN, product "Thermafiber®, Rainbarrier®".
 - c. Johns Manville, Inc., Denver CO. product: "Cladstone™ 45 Water & Fire Block Insulation".

2.3 ACCESSORIES

- A. Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each insulation type.
- B. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
 - 1. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch, minimum 2 inches square.
 - 2. Pin: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.
 - 3. Adhesive, as recommended by anchor manufacturer for substrate.
 - 4. Acceptable products include the following, or approved equal to:
 - a. Gripnail Corporation, East Providence, RI., product "SnapStik Spindle Anchors".
 - b. Gemco, Danville IL., product "Perforated Base Insulation Hangers."
 - c. AGM Industries, Brockton MA. product: Tactoo Insul-Hangers."
- C. Setting adhesive for rigid insulation: Conforming with ASTM C-557.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 INSTALLATION

- A. Foundation wall and edge of slab insulation: 2 inch thick rigid insulation.
 - 1. Place insulation boards at foundation walls.
 - a. Extend insulation to provide 100 percent coverage at foundation walls.
 - 2. Butt edges and ends tight to adjacent boards.
- B. Batt and insulation between framing members:
 - 1. Install in accordance with manufacturer's instructions. Do not compress or "stuff" insulation into voids, compressed insulation has less thermal resistant value.
 - 2. Trim insulation neatly to fit spaces. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation, do not cut around electrical boxes. Leave no gaps or voids.
 - 3. Where faced insulation is specified, apply membrane facing on warm side of building spaces. Lap ends and staple side flanges of membrane between framing members.
 - 4. Where insulation is located between joists/rafters and is not to be covered, install wire insulation supports to keep insulation in place.

- C. Foamed-in-place insulation: Apply insulation in method to a uniform monolithic density without voids, in accordance with manufacturer's instructions.
 - 1. Apply application of foam for air barrier seal includes, but is not limited to the following and elsewhere indicated on Drawings:
 - a. Roof and wall junctures.
 - b. Metal decking flutes.
- D. Where additionally indicated on Drawings Foamed-in-place insulation / air barrier sealant: Apply insulation in method to a uniform monolithic density without voids, in accordance with manufacturer's instructions.
 - 1. Apply application of foam for air barrier seal includes, but is not limited to:
 - a. Penetrations in exterior walls.
 - b. Gaps, cracks, cavities and joints in the building envelope, not sealed with other forms of air boots, including electrical boxes and conduit, ducts, fans, and piping.
 - c. Where additionally indicated on Drawings.

3.3 CLEANING

- A. Clean work under provisions of Section 01 73 00 – EXECUTION.
- B. Daily clean work areas by sweeping and disposing of debris, and scraps.
- C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 07 21 31
CLOSED CELL SPRAYED FOAM INSULATION

PART 1 – GENERAL

1.1 SUMMARY

- A. The work of this Section consists of polyurethane sprayed-in-place closed cell foam insulation system insulation where shown on the Drawings, as specified herein, and for a complete and proper installation. Work includes but is not limited to the following scope.
- B. Furnish and install the following:
 - 1. Foamed-in-place insulation infill at roof parapet.

1.2 RELATED REQUIREMENTS

- A. Section 05 40 00 – COLD-FORMED METAL FRAMING: Structural light gauge metal framing.
- B. Section 06 10 00 – ROUGH CARPENTRY
- C. Section 07 53 23 – EPDM ROOFING
- D. SECTION 09 29 00 – GYPSUM BOARD

1.3 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards shall be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM C 177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - 2. ASTM C 518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter.
 - 3. ASTM C 1029 - Spray Applied Rigid Cellular Polyurethane Thermal Insulation.
 - 4. ASTM D 1621 – Test Method for Compressive Properties of Rigid Cellular Plastics.
 - 5. ASTM D 1622 – Test Method for Apparent Density of Rigid Cellular Plastics.
 - 6. ASTM D 1623 – Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
 - 7. ASTM D 2126 – Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
 - 8. ASTM D 2842 – Test Method for Water Absorption of Rigid Cellular Plastics.
 - 9. ASTM D 2856 – Test Method for Open Cell Content of rigid Cellular Plastics by Air Pycnometer.

10. ASTM D 5116 - Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
11. ASTM E 84 - Surface Burning Characteristics of Building Materials.
12. ASTM E 96 - Water Vapor Transmission of Materials.
13. ASTM E 119 -Fire Tests of Building Construction and Materials.
14. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750°C.
15. ASTM E 2176 – Air Barrier Materials.
16. UL - Fire Resistance Directory.
17. CAN/ULC-S705.1-01 Standard for Thermal Insulation - Medium Density Closed Cell Spray Applied Rigid Polyurethane Foam – Material Specification.
18. CAN/ULC-S705.2-05 Standard for Thermal Insulation - Medium Density Closed Cell Spray Applied Rigid Polyurethane Foam – Application.
19. All applicable federal, state and municipal codes, laws and regulations for thermal insulation and vapor barriers.

B. Definitions:

1. The term “ccSPF” referenced herein refers to “Closed Cell Spray Polyurethane Foam” insulation.
2. The "R-Value" referred to herein refers to the thermal resistance of the insulation alone and does not allow consideration of air spaces or other factors.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Provide data on material characteristics, performance criteria, and limitations.
 - a. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.
 - b. Include statement that materials are compatible with adjacent materials proposed for use.
2. Manufacturer's certifications:
 - a. Provide an Evaluation Report as the manufacturer's documentation confirming material has been evaluated and conforms to the requirements of the ASTM E2176 Standard for Air Barrier Materials.
 - b. Certification from an independent testing laboratory that insulation meets fire hazard classification requirements.
3. Shop Drawings: Submit shop drawings for specific project conditions.

4. Samples: Submit clearly labeled samples, 3 by 4 inch (75 mm by 100 mm) minimum size of each material specified.
 5. Manufacturers installation instructions: indicate preparation, installation requirements and techniques, product storage and handling criteria, and limitations of the material.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 36 - CLOSEOUT SUBMITTALS.
1. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of sprayed foam insulation.
- C. Qualifications:
1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and a licensed applicator by product manufacturer.
 - a. Provide proof of manufacturer's certification upon request.
- D. Certifications:
1. Fire Hazard Classification: Maximum flame spread/smoke developed rating of 25/450, tested to ASTM E84.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.
- B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.8 SITE CONDITIONS

- A. Maintain temperature and humidity recommended by the materials manufacturer for 24 hours before, during, and 48 hours after installation of sprayed foam insulation.
- B. Field Conditions: Do not install spray foam insulation in snow, rain, fog, or mist. Do not install air barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer.

1.9 WARRANTIES

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Special Warranty:
 - 1. Warrant work of this section against defects or deficiencies for a period of two years from the date of Substantial Completion of the General Contract.
 - 2. Promptly correct, at own expense, defects or deficiencies which become apparent within the warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Bayer Material Science Bay Systems, Phoenix, AZ, product "Bayseal CC".
 - 2. Resin Technology/Henry Company, Inc., Huntington Park, CA, product "Permax Spray System RT 2045 Series".
 - 3. BASF Polyurethane Foam Enterprises, LLC, Minneapolis, MN, product "WALLTITE".
 - 4. Johns Manville Insulation Systems, Denver CO., product "Corbond III".
 - 5. Barnhardt Manufacturing Company dba NCFI Polyurethanes, Mount Airy, NC, product InsulBloc Smart SPF

2.2 DESCRIPTION

- A. General Description: Plastic resin and catalyst, cold setting low-density, closed-cell foam, two component system.
- B. Regulatory Requirements
 - 1. Obtain certificate of compliance from authority having jurisdiction indicating approval of specified products.

2.3 PERFORMANCE/DESIGN CRITERIA

- A. General:

1. Air permeability: Not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 in. water (1.57 psf) (0.02 L/sm @ 75 Pa.) when tested according to ASTM E 2178.
 2. All penetrations of the sprayed foam insulation, and paths of air infiltration/exfiltration shall be made airtight.
- B. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds.
- C. Outgassing/Reactivity or Toxicity/Hazardous Materials:
1. Formaldehyde: Products containing urea-formaldehyde shall not be permitted.
 2. Chlorofluorocarbons (CFCs)/HCFCs: Products and equipment requiring or using CFCs or HCFCs during the manufacturing process shall not be permitted.
- D. Performance criteria: Material shall meet requirements of ULC S705.1, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material - Specification. CCMC Evaluation Report or reports from accredited testing laboratory shall be made available upon request.
1. Long Term Thermal Resistance (LTTR): 6.4 per inch, when tested in accordance with ASTM C518.
 2. Closed cell content: 90 percent minimum when tested in accordance with ASTM D 1940, ASTM D 2856 or ASTM D 6226
 3. Density: Minimum 1.9 pounds per cubic foot minimum when tested in accordance with ASTM D 1622.
 4. Compressive Strength: 15 pounds per square inch minimum when tested in accordance with ASTM D 1621.
 5. Tensile Strength: 28 pounds per square inch minimum when tested in accordance with ASTM D 1623.
 6. Dimensional Stability: 11 percent change in volume maximum at 158 degrees F and 95 percent relative humidity when tested in accordance with ASTM D 2126.
 7. Water Absorption: 0.025 (grams per cubic centimeter) when tested in accordance with ASTM D 2842.
 8. Air Leakage (for 4 inches of material): ASTM E 283-04; 0.01 L/s/m² @ Pa maximum.
 9. Sound Transmission Class (STC): ASTM E 90-04; STC 43 minimum.
 10. Noise Reduction Coefficient (NRC): ASTM E 90-04; NRC 0.2 minimum.
 11. Bacterial or Fungal Growth: Zero rating when tested in accordance with ASTM G 21.
 12. Flame Spread and Smoke Developed Rating: Flame Spread <25, Smoke Developed <450 when tested in accordance with ASTM E 84-05.
 13. Fuel Contribution: 0 when tested in accordance with ASTM E 84-05.
 - a. & Company, Cambridge MA., product: "Monokote Type Z-3306.

2.4 EQUIPMENT

- A. Equipment for spraying foam shall be manufactured specifically for the application of polyurethane foam. The equipment shall be airless, capable of maintaining a 1:1 volume ratio and have primary and hose heaters (300 feet of material hose maximum allowable to meet mix pressure requirements.) Acceptable application guns shall include but are not limited to Gusmer GX-7, D Gun, GAP Pro, Fusion, Probler and other direct impingement type mixing guns with low output tips in the 15 pound per minute range or as recommended by the manufacturer.
- B. Equipment settings are to be recorded on the Daily Work Record

2.5 ACCESSORIES

- A. Prime substrate when required by spray polyurethane manufacturer or the membrane manufacturer. The type of primer and the installation of the primer shall follow the requirements of the manufacturer for the surface conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Report in writing defects in substrates which may adversely affect the performance of the foam insulation.
 - 2. Beginning of installation means acceptance of existing substrate and project conditions.
- B. Evaluation and Assessment: Examine joints before sealing to ensure configurations, surfaces and widths are suitable for foam sealant.

3.2 PREPARATION

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect existing finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.
- B. Surface Preparation: Surfaces to receive foam insulation shall be free of frost and loose or foreign matter which might impair adhesion of materials.
 - 1. Prepare surface by brushing, scrubbing, scraping, or grinding to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which shall affect adhesion and integrity of the foam insulation system. Wipe down metal surfaces to remove release agents or other no compatible coatings, using clean sponges or rags soaked in a solvent compatible with the foam insulation. Ensure surfaces are dry before proceeding.

3.3 APPLICATION – SPRAY FOAM

- A. Apply foam insulation in strict accordance with ULC S705.2, manufacturer's written instructions, and the following.
 - 1. Apply foam insulation only when surfaces and ambient temperature are within limits prescribed by the material manufacturer.
- B. Fill joints with foam sealant making allowances for post expansion of foam.
- C. Finish joints shall be free from air pockets and imbedded foreign materials. Cut back excess foam sealant after cutting flush with surrounding surfaces unless otherwise directed and/or detailed.
- D. Apply foam insulation to within the following tolerances: minus 1/4 inch thickness or plus 1/2 inch thickness indicated on the Drawings.
 - 1. Trim any excess thickness that would interfere with the application of cladding/covering system by other trades.
- E. Finished sprayed foam insulation shall be free of voids and imbedded foreign materials.
- F. Do not install spray polyurethane foam within 3 inches of heat emitting devices such as light fixtures and chimneys.
- G. Complete connections to other components and repair any gaps, holes or other damage using material which conforms to ULC S710.1 or ULC S711.1 and installed in accordance with ULC S710.2 or ULC S711.2 as applicable.
- H. Do not allow foam insulation to cover or mark adjacent surfaces. Use masking materials if necessary.
- I. Do not permit adjacent work to damage work of this section. Damage to work of this section caused by other sections shall be made good by this section at the expense of the section which caused the damage.

3.4 INTERFACE WITH OTHER WORK

- A. Coordinate the work of this Section installation of windows and door frames. Ensure air and vapor barrier transitions from windows and door frames is completed.

3.5 FIELD QUALITY CONTROL

- A. Field inspection shall be performed under the provisions of Section 01 45 29 - TESTING LABORATORY SERVICES.
- B. Non-Conforming Work: Remove and replace all non-conforming work.

3.6 CLEANING

- A. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of sprayed-foam and other materials installed under this Section.

- B. Clean work under provisions of Section 01 73 00 – EXECUTION.
 - 1. Remove over-spray and masking materials immediately after foam has cured to hard surface film.
 - 2. Clean and make good surfaces soiled or damaged by work of this section. Consult with section of work soiled before cleaning to ensure methods used shall not damage the work.
- C. Waste Management:
 - 1. Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
 - 2. Dispose of liquid waste in accordance with all applicable regulations. Consult all regulations (federal, provincial, state, local) or a qualified waste disposal firm when characterizing waste for disposal. Contact manufacturer for MSDS sheets for product information, and recommendations for proposal disposal. Utilize licensed waste disposal companies as may be required, the following phone numbers for national companies are provided for the Contractor's convenience only.
 - a. Safety Kleen, Plano TX., (telephone 800-669-5740).
 - b. Clean Harbors, Norwell MA., (telephone 800-422-8998).
 - c. Phillip Services Corporation (PSC), Houston TX., (telephone 800-726-1300).

3.7 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
- B. Protect spray foam insulation from ultraviolet light following installation on exterior surfaces, do not leave exposed to weather elements for a period greater than 30 calendar days.

End of Section

Section 07 27 13

MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this Section consists of a vapor permeable membrane system where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes but is not limited to the following.
- B. Furnish and install the following:
 - 1. Self-adhesive elastomeric sheet membrane vapor permeable air barrier system, including specified sheet membrane, required primers and adhesives by same manufacturer.
 - a. At exterior sheathing behind brick masonry veneer.
 - b. Connections to adjacent systems (unless specifically noted to be performed under another Section.
 - c. Structural penetrations through wall air and vapor barrier membrane.

1.2 RELATED REQUIREMENTS

- A. Section 04 20 00 - UNIT MASONRY:
 - 1. Masonry cavity walls/flashing.
- B. Section 07 53 23 – ETHYLENE PROPYLENE DIENE MONOMER (EPDM) ROOFING: Coordination of transitions between roofing and air barrier system.
- C. Section 07 92 00 - JOINT SEALANTS: Requirements for joint sealant and backing materials.

1.3 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C 920 Standard Specification for Elastomeric Joint Sealants
 - 2. ASTM C 1305 Standard Test Method for Crack Bridging Ability of Liquid-Applied Waterproofing Membrane
 - 3. ASTM D 412 - Test Methods for Vulcanized Rubber & Thermoplastic Rubbers and Thermoplastic Elastomers – Tension.

4. ASTM D 570 - Test Method for Water Absorption of Plastics.
5. ASTM D 882 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension
6. ASTM D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
7. ASTM D 1004 - Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
8. ASTM D 1876 Standard Test Method for Peel Resistance of Adhesive
9. ASTM D 1938 - Test Method for Tear Propagation Resistance of Plastic Film and Thin Sheeting by a Single-Tear Method.
10. ASTM D 1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep slope roofing Underlayment for Ice Dam Protection
11. ASTM D 4073 Standard Test Method for Tensile-Tear Strength of Bituminuous Roofing Membranes
12. ASTM D 4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
13. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
14. ASTM E 96 - Test Methods for Water Vapor Transmission of Materials.
15. ASTM E 154 - Test Method for Water Vapor Retarders used in contact with Earth Under Concrete Slabs, on Walls or as Ground Cover.
16. ICC ES (ICC Evaluation Service) AC48 – Acceptance Criteria for Roof Underlayment for Use in Severe Climate Areas.
17. NFPA 285 (National Fire Protection Association): Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Pre-installation meetings specified under related specifications:

1. Installer of the Work of this Section is required to attend pre-installation conference specified under Section 04 20 00 – UNIT MASONRY.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties.
 - a. Include certification of data indicating Volatile Organic Compound (VOC) content of all components of waterproofing system.
 - 2. Shop Drawings:
 - a. Show the locations and extent of air and vapor barrier system including details of typical conditions including:
 - 1) Intersections with other envelope systems and materials.
 - 2) Membrane counter-flashings.
 - 3) Bridging of gaps.
 - 4) Penetrations through barrier including conduits, pipes and similar items.
 - 3. Test and Evaluation Reports:
 - a. Provide an Evaluation Report as the manufacturer's documentation confirming material has been evaluated and conforms to the requirements of the ASTM E2176 Standard for Air Barrier Materials.
 - b. Provide an Evaluation Report as the manufacturer's documentation confirming material has been evaluated and conforms to the requirements on NFPA 285 based on the various exterior wall configurations of this project.
 - 4. Manufacturer's Instructions:
 - a. Manufacturer's application instructions including data for surface conditioners, joint and crack treatment and application temperature range.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 - 1. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of air barrier system.

1.7 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Provide mock-up areas using air and vapor membrane system, minimum 200 square feet, demonstrating the minimum standard for the Work.
- C. Locate mock-ups where directed and include all materials which are part of the air and vapor system. Incorporate as part of the mock-up area, substrate, window frame, attachment of insulation, and showing air and vapor barrier application details.
- D. Allow 72 hours for inspection of mock-up by Architect before proceeding with air/vapor barrier work. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Deliver and store waterproofing materials in new, sealed, containers showing manufacturer's identification, year of production, net weight, date of packaging, and location of packaging.
- B. Storage and Handling Requirements:
 - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 - a. Protect primers, mastic and adhesives from high heat, flames or sparks.
 - 2. Store all materials in an elevated, dry location, protected by waterproof coverings. Following manufacturer's recommended storage procedures for humidity and temperature conditions, protect materials from freezing.

1.9 SITE CONDITIONS

- A. Maintain ambient temperature above 30 degrees Fahrenheit for 24 hours or as recommended by the manufacturer before, during, and after installation until liquid or mastic accessories have cured.

1.10 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

B. Manufacturer Warranty:

1. Provide 5 year Manufacturer's product warranty which shall include replacement of defective materials.
 - a. Warranty shall include provisions for coverage of the following:
Membrane will bridge ruptures caused by cracking of the immediate substrate up to 1/16 inch width.

C. Special Warranty:

1. Provide 2 year Applicator's warranty or bond which shall include removal and replacement of defective materials, and repairs or replacement of Owner's materials and products damaged due to failure of waterproofing installation to resist water or moisture penetration.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Carlisle Coatings & Waterproofing Inc., Wylie, TX, product "Fire Resist™ 705 VP".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Carlisle Coatings & Waterproofing Inc., Wylie, TX. (Carlisle).
 2. Henry Company, Inc., Huntington Park, CA. (Henry).
 3. W.R. Grace & Co., Construction Products Division, Cambridge, MA. (Grace).
 4. Tremco, Inc., Beachwood, OH. (Tremco).

2.2 PERFORMANCE/DESIGN CRITERIA

- A. General: The air and vapor barrier shall have the following characteristics:
 1. Continuous with all joints made airtight.
 2. Air permeability not to exceed 0.002 L/s*m² under a pressure differential of 75 Pa. when tested in accordance with ASTM E 2178.
 3. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
 4. The air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of

systems due to thermal and moisture variations and creep. Transition connections shall be made between the following:

- a. Foundation and walls.
 - b. Walls and glazed aluminum curtain walls.
 - c. Different wall systems.
 - d. Wall and roof.
 - e. Wall and roof over unconditioned space.
 - f. Walls, floor and roof across construction, control and expansion joints.
 - g. Walls, floors and roof to utility, pipe and duct penetrations.
5. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

2.3 MATERIALS

- A. Product shall consist of nominal 0.023 inch (23 mils) thickness composite membrane consisting of an aluminum-faced cross-laminated high-density polyethylene sheet laminated with a styrene-butadiene-styrene modified asphalt adhesive.

1. Performance requirements:

REQUIREMENT	RESULT	TEST METHOD
Air Permeance	Not more than 0.002 L/s*m ² at 75 Pa (0.004 CFM/ft ² at 1.57 PSF)	ASTM E-2178
Tensile Strength	Not less than 40 lb _f per inch	ASTM D-882
Puncture Resistance	Not less than 50 lb _f	ASTM E 154
Tear Initiation and Propagation	Not less than 30 lb _f , machine direction and cross direction	ASTM D 4073
Low Temperature Flexibility	No cracking at minus 20 degrees F, 1 inch mandrel	ASTM D 1970
Fastener Sealability	No water leaking through fastener penetration after 24 h.	ASTM D 1970
Water Resistance	Membrane specimen including a lap shall resist a 55 cm (22 inch) column of water for 5 hours, no	AATCC-127, modified static head generated with 5" diameter PVC pipe sealed to

REQUIREMENT	RESULT	TEST METHOD
	leaking or wet through.	specimen
Pull Adhesion	Not less than 16 lbf per square inch (or report value at substrate failure) on glass-faced gypsum sheathing and concrete masonry unit, substrate prepared with contact adhesive	ASTM D 4541, modified 4 inch puck
Lap Adhesion	Not less than 1 lbf per inch of width	ASTM D 1876
Water Vapor Permeance	Not less than 10 perms	ASTM E-96, Method B
Surface Burning Characteristics.	Flame Spread Index: Not more than 25 Smoke Generation Index: Not more than 450	ASTM E 84, sample tested at full coverage, cement board substrate, including surface preparation"

2.4 Accessories:

- A. Sealants and primers as recommended by transition flashing (transition membrane) manufacturer and compatible with adjacent materials. Provide letters of compatibility from each manufacturer as required.
 - B. Lap Sealant: Manufacturer's two-part, elastomeric, trowel-grade material designed for use with self-adhered membranes and tapes 10 g/l max VOC content.
 - C. Lap Sealant assemblies to receive silicone sheet transition membranes.
 - D. Silicone sealant compatible with rubberized asphalt, and approved by both the sealant manufacturer and air barrier manufacturer for use as a lap sealant.
1. Acceptable Products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Tremco Commercial Sealants & Waterproofing, Beachwood, OH. Product: "Spectrem I".
 - b. Dow Corning Corporation, Midland MI, product "Dow 795 Silicone Building Sealant".
 - c. Pecora Corporation, Harleysville PA, product: "AVB Silicone Sealant".

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- d. Carlisle Coatings & Waterproofing Inc., Wylie, TX, product "Barribond Liquid Flashing and Detail Sealant".
 - E. Contact Adhesive: Liquid or spray-applied for preparing surfaces accepting air barrier membrane.
 - 1. Others: As acceptable to air barrier membrane manufacturer.
 - F. Detail Mastic: 1-part material for sealing details. Installation over air barrier membrane.
 - 1. CCW: Universal Single Ply Sealant
 - 2. Others: As specified by air barrier membrane manufacturer.
 - G. Fill Compound: 2-part chemical cure sealant, compatible with adhesive side of air barrier membrane.
 - 1. CCW: CCW-703 V Modified polyurethane, 2-part or CCW-201 Polyurethane, 2-part
 - 2. Others: As specified by air barrier membrane manufacturer.
 - H. Primer: As specified by air barrier membrane manufacturer.
 - I. Surface Conditioner: As specified by air barrier membrane manufacturer.
 - J. Polyurethane Sealant: used for sealing membrane surface defects, penetrations and terminations :
 - 1. Approved by CCW: Sonneborn NP-1, Dymonic FC, S-M 7100 Permthane Pro-Installer by Schnee-Morehead Div, ITW or Xtra-Bond 7500 TX by Premiere Industrial Supply
 - 2. Others: As specified by air barrier membrane manufacturer. Provide letter of compatibility from each manufacturer.
 - K. Silicone Sealant: used for sealing surface defects and penetrations.
 - 1. Approved by CCW: Dow-Corning 758, 790, 791 or 795 or Pecora AVB Silicone, 890, 891 or 895 or GE Silpruf or Silpruf LM
 - 2. Others: As specified by air barrier membrane manufacturer. Provide letter of compatibility from each manufacturer.
 - L. Polyurethane Foam Sealant: used for sealing gaps around penetrations not specified to be installed under other sections.
 - 1. Approved by CCW: Great Stuff by Dow Chemical Company, FireBlock, Gun Foam by TVM Building Products or Fireblock Foam Sealant by FOMO
 - 2. Others: As specified by air barrier membrane manufacturer. Provide letter of compatibility from each manufacturer.
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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Beginning of installation means acceptance of existing substrate and project conditions.
 - 2. Verify items which penetrate surfaces to receive air barrier and vapor barrier are rigidly installed.
 - 3. Verify surfaces are free of cracks, depressions, waves, or projections which may be detrimental to successful installation.
 - 4. Concrete Substrates: Notify the Contractor in writing if concrete substrate requires patching of holes over 1/2 inch in diameter or length and over 1/4 inch deep, by Section 03 30 00 - CAST-IN-PLACE CONCRETE. Do not proceed until patching is completed.
 - 5. Concrete Masonry Substrates: Notify the Construction Manager in writing if concrete unit masonry substrate requires filling of voids and holes greater than 1/2 inch, gaps and joints exceeding 1/4 inch, or surface irregularities greater than 1/4 inch, or other corrections required by Section 04 20 00 – UNIT MASONRY, for application of air barrier over concrete unit masonry.
 - 6. Do not apply air barrier and vapor barrier system to damp, frozen, dirty, dusty or surfaces unacceptable to membrane manufacturer.

3.2 PREPARATION

- A. Perform all preparation work on receiving surfaces as required, including removal of fins, scaling, and projecting rough spots. Remove all dirt, oil, and other foreign matter from the concrete surfaces. Clean substrate surfaces (broom, vacuum or compressed air) to remove dust, loose stones and debris.
- B. All masonry joints shall be filled and struck flush with the face of masonry and limestone, using a 3:1 mix of sharp sand and Portland cement mixed with a one part bonding agent to five parts water, and allowed to cure.
- C. Apply primer as recommended by manufacturer at a rate of 250 to 350 square feet per gallon; Prime only the area which will be covered with membrane in a working day, areas not covered with membrane in 24 hours must be reconditioned.
- D. Prepare inside corners by installing a fillet of liquid membrane, latex modified cement mortar or epoxy mortar, extend 6 inches in all directions beyond the corner.
- E. Cracks and joints in substrate surface must be properly sealed with waterstop, joint filler and sealant as recommended by the sheet membrane waterproofing manufacturer.

3.3 APPLICATION

- A. Perform the application of the sheet membrane air barrier and vapor barrier system in strict accordance with the manufacturer's installation specifications, details, and recommendations, and as specified herein.
- B. Condition and prime substrate surfaces:
 - 1. When required by dirty or dusty site conditions; by surfaces having irregular or rough texture, or if it becomes difficult to adhere the air and vapor barrier to the substrate, apply surface conditioner by spray, brush, or roller at the rate recommended by manufacturer, prior to membrane installation. Allow surface conditioner to dry completely before membrane application.
 - 2. Apply a bead or trowel coat of mastic along membrane edges, seams, cuts, and penetrations.
 - 3. Apply primer by brush or heavy nap, natural-material roller at rate recommended by manufacturer prior to membrane installation. Allow primer to dry completely before membrane application.
- C. Application of Membrane:
 - 1. Precut pieces of air & vapor barrier into easily-handled lengths.
 - 2. Remove silicone-coated release paper and position membrane carefully before placing length horizontally against the surface.
 - 3. Begin installation at the base of the wall placing top edge of membrane immediately below any masonry reinforcement or ties protruding from substrate.
 - 4. When properly positioned, place against surface by pressing firmly into place. Roll membrane with extension-handled countertop roller immediately after placement.
 - 5. Overlap horizontally-adjacent pieces 50 mm (2") and roll seams.
 - 6. Subsequent sheets of membrane applied above shall be positioned immediately below masonry reinforcement or ties. Bottom edge shall be slit to fit around reinforcing wires or ties, and membrane shall overlap the membrane sheet below by 50 mm (2"). Roll firmly into place.
 - 7. Seal around masonry reinforcing or ties and all penetrations with termination mastic.
 - 8. Continue the membrane into all openings in the wall, such as doors, windows, etc., and terminate at point 3 inches (minimum) beyond interior face of frame. Prevent visibility from interior locations where 3 inch termination is not possible.

9. Coordinate the installation of air and vapor barrier with roof installer to ensure continuity of membrane with rooftop air and vapor membrane.
10. At end of each working day seal top edge of air and vapor barrier to substrate with termination mastic.
11. Do not allow the rubberized asphalt surface of the air and vapor barrier membrane to come in contact with polysulfide sealants, creosote, uncured coal tar products or EPDM.

3.4 INTERFACE WITH OTHER WORK

- A. Coordinate the work of this Section installation of windows and door frames. Ensure air and vapor barrier transitions from windows and door frames is completed.

3.5 FIELD QUALITY CONTROL

- A. Field inspection will be performed under the provisions of Section 01 45 00 - QUALITY CONTROL.
 1. Fully inspect air and vapor barrier installation, including transitions, prior to enclosing. Repair punctures, damaged areas and inadequately lapped seams with a patch of the membrane sized to extend 150 mm (6") in all directions from the perimeter of the affected area.
- B. Manufacturer Services: Make arrangements to have Manufacturer's representative (employed by manufacturer) on-site during work of this Section to periodically review installation procedures. A minimum of 3 site visits are required.

3.6 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris, and scraps.

3.7 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
- B. Do not expose air and vapor barrier membrane to sunlight for more than thirty days prior to enclosure.

End of Section

Section 07 42 13
METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install preformed metal wall panel system which includes, but is not limited to:
 - 1. Non-insulated metal panel system.
 - 2. Related flashing adapters, copings, trim and filler components indicated as integral parts of the panel system or as designed.
 - 3. Sub-assemblies, anchorages, shims, furring, fasteners, gaskets, and sealant associated with the work of this Section.
 - 4. Thermally isolated façade attachment vertical girt system.
 - 5. Continuous termination stiffener at termination metal and change of direction of thermally insulated façade system and locations to secure semi-rigid insulation.
 - 6. Continuous termination metal.
 - 7. Continuous metal flashings and hookstrips at curtain wall system heads.
 - 8. Continuous metal sill flashing at canopy gutter.
 - 9. Continuous sealant behind metal through wall flashing.
 - 10. Semi-rigid mineral wool board insulation system behind metal wall panel construction assembly or as otherwise noted, including semi-rigid mineral wool board insulation, compatible adhesives for attachment to air barrier membrane, retention clips, and related accessories.

1.2 RELATED SECTIONS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 04 20 00 - UNIT MASONRY: Preparation of adjacent masonry work.
- C. Section 05 40 00 - COLD-FORMED METAL FRAMING: Structural wall framing.
- D. Section 07 21 00 – THERMAL INSULATION:
- E. Section 07 27 13 – MEMBRANE AIR BARRIERS: Membrane air barrier.
- F. Section 07 53 23 – EPDM ROOFING: Membrane roofing and related insulation.
- G. Section 07 62 00 – SHEET METAL FLASHING AND TRIM:
- H. Section 07 71 00 - ROOF SPECIALTIES: Metal coping at parapet edge and top of metal panel system wall.
- I. Section 07 92 00 - JOINT SEALANTS: Requirements for sealant and backing materials.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
1. AAMA 620 - Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Aluminum Substrates.
 2. AAMA 621 - Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.
 3. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
 4. ASTM A 653 Structural Quality Grade 37 (A 653M), Steel Sheet, Zinc-Coated, (galvanized) by the hot-dip process, structural (physical) quality with coating applied in accordance with A 924 (A 924M) general requirements for Steel Sheet, Zinc-Coated (galvanized) by the hot-dip process.
 5. ASTM A 755 – Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 6. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 7. ASTM B 209 - Specification for Aluminum and Aluminum Alloy Sheet and Plate.
 8. ASTM C 754 - Specification for Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products.
 9. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants.
 10. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
 11. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
 12. ASTM E 283 - Rate of Air Leakage through Exterior Entrance and storefront, Curtains Walls and Doors.
 13. ASTM E 331 - Test method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 14. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA): Architectural Sheet Metal Manual.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 2. Manufacturer's instructions: Manufacturer's installation instructions indicating special procedures, and perimeter conditions requiring special attention.

3. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
4. Shop drawings:
 - a. 1/4 inch scale elevations indicating panel jointing.
 - b. Large scale design details of wall system; indicating sizes, types, and gauges of all metal components; expansion provisions, sealant details, indicating types and thickness of bracing and stabilizing members; attachment clips and brackets; and complete installation details.
 - c. Design engineering shall be the responsibility of the wall systems manufacturer; details may vary from those indicated on the Contract Drawings.
5. Selection Samples:
 - a. Sample card indicating Manufacturer's full range of coating colors available for selection by Architect.
 - b. Provide physical samples as requested by Architect for initial selection of colors and finishes
 - c. Manufacturer's sample boards for sealant colors, for selections by the Architect.
6. Verification Samples:
 - a. After receipt of selected standard colors from the Architect, submit at least two 12-inch long pieces of major metal extruded components of the systems, and 12 by 12 inch samples of finished sheet metal used for trim components, prefinished in the specified finish system in selected colors.
7. Performance: Indicate how design requirements for loading and other performance criteria have been satisfied.

1.5 QUALITY ASSURANCE

- A. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1.6 QUALIFICATIONS

- A. Manufacturer Qualifications: Minimum of 10 years experience in manufacturing of architectural metal wall panels.
- B. Applicator, with a minimum of 5 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Deliver all materials packaged, boxed, wrapped or otherwise protected to assure complete protection from damage during shipment.

- C. Handle, store and protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
 - 1. Storage method shall provide air circulation and protection from surface staining.
- D. Damaged material: Inspect delivered materials for damage and stains upon their arrival at the site. Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.8 FIELD MEASUREMENTS

- A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
- B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Maintain substrate surface temperature above 50 degrees Fahrenheit for 24 hours before, during, and 48 hours after installation of joint sealant.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for interfacing work.

1.11 WARRANTY

- A. Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 - 1. Manufacturer's written warranty for wall panel systems, covering repair or replacement of any system which leaks, or exhibits defects in materials, finish, design, within 2 years from date of substantial completion of the General Contract. Failure due to defective materials or workmanship is deemed to include, but not to be limited to:
 - a. Failures in operation of operating component or components.
 - b. Leakage or air infiltration in excess of the specified standard.
 - c. Deterioration of finish to an extent visible to the unaided eye.
 - d. Defects which contribute to unsightly appearance, potential safety hazard, or potential untimely failure of the work of this Section or the Work as a whole.
 - 2. Provide 10 year warranty on polyvinylidene fluoride enamel finish which shall include covering the applied finish against defects, including color fading, chipping, crazing, pitting, and delamination.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Centria Architectural Systems, product "Concept Series Exposed Fastener Panels, MR3-36".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Centria Architectural Systems, Moon Township, PA.
 - 2. IMSA Building Products, Inc., Los Angeles CA.
 - 3. Metal Sales Manufacturing Corporation, Rancho Cucamonga CA.

2.2 SYSTEM DESCRIPTION

- A. Single-skin, exposed fastener, metal wall panels applied as exterior rainscreen cladding over wall framing and exterior sheathing, membrane air barrier and insulation. Metal wall panel installation specified in this Section includes secondary metal sub-girt framing and mounting clips for panel attachment.

2.3 PERFORMANCE REQUIREMENTS

- A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with the 2021 International Building Code with Massachusetts Building Code, Tenth Edition amendments.
- B. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, per ASTM E 72:
 - 1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated in the 2021 International Building Code with Massachusetts Building Code, Tenth Edition amendments but in any case not less than 100 miles per hour.
 - 2. Limits of Deflection: Metal wall panel assembly shall withstand scheduled wind pressure with the following allowable deflection:
 - a. Maximum allowable deflection limited to L/180 deflection of panel perimeter normal to plane of wall with no evidence of failure.
 - 3. Secondary Metal Framing: Design secondary metal framing for metal wall panel assembly according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
- C. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures in accordance with the 2021 International Building Code with Massachusetts Building Code, Tenth Edition amendments. Accommodate movement of support structure caused by thermal expansion and contraction.

2.4 MATERIALS - GENERAL

- A. Substrate: Steel substrate, hot-dipped galvanized to G-90 and conforming to ASTM A 653, Grade A, and ASTM A 755 having a minimum yield strength of 33,000 psi.

1. The galvanized steel shall be specified as having minimum spangle to assure proper adhesion and coating performance.
 2. The galvanized steel surface shall be properly cleaned and prepared with an approved pretreatment.
- B. The flashing and trim shall be of the same material, gauge, finish and color(s) as the panels, unless otherwise indicated.

2.5 METAL WALL PANELS

- A. Factory-formed exposed fastener panels with interconnecting side joints, fastened to supports with exposed fasteners, with factory-applied sealant in side laps where required to meet performance requirements.
1. Profile: Centria MR3-36 or approved equal, horizontal orientation.
 2. Face sheet: Thickness 0.036 inch (20 gage, 0.91 mm) nominal, uncoated.
 3. Surface: Smooth.
 4. Panel coverage: 36 inches.
 5. Rib Spacing: 3 at 12 inches (305mm) o.c.
- B. Panel lap joints: Provide manufacturer's standard four corner intersection complying with Centria standard detail CS-6019 or approved equal.

2.6 ACCESSORIES

- A. Closures:
1. Provide pre-molded flexible, cross-linked, closed-cell, polyethylene foam to fit the contour of the panel specified where indicated on approved shop drawings.
 2. Provide metal closures manufactured from material that is the same finish and color of the adjacent metal panels and furnished where shown on drawings.
- B. Sealant: Type "SE" and backer materials as specified under Section 07 92 00 - JOINT SEALERS.
- C. Sub-girts and Z-furring: Steel, hot-dipped galvanized to G90 coating, designed to accommodate expansion and contraction, dynamic movements and design load requirements; provide plastic shims as thermal separator between extrusions and sub-girts.
1. Subgirts shall be roll-formed from 16 gage minimum.
 2. Subgirts shall be located at each structural building support and not more than 4 feet on center between supports.
- D. Negative pressure clips: Designed for use with panel system and to assist in resisting high pressure conditions. Clips shall be 22 gage spring steel with no additional fasteners required. Locate clips at each subgirt.
- E. Thermally Insulated Façade Attachment System: Manufacturer's engineered shape fabricated from pultruded thermosetting, fire retardant, fiberglass reinforced isophthalic polyester resin size as shown on Drawings, thickness as required by manufacturers engineers calculations.

1. Acceptable Manufacturers and products: Subject to compliance with the requirements specified herein, Manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Basis of Design: Knight Wall, Deer Park, WA, product Knight Wall Cladding KWS MFI™ System Rainscreen
 - b. SFS Nvelope, product "NH2 System".
 - c. EcoCladding, Solana Beach, CA, product "Alpha HC110".
 - d. Manufacturers and systems not listed as basis of design and approved for use on the project must include all products, and accessories to equal or exceed basis of design as detailed.
 - e. Spacing, quantities, and layout of thermally insulated façade attachment system as shown on construction documents is to establish the general location of the girts within the assembly. Provide design and shop drawings of assembly based the engineered calculation requirements in conjunction with construction document design intent.
- F. Support system framing: Steel, "Z" or hat shaped furring hot-dipped galvanized to G90 coating, designed to accommodate expansion and contraction, dynamic movements and design load requirements; provide plastic shims as thermal separator between extrusions and subframe/furring assembly.
Basis of design: Knight Wall, Deer Park, WA, product PanelRail™
 1. Subframe/furring assembly shall be roll-formed from 16 gage minimum.
 2. Subframe/furring assembly shall be located at each structural building support and not more than 4 feet on center between supports unless otherwise indicated on the Drawings.
- G. Fasteners: Self-tapping screws, bolts, nuts, and other acceptable fasteners recommended by panel manufacturer. All exposed fasteners must be stainless steel with heads matching color of metal wall panels by means of factory-applied coating. Color as selected by the Architect.
- H. Semi-rigid mineral wool board insulation: Mineral wool fiber insulation board, conforming to ASTM C612, Type IVB having a nominal density of 4.4 pounds per cubic foot.
 1. Non-Combustible as tested per ASTM E-136.
 2. Flame Spread Classification: Class A (less than 25, per testing by NFPA 255, ASTM E-84 or UL 723), with flame spread rating of 0 and smoke developed rating of 0.
 3. Thermal Resistance: ASTM C518 (C177), R-value of 15 minimum at 3.5 inches thick.
 4. Thickness: 3.5 inches.
 5. Acceptable products include the following or approved equal:
 - a. Roxul, Inc., Milton, Ontario, product "CavityRock".
 - b. Owens Corning, Wabash IN, product "Thermafiber, RainBarrier 45."
 - c. Johns Manville, Inc., Denver CO. product: "MinWool Curtainwall CW4".

2.7 FINISHES

- A. Factory Finish: Equal to Centria "Duragard System":

1. Shop-applied, fully oven cured Polyvinylidene Flouride (PVDF) resin based, high performance thermoplastic organic coating applied to all exposed surfaces, including all exposed screws, fastenings, etc., having a minimum total film thickness of 1.5 mils and conforming to AAMA 2605, NAAMM - Metal Finishes Manual, and the following:
 - a. Resin base of 70 percent PVDF by weight.
 - b. Surface Preparation: Properly clean metal substrate with inhibited chemical cleaner and pretreat with acid chromate-fluoride-phosphate conversion coating.
 - c. Primer: Corrosion resistant, polyvinylidene flouride based primer compatible with finish coating, averaging 0.8 mils dry film thickness on exterior and interior surface of panels.
 - d. Finish Coat: Polyvinylidene flouride enamel 0.8 mils dry film thickness on exterior side of panels.
2. Color: As approved by the Architect to match adjacent existing metal wall panels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 1. All structural supports shall be in place and all sag rods, diagonal bracing and connections shall be tightened before work proceeds.
 2. Field check dimensions and check support alignment with a taut string or wire; support misalignment will cause panel "oil-canning".
- B. Beginning of installation means acceptance of substrate and project conditions.

3.2 INSTALLATION

- A. Install metal panels, fasteners, trim and related items in conformance with approved drawings and performance requirements as set by system manufacturer.
- B. Protect installed panels from abuse by other trades. The general contractor shall be responsible for protecting the panels from wet cement, plaster, painting operations, etc.

3.3 TOLERANCES

- A. Maximum variation from plumb or level: 1/8 inch.
- B. Maximum offset from true dimensional alignment: 1/4 inch.

3.4 DAMAGED MATERIAL AND CLEANING

- A. Replace damaged panels and other components of work which cannot be repaired by finish touch-up or similar minor repair.
- B. To prevent rust staining, remove immediately from finished surfaces any filings caused by drilling or cutting.

- C. Wipe down each area after erection is complete for final acceptance.

3.5 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

Section 07 53 23
ETHYLENE PROPYLENE DIENE MONOMER (EPDM) ROOFING
(FILED SUB-BID REQUIRED AS PART OF SECTION 07 00 02)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Contract Requirements: As provided under Section 07 00 02 – ROOFING FILED SUB-BID CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Sub-Contract includes all individual specification sections listed in Section 07 00 02.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Ethylene propylene diene monomer (EPDM) fully adhered single ply membrane roofing system.
 - 2. Flat insulation including tapered crickets and drain sumps beneath the roofing work of this Section.
 - 3. Roof vapor barrier.
 - 4. Flashing at all penetrations through the roofing system and at all materials which abut roofing system.
 - 5. Metal roof edge and flashing.
 - 6. Provide walkway pads by roofing membrane manufacturer as indicated on Drawings.
 - 7. New tie in, penetrations and other work at the existing EPDM roof at the main building
- B. Install the following furnished under the designated Sections:
 - 1. PT plywood at perimeter of HVAC units where indicated on the drawings, furnished under Section 06 10 00 - ROUGH CARPENTRY
- C. Provide field testing of fasteners.
- D. Provide manufacturer's pre-construction and final inspection as specified herein. These inspections are to be included in the base bid; additional inspections, or work incurred as a result of the final inspection shall be without additional cost to the Owner.
 - 1. Work of this Section additional includes providing Owner assistance in the preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended insurance coverage of roofing and associated work.

1.3 RELATED REQUIREMENTS

- A. Section 01 73 00 - EXECUTION: Procedural and administrative requirements for cutting and patching.
- B. Section 024119 – SELECTIVE DEMOLITION: Removal of main old roofing and related materials.
- C. Section 04 20 00 - UNIT MASONRY: Concrete unit masonry curbs.
- D. Section 06 10 00 - ROUGH CARPENTRY: Pressure treated blocking, curbing and nailers.
- E. Section 07 21 00 - THERMAL INSULATION: Interior building insulation, below roof deck.
- F. Section 07 92 00 - JOINT SEALANTS: Sealants other than those specified in this Section 07 53 23.
- G. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Prefabricated curbs for roof mounted mechanical equipment.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C1177: Glass Mat Gypsum Substrate for Use as Sheathing.
 - 2. FM Roof Assembly Classifications and Loss Prevention requirements, I-28 and I-29S.
 - 3. UL Fire Resistance Directory.
 - 4. All applicable federal, state and municipal codes, laws and regulations for fire-resistance roof ratings.
- B. The following reference materials are hereby made a part of this Section by reference thereto:
 - 1. NRCA Roofing and Waterproofing Manual, latest printing.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Pre-installation Meetings:

1. Air Vapor Barrier Coordination Conference: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 07 27 13 - MODIFIED BITUMINOUS SHEET AIR BARRIERS.
2. Roofing Pre-Installation Meeting: At least two weeks prior to commencing the on-site work of this Section, conduct a pre-installation conference at the Project site. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
 - a. Required attendees: Owner, Architect, Contractor, Roofing Applicator's Project Superintendent, roof manufacturer's technical representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
 - 1) Section 06 10 00 – ROUGH CARPENTRY.
 - 2) Section 07 62 00 - SHEET METAL FLASHING AND TRIM.
 - 3) Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING.
 - b. Agenda:
 - 1) Scheduling of roofing operations.
 - 2) Review of staging and material storage locations.
 - 3) Coordination of work by other trades.
 - 4) Installation procedures for mechanical equipment.
 - 5) Protection of completed roofing.
 - 6) Establish weather and working temperature conditions to which Architect and Contractor must agree.
 - 7) Emergency rain protection procedure.
 - 8) Establish conditions for which a temporary roof will be provided by the Contractor.
 - 9) Discuss process for manufacturer's inspection and acceptance of completed roofing and flashings.
 - 10) Manufacturer's deck inspection to be performed.

C. Scheduling:

1. The Roofing applicator shall maintain communication with roofing manufacturer's representative to inform of installation progress, and to schedule period sample testing, and visual inspections.
2. Notify manufacturer's representative 48 hours in advance for deck acceptance. Plan the lay-up roofing membrane with respect to deck slope. Avoid situations where excessive drainage could pass into completed roofing.

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 2. Manufacturer's specimen warranties: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
 3. Certification:
 - a. Manufacturer's certification stating that roofing materials comply with specified ASTM and referenced trade standards.
 - b. Manufacturer's written certification stating that roofing and insulation products and all related items to be furnished hereunder, meet or exceed the requirements specified under this Section and that all FM and Underwriters Laboratories (UL) fire-resistive requirements for the indicated Labels have been met.
 - c. Submit roof manufacturer's certification that insulation fasteners and insulation furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.
 - d. Roof manufacturer's certification that roof system is approved by Factory Mutual (FM), Underwriters Laboratories (UL), Warnock Hersey (WH) or approved third party testing facility in accordance with ASTM E108, Class 1A for external fire and meets local or nationally recognized building codes.
 4. Review statement: Written statement, signed by the roofing applicator, stating that the Contract Drawings have been reviewed by an agent of the roofing system manufacturer; accompanied by a pre-installation written statement from the manufacturer that the selected roof system is proper, compatible, and adequate for the application shown.
 - a. The roofing applicator will notify the Architect and Owner in writing if the existing conditions when exposed are in conflict with the Contract Documents for the proper application of the selected roofing system or the warranty requirements.
 5. Roof manufacturer's installation progress reports: Provide minimum 3 field reports by the roofing system manufacturer's representative at these milestones:
 - a. Day one of roofing system installation to ensure complete understanding of the details and their execution.
 - b. One at 100 percent roofing system installation completion, which will include representative's punchlist.

- c. Final field report is to confirm all items on representative's punchlist was completed satisfactorily.
- 6. Project roofing superintendent's resume and project experience list for similar installations.
- 7. Shop drawings:
 - a. Setting plans for roofing insulation, thickness and direction of slopes.
 - b. Fully dimensioned 1/4-inch scale plans of roof. Indicate on plans, major areas of patching existing roofing and all areas of new roofing. Plans shall show changes in level, key locations of details, all roof penetrations, roof slopes and direction of slope. Indicate on plans any areas of proposed staging and material storage on roof.
 - c. Large scale design details, minimum of 1-1/2 inch per foot scale, showing perimeter flashing conditions and penetrations. Details shall show dimensions of actual measurements taken at the project and reflect actual conditions; manufacturer's standard preprinted details will not be accepted as substitute for shop drawings.
- 8. Verification samples :
 - a. Provide 8-1/2 by 11 inch samples of all roof system components.
 - b. Provide 12 inch long samples of each metal flashing type.
 - c. Furnish additional samples are requested by the Architect.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 - 1. Manufacturer's field quality control reports of field inspections, including, revised "as-built" shop drawings and manufacturer's final punch list.
 - 2. Manufacturer's warranties: Include coverage of materials and installation.

1.7 QUALIFICATIONS

- A. Roofing manufacturer, with a minimum of 10 years documented experience demonstrating previously successful work of the type specified herein.
- B. Roofing subcontractor/installer's supervisor/foreman: minimum of 5 years documented experience of the type specified herein, and trained by product manufacturer.
 - 1. Installer to maintain a full-time supervisor/foreman on the job site for all phases of roofing work and at all times when roofing work is in progress.

1.8 QUALITY ASSURANCE

- A. Single source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of roofing system membrane.

1. All roofing materials shall be provided and approved by the roof system manufacturer. Any materials not manufactured or provided by manufacturer shall have written approval from the manufacturer stating the materials are acceptable and are compatible with the other materials and systems required.
- B. Manufacturer's On-site Inspections: Make arrangements to have Manufacturer's representative (employed by manufacturer) be present on-site during the Work of this Section at key points at no additional cost to the Owner, which include, but are not limited to:
 1. Pre-installation conference.
 2. Review of installation procedures (a minimum of 3 site visits are required).
 3. Inspection of installation prior to flood testing.
 4. Final inspection at the completion of the project to insure, that the project has been completed in accordance with the manufacturer's requirements. Upon approval and acceptance of the project, then a manufacturer's warranty certification shall be written, executed and furnished to the Owner.
- C. Submit Manufacturer's field quality control reports of field inspections, including, revised "as-built" shop drawings and manufacturer's final punch list.
- D. UL listing: Provide labeled materials which have been tested and listed by UL in "Building Materials Directory" for application indicated, with "Class A" rated materials/system for roof slopes shown.
- E. Fire performance characteristics: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction:
- F. The roof system manufacturer's Technical Specifications shall be considered a part of this specification and should be used as a reference for specific application procedures and recommendations. Where a conflict does exist between the manufacturer's written specifications and those procedures specified in this Section, the more stringent requirements meeting the Manufacturer's minimum requirements for the provided warranty shall apply.
 1. Roofing Trade Contractor shall provide at no additional cost to this contract, all additional labor and materials to conform to manufacturer's required installation procedures which are necessary to provide a total roofing system which is in full compliance with manufacturer's warranty requirements, including additional materials, installation procedures, manufacturer's inspections, sample testing and other requirements.
 2. Maintain clean and easily accessible copy of the roof system manufacturer's Technical Specifications on-site at all times during roofing work.

1.9 REGULATORY REQUIREMENTS

- A. Roofing system, including insulation and substrate, shall meet Underwriters Laboratories, Inc. Fire Hazard Classification "Class A" roof.
- B. Refer to applicable building codes for roofing system installation requirements and limitations. When a conflict exists, the more restrictive document will govern.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's original, unopened containers or packages with labels and package seals intact and legible.
- B. Store all materials in accordance with the manufacturer's recommendations. Store rolled goods on clean, raised platforms. Store other materials in dry areas, protected from water and direct sunlight.
- C. Do not expose stored curable roofing materials and accessories, including uncured flashing, adhesives, sealant and pourable sealer, to a constant temperature in excess of 80 degrees Fahrenheit.
- D. Provide continuous protection of stored materials against deterioration for duration of project.
- E. Store insulation on dunnage and completely cover with a water-resistant breathable material. Provide weights to prevent wind damage to insulation.
- F. Distribute any materials stored on roof levels for immediate use to prevent concentrated loads that would impose excessive strain on deck or structural members. Protect roof stored materials to prevent displacement by the wind and protect from exposure to inclement weather and sun.
- G. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Apply roofing in dry weather; do not install roofing in inclement weather or when precipitation is predicted with greater than 20 percent possibility.
- B. Do not apply roofing membrane to damp or frozen deck surface.
- C. Apply roofing when ambient temperature is above 40 degrees Fahrenheit.

1.12 WARRANTY

- A. Deliver to the Owner upon completion of the work of this Section, an unconditional warranty, on the work of this Section agreeing to promptly repair the roofing as necessary to prevent penetration of water through it.

1. Warranty shall cover product quality, performance, and workmanship for a period of 15 years.
2. Warranty shall cover total roofing system including roof board, membrane, insulation, vapor barrier, cover board, adhesives, sealant, fasteners, membrane flashings, metal flashings and other materials furnished and installed under this Section.
3. Warranty shall provide coverage for uplift created by maximum wind speed of 72 miles per hour (measured 10 meters above grade).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Carlisle Syntec, Carlisle PA.
 2. Firestone Building Products Co., LLC, Indianapolis, IN.
 3. Mule-Hide Products Co., Inc., Beloit, WI.

2.2 SYSTEM DESCRIPTION

- A. Fully adhered Ethylene propylene diene monomer (EPDM) roofing system, including insulation and substrate, shall meet Underwriters Laboratories, Inc. Fire Hazard Classification "Class A" roof.
- B. Performance Requirements
 1. Wind Loading: Panels and installation shall be designed to conform to Massachusetts State Building Code, Ninth Edition, (780 CMR 1609) for basic wind speed of 100 miles per hour (3 second gust).
 - a. Additional Wind Uplift Performance Requirements: Design and construct roofing to in accordance with requirements of FM 1-28 for Roof System Approval Rating of FM 1-75.
 2. Above-deck roof components shall be designed and installed in accordance with requirements of FM 1-29 for performance requirements specified above.

2.3 ROOFING MATERIALS

- A. EPDM membrane: Elevate, formerly Firestone Building Products, are detailed on the Drawings and Specifications and shall establish the minimum level of quality, performance, dimension, and appearance required.
 1. Description: Provide RubberGard EPDM Fully Adhered Roofing System, manufactured by Firestone Building Products, or approved equal. Provide elastomeric roofing system consisting of adhered single-ply EPDM sheet.
 - a. Membrane: Provide 0.060 inch thick "Rubber-Gard EPDM Roof Membrane" ultraviolet and ozone resistant, or Architect approved equal.

- b. Flashing: Provide "Rubber-Gard FormFlash" self-curing membrane flashing, ultraviolet and ozone resistant, 0.060 inch minimum thickness where concealed. Flashing shall match roof membrane.
 - c. Color: Black
- B. Sheet seaming system: Manufacturer's standard materials for sealing lapped joints, including edge sealer to cover exposed spliced edges.
- C. Cant strips, tapered edge strips and flashing accessories: Types recommended by manufacturer of EPDM material, provided at locations indicated and at locations recommended by manufacturer, including adhesive tapes, flashing cements, and sealant.
- D. Flashing material: Manufacturer's standard system compatible with flexible sheet membrane.
- E. Membrane adhesive: As recommended by EPDM membrane manufacturer for particular substrate and project conditions, formulated to withstand min. 60 psf uplift force.
- F. Membrane primer: As recommended by EPDM membrane manufacturer for particular substrate and project conditions.

2.4 INSULATION MATERIALS

- A. General: Insulation shall be approved by the roof manufacturer, and shall be UL listed and FM approved.
- B. Acceptable manufacturers: Subject to acceptance of roofing manufacturer and the following specification requirements:
 - 1. Atlas Roofing Corporation, Atlanta, GA.
 - 2. The Dow Chemical Co., Midland, MI.
 - 3. Hunter Panels, Portland ME.
 - 4. Johns Manville Roofing System, Denver, CO.
- C. Polyisocyanurate foam insulation manufactured with HCFC 14 pound blowing agent and bonded to glass fiber reinforced facers on top and bottom surfaces during the manufacturing process. Insulation shall conform to property requirements of FS HH-I-1972/GEN and FS HH-I-1972/2.
 - 1. Insulation entirely above roof deck: U-Factor of 0.32 maximum.
 - 2. Density: 2.0 pounds per cubic foot (ASTM D-1622).
 - 3. Compressive strength: 25 psi, Grade 3, (ASTM D1621).
 - 4. Moisture vapor transmission: Less than 1 perm (ASTM E-96).
 - 5. Water absorption: Less than 1 percent per volume (ASTM C209).

6. Provide tapered insulation system as required to meet elevations and slopes shown on drawings or as required by membrane manufacturer, whichever is more stringent. Provide cants, crickets, and sumps at drains.

2.5 ROOF EDGE FASCIA SYSTEM

- A. Acceptable Manufacturer: Provide roof edge fascia system, acceptable to the single-ply roofing system manufacturer as a component of the total system roofing warranty, as manufactured by Firestone Building Products or approved equal.
- B. Material: 0.050 inch thick aluminum
 1. Roof edging shall lock membranes, preventing wind pullback.
 2. Fascia shall freely thermal cycle on waterdam, preventing periodic maintenance.
 3. Roof edge fascia system shall be FM 1-75 approved.
- C. Sub-fascia waterdam shall be 0.050 inch thick aluminum. Roofing membrane shall extend below the sub-fascia and overhang to the roof edge of the clip.
- D. Fascia Height: As dimensioned on the Drawings. Roofing Contractor shall be responsible for all field dimensions.
- E. Finish: Kynar 500; color as selected by Architect from manufacturer's FULL line of available colors.
- F. Fascia: Provide minimum 10 foot lengths with matching concealed joint splice plates.
- G. Fasteners: as recommended by manufacturer. No exposed fasteners permitted.
- H. Accessories:
 1. Provide Contractor fabricated mitered corners, fascia scuppers, spillouts, etc.
 2. Provide matching ledge caps, scuppers, downspouts, and other special fabrications as indicated on Drawings.

2.6 ROOF WALKWAY PADS

- A. Acceptable Manufacturer: Provide roof walkway pads, acceptable to the single-ply roofing system manufacturer as a component of the total system roofing warranty, as manufactured by Firestone Building Products or approved equal.
- B. Material: QuickSeam Walkway Pad
- C. Description: Rubber walkway pads with textured walking surface and QuickSeam Tape factory-laminated to bottom of pad.
- D. Size: 30 inch x 30 inch x 0.30 inch thick.

2.7 ACCESSORIES

- A. Vapor Barrier: Polymeric air/vapor barrier membrane protected by release paper on cross-laminated polyethylene carrier film with exposed polymeric membrane strips on both sides protected by pull-off release strips.

1. Water vapor permeance (free film): ASTM E 96, Procedure B: 0.035 Perms.
2. Acceptable products include the following or approved equal:
 - a. Carlisle Syntec, product: "VapAir Seal 725TR" air and vapor barrier.
 - b. Firestone, products "V-force" membrane.
 - c. W.R. Meadows, Inc., Hampshire, IL., product "Air Shield Air/Vapor Barrier System".
 - d. Substitutions: Roofing manufacturer's proprietary vapor barriers will be considered as acceptable alternative.
- B. Adhesive to bond insulation to insulation, and insulation to overlayment board: manufacturer's standard single-component, moisture-curing polyurethane adhesive.
- C. Bonding adhesive shall be as recommended by manufacturer. Adhesive shall be compatible with all materials to which the elastomeric membrane is to be bonded.
- D. Splicing cement and in-seam sealant shall be as recommended by membrane manufacturer.
- E. Lap sealant for sealing the exposed edge of the splices shall be trowel on gun consistency as recommended by membrane manufacturer.
- F. Water cutoff mastic shall be as recommended by membrane manufacturer.
- G. Night sealer shall be as recommended by membrane manufacturer.
- H. Pourable sealer for penetration pockets, preparation of decking and wall substrates shall be as recommended by membrane manufacturer.
- I. Prefabricated elastomeric accessories (pipe seals, inside and outside corners) shall be as manufactured and recommended by membrane manufacturer.
- J. Expansion Joints: Manufacturer' standard bellows type expansion joint, sized for conditions indicated on Drawings.
 1. Expansion joint flashing: Uncured EPDM flashing, 0.060 inch thick.
 2. Expansion joint supports: foamed EPDM expansion joint as recommended by roofing manufacturer. Provide in profile(s) detailed on the Drawings.
 3. Expandable filler: Ceramar flexible filler manufactured by W.R. Meadows, or approved equal.
- K. Termination bars: Minimum 1/8 inch thick extruded aluminum, of channel profile with 1/4-inch legs and minimum 1 inch width. Termination bar shall be factory punched to accept fasteners 4 inches on-center. Install with stainless steel screw fasteners.
- L. Masonry fasteners: Round head stainless steel screw and neoprene washer with lead expansion anchor as recommended by membrane manufacturer.

Manufacturers offering masonry fastener products which may be considered equal, include the following:

1. Dur-O-Wal Inc., Dayton, OH.
 2. Hilti Corporation, Tulsa OK.
 3. Rawlplug by the Rawlplug Company, Inc., New Rochelle NY.
- M. Fasteners: Austenitic stainless steel or steel fastener with fluorocarbon coating. Minimum thread diameter 0.22 inches and minimum shank diameter of 0.172 inches. The fastener must have 11 threads per inch and a 30° spade.
- N. Miscellaneous materials: Best grade or quality approved by the roofing manufacturer for the specific application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Verify edge nailers, curbs and penetrations are in place prior to roofing, so that the roof system can be installed as continuously as possible.
- C. Verify the roof deck, and related surfaces are clean, smooth, flat, free of depressions, waves, or projections, properly sloped to drains, and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Any condition requiring correction or completion shall be corrected or completed prior to the installation of the roofing system Notify Contractor of unacceptable conditions.
- F. Do not proceed until defects are corrected.
- G. Verify sizing of existing roof drain plumbing.
- H. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. During the operation of work of this Section, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.
- B. Where surface joints at roof and wall substrates exceed 1/4-inch width, fill flush with surface with pourable sealer before proceeding with the installation.

3.3 EMERGENCY MATERIALS AND PROCEDURES

- A. Maintain continuous temporary protection prior to and during installation of new roofing system. Do not leave unfinished roof areas uncovered over-night or during inclement weather.
 - 1. Provide temporary protective sheeting over uncovered deck surfaces.
 - 2. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights or temporary fasteners.
 - 3. Provide for surface drainage from sheeting to existing drainage facilities.
 - 4. Do not permit traffic over unprotected or repaired deck surface.
- B. Maintain on site equipment and materials necessary to apply emergency temporary coverage in the event of sudden storms or inclement weather.
- C. Do not install more insulation than can be covered by roofing system in the same workday. Do not apply more roofing than can be properly fastened and sealed in the same workday. Ensure that water does not flow beneath any completed sections of the roofing system, provide temporary closures.
- D. Temporary Roofing Systems
 - 1. Install temporary roofing system in accordance with the sequencing and coordination requirements as specified in Section 01 10 00, SUMMARY, and as required to maintain a watertight condition at occupied areas located below the roof area.
 - 2. Temporary roofing system shall consist of roofing membrane and flashing as specified for the new roofing system.
 - 3. Provide flashings as recommended by the membrane manufacturer for the conditions encountered.
 - 4. Provide roofing accessories required for the installation and maintenance of the temporary roofing system.
 - 5. Coordinate with the work of other trades as they may be affected by the work of this Section.
 - 6. Remove and dispose of the temporary roofing system as required by the phasing and sequencing of the Work or when work has progressed to the point where such roofing system is not required to maintain a watertight condition.
 - 7. No portion of the temporary roofing system shall be reused as part of the permanent new roofing system.
- E. Roofing Trade Contractor is fully responsible for all damage due to water penetration occurring during the Work of this Section.

3.4 INSTALLATION - GENERAL

- A. The entire work of this Section shall be performed in accordance with the best standards of practice relating to trades involved.
- B. Follow local, state and federal regulations, safety standards and codes. When a conflict exists, the more restrictive document shall govern.
- C. Follow insurance underwriter's requirements acceptable for use with specified products or systems.
- D. Review all special conditions, such as at projections, at connections to sheet metal gravel stops, flashings with the Roofing Manufacturer, submit the Roofing Manufacturer's recommendations and details to the Architect for approval.
- E. Special Cautions:
 - 1. Do not use oil-based or plastic roof cement.
 - 2. Do not subject elastomeric materials to contact with petroleum, grease, oil, solvents, vegetable or mineral oil, nor animal fat. Prevent contact with hot pipes, and ducts.
 - 3. Cements and bonding adhesive contain petroleum distillates and are extremely volatile and flammable. Avoid breathing vapors and do not use near fire or flame.
 - 4. Ensure that splicing and bonding surfaces are dry during installation.

3.5 INSULATION INSTALLATION

- A. Place the constant thickness insulation of first layer and the subsequent tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- B. Secure roof insulation to substrate with mechanical anchors of type and spacing indicated by membrane manufacturer; but in no case provide less than one anchor per 4 square feet of surface area, or less anchorage than required by FM "Loss Prevention Data Sheet 1-28".
 - 1. Test fasteners for pull-out resistance as specified herein below under FIELD QUALITY CONTROL; report findings to Architect and roofing manufacturer.

3.6 MEMBRANE ADHERED INSTALLATION

- A. Apply adhesive at a rate of 60 square feet per gallon in manner recommended by manufacturer.
- B. Apply primer to surfaces as recommended by EPDM membrane manufacturer for particular substrate and project conditions.
- C. Roll out membrane and allow it to relax. Inspect sheet for defects as it is being rolled out. Align sheet so that it overlaps the previous sheet by the lap width recommended by the manufacturer, but not less than 3 inches.

- D. Fold membrane back on itself and coat the bottom side of the sheet and the top side of the deck with adhesive. Avoid getting adhesive in the lap joint area.
- E. After adhesive has been allowed to set in accordance with the manufacturers requirements, roll the membrane into the adhesive, free from air pockets, wrinkles, or tears. Firmly press sheet into place without stretching.
- F. Bond sheet to substrate except those areas directly over or within 3 inches of a control or expansion joint.
- G. Clean and dry splice joint areas of both membrane sheets. Apply splicing cement as recommended by manufacturer, and seal joint permanently waterproof. Apply uniform bead of sealant to joint splice.
- H. Provide additional membrane securement at the perimeter of roof, at expansion joints, curbs, skylights, and similar roof top penetrations, at interior wall and penthouse perimeter s, and at any angle change which exceeds 2 inches in on horizontal foot.
 - 1. Install continuous reinforcement strips 3 inches to 6 inches from inside and outside corners where additional membrane securement is required and where recommended by roofing manufacturer. Secure reinforcement strips with 2 -inch diameter aluminum or stainless steel seam fastening plates; space fastening plates not greater than 12 inches on center.
 - 2. Install reinforcement strips either horizontally into deck or vertically into curbs as recommended by roofing manufacturer.
 - 3. Cement EPDM flashing over installed fastening plates and reinforcement strips as recommended by roofing manufacturer, and in no case provide flashing of less than 6 inches in width, and at ends of flashing, provide a minimum 2 inch splice from edge of plate/strip.
- I. Extend membrane up cant strips and a minimum of 8 inches onto vertical surfaces.
- J. Install termination bars with screw fasteners and EPDM or neoprene washers, located 6 inches on center. Install roofing manufacturer's recommended sealant along top and bottom edges of termination bar.
- K. Seal membrane around roof penetrations.
- L. Walkway protection: Install additional membrane at locations shown and where required for access to roof-mounted equipment.
 - 1. Clean roofing membrane and fully adhere walkway pads as recommended by manufacturer's instructions.
- M. Provide daily night seal at loose edges to prevent water flow beneath finished roofing.
 - 1. Mix sealer components as instructed by manufacturer. Apply at rate of 1 gallon/100 linear foot, 12 inch. back from sheet edges on exposed substrate.

2. Embed membrane in sealer and apply continuous pressure with 2-1/2 inch tubing filled with sand. Pull sheet free before continuing permanent installation.

3.7 INSTALLATION - ELASTOMERIC FLASHINGS

- A. Elastomeric Flashings. Provide elastomeric sheet flashings at elastomeric sheet roofing work, as indicated.
 1. Use longest practical lengths and widths of elastomeric sheet flashing material to eliminate or minimize joints. Complete splices between flashings and main-roof sheet before bonding flashings to vertical surfaces. Splices shall be sealed 3 inches beyond fasteners that attach membrane to horizontal nailer in same manner as splices within roofing membrane. Flashings shall be bonded 100 percent to sub-surfaces, except at coves where movement is anticipated.
 - a. Install flexible tube at coves where movement is anticipated.
 2. Apply bonding adhesive to flashing and surface to which it is being bonded. When bonding adhesive has dried to the point where it does not string or stick to a dry finger touch, roll flashing into adhesive. Do not bridge flashing at changes of direction.
 3. Nail top of flashing 12 inches on center under sheet metal copings, counter flashing, and other sheet metal work.
 4. Expansion Joints: Treat expansion joints as indicated in expansion joint manufacturer's standard details and published instructions for specific conditions.
 5. Sheet metal copings, fascias, gravel stops, and flashings will be furnished and installed under Section 07 53 23 – ETHYLENE PROPYLENE DIENE MONOMER (EPDM) ROOFING.

3.8 FIELD QUALITY CONTROL

- A. General: Field inspections will be performed under the provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Roofing Subcontractor to correct all deficiencies in roof as determined by roof sample analysis and as prescribed by roof system manufacturer. Should additional samples be required, these costs will be borne by the roofing applicator.
- C. Prior to installation of roofing membrane, obtain an independent testing agency approved by the Architect and test six fasteners for each separate roofing area pull out resistance. Report findings to Architect and the roofing manufacturer. Perform testing without additional cost to the Contract.
- D. Provide final visual inspection of the Work by Manufacturer's technical representative and his/her written approval of installation, as precondition for issuance of Manufacturer's warranty.
 1. Assignment of the responsibilities of the Manufacturer's technical representative to a contractor or other agent is prohibited.

3.9 CLEANING

- A. Remove elastomeric adhesive markings from finished surfaces.
- B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.
- C. Repair or replace defaced, or disfigured finishes caused by the work of this Section.

3.10 PROTECTION

- A. Provide special protection or avoid traffic on completed work. Contractor is responsible to restore to original condition, or replace, work and roofing materials damaged by work of other trades.

End of Section

Section 07 62 00
SHEET METAL FLASHING AND TRIM
(TRADE CONTRACT REQUIRED AS PART OF SECTION 07 00 02)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Trade Contract Requirements: As provided under Section 07 00 02 - ROOFING AND FLASHING FILED TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 07 00 02.

1.2 SUMMARY

- A. General: The work of this Section consists of metal flashings and backing materials where shown on the Drawings, as specified herein, for a complete and proper installation.
 - 1. Canopy roof edge flashing and hookstrip as shown in roofing details.
 - 2. Galvanized steel brake metal gutter at canopy as detailed and noted.
 - 3. Galvanized steel drip edge at scupper.
 - 4. HVAC roof curb cap flashing.
 - 5. This Section specifies general requirements, definition of flashing types, and application requirements for sheet metal flashing and trim work specified within other individual specification sections.

1.3 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 04 20 00 - UNIT MASONRY
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, nailers.
- D. Section 07 00 02 – ROOFING AND FLASHING TRADE CONTRACT REQUIREMENTS: Trade Contract requirements for work of this Section.
- E. Section 07 53 23 – EPDM ROOFING
- F. Section 07 71 00 - ROOF SPECIALTIES: Factory fabricated and finished roof edging.
- G. Section 07 72 00 – ROOF ACCESSORIES
- H. Section 07 92 00 - JOINT SEALANTS: Sealant and backing material not specified herein
- I. Flashing sleeves and collars for mechanical and electrical items protruding through roofing: By respective trade sections furnishing same.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM A 666 -
 - 2. ASTM B 209 - Specification for Aluminum Alloy, Sheet and Plate.
 - 3. ASTM B 221 - Specification for Aluminum Extrusions.
 - 4. ASTM D 226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 - 5. ASTM D 2178 - Asphalt Impregnated Glass Mat for Roofing and Waterproofing.
 - 6. ASTM D 4586 - Asphalt Roof Cement, Asbestos-Free.
 - 7. FS QQ-A-250d - Aluminum and Aluminum Alloy, Plate and Sheet.
- B. The following reference materials are hereby made a part of this Section by reference thereto:
 - 1. SMACNA - Architectural Sheet Metal Manual 6th Edition, referred to herein as "Sheet Metal Manual".
 - 2. NRCA - Roofing and Waterproofing Manual.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's data sheets for each metal type and accessories furnished hereunder, include material specifications, performance data, physical properties and finishes.
 - 2. Certification: Provide certifications that materials and systems comply with the specified requirements for the use indicated.
 - 3. Shop drawings:
 - a. Fully dimensioned large scale design details showing material profiles, splices, flashing terminations and other jointing details, fastening methods and installation details. Indicate material type, sizes, and weights or gages. Indicate extent of adjacent work specified under other Sections of the Specifications.
 - b. Fully detail methods of relieving stresses due to thermal movement, including sealing of expansion seams.
 - c. All details bearing dimensions of actual measurements taken at the project.
 - 4. Selection Samples:
 - a. Color samples: Architect to select custom color including colors designated by the coating manufacturer as premium or metallic colors. Up to two colors may be selected. Architect to provide color samples.
 - b. Provide physical samples as requested by Architect for initial selection of colors and finishes.

- c. Manufacturer's sample board for sealant colors, for selections by the Architect.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 - 1. Manufacturer's warranties: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.
- 1.6 QUALITY ASSURANCE
 - A. Company specializing in fabrication and installation of sheet metal flashing work with minimum 5 years documented experience.
- 1.7 MOCK-UP
 - A. Provide mock-up elements for field panel in accordance with Section 01 43 39 – MOCKUPS at exterior location where directed by Architect. Mock-up shall demonstrate quality of work, construction methods, relationship to other work.
- 1.8 PRE-INSTALLATION CONFERENCES
 - A. Installer of the Work of this Section is required to attend pre-installation conference specified under Section 04 20 00 - UNIT MASONRY.
- 1.9 DELIVERY, STORAGE AND HANDLING
 - A. Store preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
 - B. Prevent contact with materials during storage which may cause discoloration, staining, or damage.
- 1.10 SEQUENCING AND SCHEDULING
 - A. Coordinate the installation of flashings and sheet metal work with the various trades responsible for installing interfacing materials and install the work at appropriate times so as not to delay the progress of related work.

PART 2 - PRODUCTS

- 2.1 MATERIALS
 - A. Aluminum flashing: FS QQ-A-250d sheet aluminum, PVDF finish, having a minimum thickness as specified herein below, for applications where indicated:
 - 1. Aluminum Finish:
 - a. Polyvinylidene Fluoride (PVDF), Kynar 500 shop applied three coat resin based, high performance thermoplastic organic coating in custom non-standard color to match Architect's sample, conforming to AAMA 605.2, NAAMM - Metal Finishes Manual, and the following.
 - 1) Resin base of 70 percent PVDF by weight, Atochem North America, Inc., product "Kynar 500" or Ausimont USA. product "Hylar 5000".
 - 2) Finish Coating shall be manufactured as one of the following products:
 - a) Glidden Company; product "Visulure".
 - b) Morton International; product "Fluoroceram CL".

- c) PPG Industries Inc.; product "Duranar XL".
 - d) Valspar Corp., product: "Flurothane".
 - b. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with acid chromate-fluoride-phosphate conversion coating, in accordance with Aluminum Association method AA-C12C42.
 - c. Primer: Corrosion resistant, epoxy or urethane based primer compatible with finish coating, averaging 0.2 to 0.3 mils dry film thickness.
 - d. Finish Coat (Color Coat): Polyvinylidene fluoride enamel averaging 0.70 to 0.80 mil dry film thickness.
 - e. Top Coat: Polyvinylidene fluoride enamel clear top coat averaging 0.45 to 0.55 mils dry film thickness.
 - 2. Color and Appearance: Provide colors to match Architect provided sample from manufacturer's complete range of options, without additional cost to the Owner. Color required may be considered "premium" or "metallic" by the coating manufacturer.
 - a. Gloss: Medium, measured by ASTM D523, 35±5 at 60 degrees Fahrenheit.
 - 3. The manufacturer of the products specified herein, under this Section, shall furnish to the Architect, color control samples of the color and finish selected on aluminum for issuance to other trades and manufacturers required to match these colors and finishes.
- B. Miscellaneous galvanized sheet metal flashing: ASTM A653, 20 gauge, G90, hot-dip galvanized.
- C. Stainless steel: 26 gauge U.N.O., No. 2D-matte, mill rolled finish, Type 302/304 stainless steel.

2.2 ACCESSORIES

- A. Nails shall not be smaller than N^o.2 of 12 stub gauge (1.109 inches), with large flat heads, and of sufficient length to penetrate the wood nailers a minimum of 7/8-inch. Nails shall be stainless steel.
- B. Screws: Stainless steel wood screws, of sizes most appropriate for the specific application, and equipped with soft neoprene washers.
- C. Joint Sealer: Low modulus single component gun-grade polyurethane sealant, non-sagging, conforming to FS TT-S-000227E, Type II, Class A, and ASTM C 920, Type S, Class 12-1/2, Grade NS, use NT,M, A and O with a minimum movement capability of ±25 percent, equal to the following:
- 1. Mameco International, Inc., product "Vulkem 116".
 - 2. Sika Corp., Lyndhurst NJ; product, "Sikaflex".
 - 3. Sonneborn Building Products Inc., Minneapolis MN, product, "Sonolastic NP1".
 - 4. Tremco, Beachwood OH, product, "Dymonic".
 - 5. Pecora Corporation, Harleysville PA, product "Dynatrol I".
- D. Plastic cement as recommended by roofing manufacturer and eave protection manufacturer.

- E. Stainless Steel Solder: Provide solder compatible with Type 304 or 316 stainless steel, suitable for soft or hard soldering as indicated. Comply with AWS (American Welding Society) or ASTM standards for metal joining materials.
 - 1. Type: Tin-silver or tin-copper solder alloy, lead-free.
 - 2. Acceptable Alloys:
 - a. Tin/Silver (Sn96.5/Ag3.5)
 - b. Tin/Copper (Sn99.3/Cu0.7)
 - 3. Melting Range: 430°F to 475°F (221°C to 246°C).
 - 4. Standards: Comply with ASTM B32, Alloy Types Sb5 or SnAg3.5 or equivalent.
 - 5. Flux: Use a stainless-steel-compatible acid-type flux with chloride-free formulation. Flux shall be non-corrosive, non-conductive when dry, and water-soluble or neutralizable after soldering. Comply with ASTM B813.

2.3 FLASHING FABRICATION - GENERAL

- A. Form flashings or profiles as indicated on the Drawings and to protect materials from physical damage and shed water.
- B. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance. To the greatest extent applicable, fabricate sheet metal components in shop, and thoroughly clean all joints on both sides of the sheet metal work.
- C. Fabricate cleats and starter strips of same material as sheet.
- D. Form pieces in longest practical lengths, with flat lock seams. Hem exposed edges on underside 1/4 inch, miter and seam corners.
- E. Fabricate corners from one piece with minimum 18 inch long legs, solder for rigidity, seal with sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place and nailing strips located.
- B. Beginning of work shall constitute acceptance of the conditions of the surfaces to which this work is to be applied.

3.2 PREPARATION

- A. Field measure site conditions prior to fabrication.
- B. Install starter and edge strips, and cleats before starting installation.
- C. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- D. Cleat and seam all joints. Apply sealant between metal flashings.

- E. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- F. Seal all aluminum joints watertight.
- G. During the installation of work of this Section, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

3.3 FLASHING INSTALLATION - GENERAL

- A. Except as otherwise shown on the reviewed shop drawings or specified herein, the workmanship of sheet metal work, method for forming joints anchoring, cleating, and provisions for thermal movement, shall conform to the standard details and recommendations of the sheet metal producer and those of producer organizations and research institutions and associations concerning the sheet metal used, in addition to the standards and details set forth in the referenced materials specified this Section.
- B. Face nailing shall not be permitted; concealed cleating or other concealed method must be used to attach sheet metal work to structure.
- C. Ensure that fastenings do not exceed 8 inches on centers. Use flat head fasteners throughout and seal all fastener heads after installation thereof.
- D. Fill all slip joints and overlapping surfaces in the assembly with specified sealant material, removing all excess sealant material from the prefinished surfaces immediately, to prevent staining the finish.

3.4 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 07 71 00
ROOF SPECIALTIES
TRADE CONTRACT REQUIRED AS PART OF SECTION 07 00 02)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Trade Contract Requirements: As provided under Section 07 00 02 - ROOFING AND FLASHING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 07 00 02.

1.2 SUMMARY

- A. The work of this Section consists of pre-fabricated and pre-finished metal roof specialties where shown on the Drawings, as specified herein, for a complete and proper installation. Work includes but is not limited to the following.
- B. Furnish and install the following:
 - 1. Factory fabricated and finished roof edging with drip edges.
 - 2. Sealant in conjunction with sheet metal work specified herein.

1.3 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 07 00 02 – ROOFING AND FLASHING TRADE CONTRACT REQUIREMENTS: Trade Contract requirements for work of this Section.
- C. Section 07 53 23 – EPDM ROOFING: Sheet membrane flashings for flanges of curbs, and sheet membrane roofing and flashing system.
- D. Section 07 62 00 - SHEET METAL FLASHING AND TRIM:
 - 1. Shop and field formed flashing.
- E. Section 07 92 00 - JOINT SEALANTS: Sealant and backing material not specified herein.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM A 361 - Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process for Roofing and Siding.
 - 2. ASTM A 446 -Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
 - 3. ASTM A 525 - Specification for Sheet Steel, Zinc Coated (Galvanized).

4. ASTM B 209 - Specification for Aluminum Alloy, Sheet and Plate.
5. ASTM B 221 - Specification for Aluminum Extrusions.
6. ASTM D 226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
7. ASTM D 1784 - Polyvinyl chloride material for outdoor exposure.
8. ASTM D 2178 - Asphalt Impregnated Glass Mat for Roofing and Waterproofing.
9. ASTM D 4586 - Asphalt Roof Cement, Asbestos-Free.
10. FS QQ-A-250d - Aluminum and Aluminum Alloy, Plate and Sheet.

- B. The following reference materials are hereby made a part of this Section by reference thereto:
1. SMACNA - Architectural Sheet Metal Manual, referred to herein as "Sheet Metal Manual".
 2. NRCA - Roofing and Waterproofing Manual.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequencing:
1. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's data sheets for each metal type and accessories furnished hereunder, include material specifications, performance data, physical properties and finishes.
 2. Certification: Provide certifications that materials and systems comply with the specified requirements for the use indicated.
 3. Shop drawings:
 - a. Fully dimensioned large scale design details showing material profiles, splices, flashing terminations and other jointing details, fastening methods and installation details. Indicate material type, sizes, and weights or gages. Indicate extent of adjacent work specified under other Sections of the Specifications.
 - b. Fully detail methods of relieving stresses due to thermal movement, including sealing of expansion seams.

- c. All details bearing dimensions of actual measurements taken at the project.
- 4. Selection Samples:
 - a. Metal sample chips.
 - b. Manufacturer's sample boards for sealant colors.
- 5. Verification Samples:
 - a. 12 inch long samples of formed fascia, and downspouts.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 - 1. Bonds and Warranty Documentation: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.
- C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
 - 1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner minimum 1 pint extra air-dry paint materials for future touch-up repairs and maintenance.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Company specializing in fabrication and installation of sheet metal flashing work with minimum 5 years documented experience.
- C. Qualifications:
 - 1. Flashing and sheet metal applicator, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein and approved by product manufacturer.
- D. Factory fabricated roof edge shall be certified by roof edge manufacturer to meet the following design criteria:
 - 1. SPRI Test Method RE-1 Test for Roof Edge Termination of Single-ply Roofing Membranes: The fascia system shall be tested to secure the membrane to minimum 100 lbs/ft in accord with SPRI Test Method RE-1. Use current edition of 'Wind Resistance Guide for Edge Systems Used with Low Slope Roofing Systems'.
 - 2. SPRI Test Method RE-2 Pull-Off Test for Fascia: The fascia system shall be tested in accord with SPRI Test Method RE-2. Use current edition of 'Wind Resistance Guide for Edge Systems Used with Low Slope Roofing Systems'.
 - 3. FMRC Loss Prevention Data Sheet 1-49 "Perimeter Flashing". The fascia product shall be listed in current Factory Mutual Research Corporation "Approval Guide for Zone 1 - 60 PSF uplift.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Deliver materials in original packages or bundles bearing brand name, identification of manufacturer or supplier, and finish information.
- B. Storage and Handling Requirements:
1. Store preformed and prefinished material to prevent twisting, bending or abrasion and to provide ventilation. Slope metal sheets to ensure drainage.
 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
 3. Prevent contact with materials during storage which may cause discoloration, staining or damage.
- 1.9 SEQUENCING AND SCHEDULING.
- A. Coordinate the installation of roof edge, copings, and sheet metal work with the various trades responsible for installing interfacing materials and install the work at appropriate times so as not to delay the progress of related work.
- 1.10 WARRANTY
- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Manufacturer Warranty:
1. Furnish 15 year warranty for fascia edging. Warranty shall include the replacement of gravel stop due to blow-off, leakage or membrane failure due to any form of weather with wind conditions up to 110 miles per hour.
 2. Furnish manufacturer's 20 year coating warranty for custom colors, covering film integrity, chalk resistance and color change, assigned to project. Warranty shall be pro-rated after 10 years.
- 1.11 EXTRA MATERIALS
- A. Provide sufficient quantity of each color finish coat material, for field touch-up work after erection, and pack the additional coating materials with the components to be furnished hereunder.
- B. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 FACTORY FABRICATED FASCIA TRIM/ROOF EDGE

- A. Manufacturers and products: Subject to compliance with the requirements specified herein, products which may be incorporated in the work are limited to the following:
1. Sika Sanarfil Corporation, Canton MA, product "Edge-Tite Fascia".
 2. Firestone Building Products, Wausheka, WI, Product "AnchorGard SP/Fascia.
 3. Metal ERA, Waukesha WI, Product: "Anchor-Tite AF".

- B. Fascia trim/ roof edge: Multi-component aluminum system, Factory Mutual Inc. certified Class I-90, and shall conform to the following additional requirements:
 - 1. Performance characteristics:
 - a. Fascia shall freely thermal cycle on extruded bar substrate.
 - 2. Fascia trim, nominal 7 inch height, formed aluminum alloy 6063, temper T5 0.050 inch thick, 12 feet 0 inches lengths.
 - 3. Fascia corners: Factory fabricated, welded fascia, shop finished to exactly match running fascia. Minimum leg length 12 inches.
 - 4. Extruded bar: Shall be continuous 6063-T6 alloy aluminum at 12 feet 0 inches standard lengths with pre-punched slotted holes.
- C. Fasteners: As recommended by fascia manufacturer for particular substrate encountered. No exposed fasteners permitted.
- D. Finish, exposed aluminum:
 - 1. Polyvinylidene Fluoride (PVDF), Kynar 500 shop applied three coat resin based, high performance thermoplastic organic coating in custom non-standard metallic finish color to match Architect's sample, conforming to AAMA 605.2, NAAMM - Metal Finishes Manual, and the following:
 - a. Resin base of 70 percent PVDF by weight, Atochem North America, Inc., product "Kynar 500" or Ausimont USA. product "Hylar 5000".
 - b. Finish Coating shall be manufactured as one of the following products:
 - 1) Glidden Company; product "Visulure".
 - 2) Morton International; product "Fluoroceram CL".
 - 3) P.P.G. Industries Inc.; product "Duranar XL".
 - 4) Valspar Corp., product: "Flurothane".
 - c. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with acid chromate-fluoride-phosphate conversion coating, in accordance with Aluminum Association method AA-C12C42.
 - d. Primer: Corrosion resistant, epoxy or urethane based primer compatible with finish coating, averaging 0.2 to 0.3 mils dry film thickness.
 - e. Barrier Coat: Epoxy-based primer compatible with finish coating, averaging 0.70 to 0.80 mils dry film thickness.
 - f. Finish Coat (Color Coat): Polyvinylidene fluoride enamel averaging 0.70 to 0.80 mil dry film thickness.
 - g. Top Coat: Polyvinylidene fluoride enamel clear top coat averaging 0.45 to 0.55 mils dry film thickness.
 - 2. Color and Appearance: Provide up to three (3) custom colors as provided by Architect including colors designated by the coating manufacturer as "bright," "premium," "pearlescent," or "metallic". Colors shall be in configuration approved by the Architect. Multiple colors are required.
 - a. Gloss: Medium, measured by ASTM D523, 35 plus minus 5 at 60 degrees Fahrenheit.

2.2 ACCESSORIES

- A. Sealant in conjunction with metal work: Custom colored sealant, multi-component non-sagging gun-grade polyurethane sealant, conforming to FS TT-S-000227E,

Type II, Class A, and ASTM C 920, Type M, Class 25, Grade NS, use NT,M, A and O with a minimum movement capability of ± 50 percent, equal to the following:

1. Tremco, product "Dymeric 240 / Dymeric 240FC".
2. Sonneborn, product "Sonolastic NP2".
3. Pecora, product "Dynatrol II".
4. Sika, product "Sikaflex 2CNS".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 1. Beginning of installation means acceptance of existing substrate and project conditions.
- B. Verify roof parapets are solidly set, cant strips and reglets in place and nailing strips located.

3.2 PREPARATION

- A. Field measure site conditions prior to fabrication.
- B. Install starter and edge strips, and cleats before starting installation.
- C. During the installation of work of this Section, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

3.3 FLASHING INSTALLATION - GENERAL

- A. Except as otherwise shown on the reviewed shop drawings or specified herein, the workmanship of sheet metal work, method for forming joints anchoring, cleating, and provisions for thermal movement, shall conform to the standard details and recommendations of the sheet metal producer and those of producer organizations and research institutions and associations concerning the sheet metal used, in addition to the standards and details set forth in the referenced materials specified this Section.
- B. Face nailing shall not be permitted; concealed cleating or other concealed method must be used to attach sheet metal work to structure.
- C. Ensure that fastenings do not exceed 8 inches on centers. Use flat head fasteners throughout and seal all fastener heads after installation thereof.
- D. Fill all slip joints and overlapping surfaces in the assembly with specified sealant material, removing all excess sealant material from the prefinished surfaces immediately, to prevent staining the finish.

3.4 INSTALLATION – ROOF EDGE / FASCIA

- A. Coordinate with roofing installer prior to installation. Verify site conditions and manufacturer's roof edging details. Comply with roof edging manufacturer's installation instructions and recommendations.

- B. Nail galvanized spring clip in continuous manner to vertical face of wood nailers. Locate fasteners 3/4 inch below roof edge and 12 inches on center using a minimum 1-1/2 inch galvanized roofing nail. Allow 1/4 inch gap between sections of spring clip.
- C. Lay roofing membrane over the spring clip allowing it to extend down the face to the drip edge. Locate and hang joint covers at all joints between corners and straight sections.
- D. Hook each fascia section over the top of the spring clip and membrane. Press down on the fascia until the drip edge is engaged. Allowed 1/8 to 1/4 inch gap for expansion (as recommended by manufacturer).

3.5 FIELD QUALITY CONTROL

- A. Field inspection shall be performed under the provisions of Section 01 45 29 - TESTING LABORATORY SERVICES.

3.6 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 07 81 00
APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install factory blended, spray applied cementitious fireproofing as indicated on Drawings.

1.2 RELATED REQUIREMENTS

- A. Section 01 45 29 - TESTING LABORATORY SERVICES.
- B. Section 01 45 90 – PROGRAM OF STRUCTURAL TESTS AND INSPECTIONS.
- C. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- D. Section 05 12 00 - STRUCTURAL STEEL.
- E. Section 05 31 00 – STEEL DECK.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM E 84 - Test for Surface Burning Characteristics of Building Materials
 - 2. ASTM E 119 -Fire Tests of Building Construction and Materials
 - 3. ASTM E 605 - Thickness and Density of Sprayed Fire-Resistive Material Applied to Structural Members
 - 4. ASTM E 736 - Cohesive Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
 - 5. ASTM E 759 - Effect of Deflection of Sprayed Fire-Resistive Material Applied to Structural Members
 - 6. ASTM E 760 - Effect of Impact on Bonding of Sprayed Fire- Resistive Material Applied to Structural Members
 - 7. ASTM E 761 - Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members
 - 8. ASTM E 859 -Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members
 - 9. ASTM E 937 - Corrosion of Steel by Sprayed Fire-Resistive Materials Applied to Structural Members
 - 10. UL - Fire Resistance Directory.
 - 11. NFCA - Special Inspection Procedures for SFRM and Intumescent Fireproofing Materials
 - 12. All applicable federal, state and municipal codes, laws and regulations for fire-resistant construction.

1.4 PERFORMANCE CRITERIA

- A. Materials, procedures for application, dry densities, and thicknesses necessary to provide the required protection shall be tested and rated by UL in accordance with the procedures of UL 263 (ASTM E119) for the uses indicated. Steel members are to be considered restrained unless specifically noted otherwise. Load restricted fire-resistance designs shall be utilized for steel beams and joists
- B. Fire ratings interpolated or extrapolated from actual test data shall not be acceptable. Provide evidence prior to application that proposed materials, installation methods and materials have been approved by all authorities having jurisdiction.
- C. Thickness and density: Thickness and dry density of fire protection material shall be according to the manufacturer's data and UL requirements to provide the fire resistance ratings indicated on the Drawings.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and limitations of fireproofing.
 - 2. Manufacturer's installation instructions and typical details. Indicate any special application procedures or conditions.
 - 3. Test reports:
 - a. Bond strength of fireproofing: Indicate compliance with ASTM E 736.
 - b. Fire test reports of fireproofing application to substrate materials similar to project conditions.
 - c. Reports from reputable independent testing agencies, of product proposed for use, which indicate conformance with ASTM E 119 and ASTM E 84
 - 4. Samples: 3 by 3 inch samples of each type of sprayed fireproofing to be used on the project.
 - 5. Shop Drawings: Prepare shop drawings indicating the applied fireproofing application location, product, and thickness of fireproofing.

1.6 QUALITY ASSURANCE

- A. Applicator, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein and approved by product manufacturer.

1.7 REGULATORY REQUIREMENTS

- A. Provide under Section 01 45 00 - QUALITY CONTROL: A certification by an independent Testing Laboratory acceptable to the Owner that materials, dry densities, thickness, and application procedures satisfy the requirements of the governing laws and building code, and UL requirements, with respect to the minimum protection requirements specified herein when tested in accordance with ASTM E 119.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials, factory proportioned and mixed, in original, unopened packages bearing the name of the product, manufacturer's name, plant identification, lot number and Underwriter's Laboratories, Inc. label.
- B. Store all materials in an elevated dry location, protected by waterproof coverings. Dispose of any materials which have been exposed to moisture. during shipping storage or handling.

1.9 SEQUENCING AND COORDINATION

- A. The installation of ducts, piping, conduit or other suspended equipment shall not take place until the application of sprayed fire protection is complete in an area.
- B. The spray-applied fire resistive material shall only be applied to steel deck, which has been fabricated and erected in accordance with the criteria set forth by the Steel Deck Institute.
- C. The application of spray-applied fire resistive material to the underside of roof deck shall not commence until the roof is completely installed and tight, all penthouses are complete, all mechanical units have been placed, and construction roof traffic has ceased.
 - 1. Fire protection shall not be applied to steel floor decks prior to the completion of concrete work on that deck.
 - 2. When occasional roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.

1.10 ENVIRONMENTAL AND PROJECT CONDITIONS

- A. Do not apply spray fireproofing when ambient temperature or surface temperature of substrate material is below 40 degrees Fahrenheit unless temporary protection and heat are provided to maintain temperature at or above this level during application, and 24 hours before and after application.
- B. Provide ventilation in areas to receive fireproofing during and 24 hours after application, to cure fireproofing material.

1.11 WARRANTY

- A. Provide 2 year warranty under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranty shall include failure of fireproofing, including cracking, checking, dusting, flaking, spalling, separation and blistering. Failure to provide such performance shall require re-installation to repair to satisfaction of Owner at no additional cost.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. AD/Carboline, Fireproofing Products Division of RPM Inc., St. Louis MO. ("AD/Carboline")
2. GCP Applied Technologies, Cambridge, MA.
3. Isolatek International, Inc. "CAFCO", Stanhope NJ.
4. Southwest Fireproofing Products Co., Albuquerque, NM ("Southwest").

2.2 MATERIALS

- A. General: Spray applied fireproofing, factory proportioned and mixed meeting the following requirements:
1. Fireproofing materials shall be standard, factory-mixed, Portland cement based dry formulation, complying with indicated fire-resistance design, and mixed with water at project site to form a slurry or mortar before conveyance and application. Dry mixed mineral fiber type fireproofing materials shall not be accepted.
 2. Sprayed fireproofing materials shall be free of all forms of asbestos, including actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite. Material manufacturer shall provide certification of such upon request.
 3. Fireproofing materials shall not be subject to losses from finished application by sifting, flaking or dusting.
 4. Bare, shop-coated, and galvanized steel sheets with the fireproofing applied shall be kept at 90 degrees Fahrenheit and 70 percent relative humidity for 240 hours without evidence of corrosion of steel, tested in accordance with ASTM E 937.
 5. Corrosion Resistance: When tested in accordance with ASTM E937, the material shall not promote corrosion of steel.
 6. Noncombustibility: When tested, the material shall be noncombustible.
 7. Surface Burning Characteristics: When tested in accordance with ASTM E84, the material shall exhibit the following surface burning characteristics:
 - a. Flame Spread 10
 - b. Smoke Developed 0
- B. Spray applied fireproofing Type I – "Standard Density": For structural steel elements including: built-up trusses, steel deck, beams, bracing, and columns, and all other concealed applications except as otherwise indicated on the drawings, or as otherwise specified herein:
1. Acceptable products:
 - a. AD/Carboline, product: "Pyrolite 15HY".
 - b. GCP Applied Technologies, product: "Monokote Type MK-6".
 - c. Isolatek International, product: "Cafco 300".
 - d. Southwest Fireproofing Products Co., product: "5GP".
 2. Deflection: When tested in accordance with ASTM E759, the material shall not crack or delaminate when the non-concrete topped galvanized deck to which it is applied is subjected to a one time vertical center load resulting in a downward deflection of 1/120th of the span.
 3. Bond Impact: When tested in accordance with ASTM E760, the material shall not crack or delaminate from the concrete topped galvanized deck to which it is applied.

4. Cohesion/Adhesion (bond strength): When tested in accordance with ASTM E736, the material applied over uncoated or galvanized steel shall have an average bond strength of 150 psf.
 5. Air Erosion: When tested in accordance with ASTM E859, the material shall not be subject to losses from the finished application greater than 0.025 grams per sq. ft.
 6. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 750 psf.
 7. Density: When tested in accordance with ASTM E605, the material shall meet the minimum individual and average density values as listed in the appropriate UL design, or as requested by the Authority having jurisdiction, or shall have a minimum average density of 15 pcf.
 8. The material shall have been tested and reported by Underwriters Laboratories, Inc. (UL) in accordance with the procedures of UL 263 (ASTM E119).
- C. Potable water shall be used for the application of sprayed fireproofing materials.
- D. Adhesive and sealer:
1. AD/Carboline, product: "Carboguard 1340".
 2. W.R. Grace & Company: product as recommended by manufacturer.
 3. Isolatek International, product: "Bond-Seal".
 4. Southwest, product as recommended by manufacturer.
- E. Mold Inhibitor: Mold inhibitor shall be added to fireproofing materials in accordance with manufacturer's instructions.
- F. Primer for applied-fireproofing application over at structural steel with fluid-applied insulative coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper acceptance of existing substrate and site conditions.
1. Contact fireproofing manufacturer for procedures on handling primed / painted steel.
 2. Ensure clips, hangers, supports, sleeves and other attachments to the substrate are placed by applicable trade contractors prior to the application of spray-applied fire resistive materials.
 3. Ensure insulative coating has been applied to steel at designated areas prior to work of this section.

3.2 PREPARATION

- A. Close and seal ductwork in areas where fireproofing is being applied.
- B. Protect adjacent surfaces and equipment from damage by overspray and dusting. Mask adjacent work.

- C. Provide temporary enclosures to prevent spray from contaminating air.
- D. Clean substrate of dirt, dust, grease, oil, loose material, or other matter which may effect bond of fireproofing.
- E. Remove incompatible materials which affect bond by scraping, brushing, scrubbing, or sandblasting. Repair or replace any work so damaged and soiled.

3.3 MIXING AND APPLICATION

- A. Mixing shall conform to manufacturer's written instructions.
- B. Materials and equipment shall be approved by the materials manufacturer. Application shall be by licensed manufacturer's applicators. Procedures shall be in strict accordance with said manufacturer's directions and specifications. Only experienced, skilled mechanics approved by the materials manufacturer shall be allowed to place the materials. A qualified manufacturer's representative shall be present for initial application to guide and assist applicator's personnel.
- C. Work shall comply with applicable UL standards in addition to the requirements imposed by the applicable laws and codes for the indicated ratings, including local pollution control regulations.
- D. Sprayed-on fireproofing shall be applied in the exact manner described in the certificates submitted to prove compliance with specified protection requirements. The fireproofing applicator shall be responsible for providing a controlled application of fireproofing material so that uniform quantity and thickness is maintained.
- E. Manufacturer's recommended sealer shall be applied to all sprayed on fireproofing.
- F. After completion of fireproofing work, equipment shall be removed and all surrounding wall and floor areas cleaned of deposits of sprayed-on fireproofing materials. Where hangers and other surfaces not requiring fireproofing have been sprayed unavoidably, the sprayed material shall be removed and the surfaces made clean.

3.4 FIELD QUALITY CONTROL

- A. Field inspection shall be performed under the provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Ensure that applied fireproofing remains exposed to view until verification inspections and testing is made and approval of applied fireproofing is obtained. All costs for removal and replacement of prematurely installed materials to allow inspection of fireproofing shall be borne by the Contractor
- C. Inspection and testing shall verify that applied thickness and density meets manufacturer's tested requirement standards for required fire-resistance ratings.
- D. Where samples fail to meet thickness, quality, or dry density requirements, further sampling and testing shall be required in the area of deficient sample. If such further testing indicates a deficient area, correction shall be made by the application of additional material or removal and replacement of faulty material.

3.5 PATCHING

- A. Patch all areas of testing and any area where fireproofing has been damaged or removed during construction.

3.6 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris. Place waste material in suitable bags or containers and remove from site.
- B. Upon completion of the work of this Section in any given area, clean walls, floors and surrounding surfaces of overspray or drippings. Remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install fireproof firestopping, firesafing materials, smoke seals and related accessories required for this Project for all penetrations through fire resistance rated construction, including, but not limited to, penetrations for plumbing, fire suppression, heating, ventilating and air conditioning, electrical systems, and specialized equipment.
 - 1. Fire resistance rated construction requiring firestopping includes, but is not limited to: floors, rated partitions, smoke barriers, smoke partitions, partitions in rated corridors, passageways and stairs, shaft partitions, shaft wall (vertical and horizontal), area separation fire walls, party wall systems, and temporary fire resistant rated partitions and barriers.
 - 2. Provide removable temporary firestopping (pillows) as required to maintain fire integrity prior to Owner's final acceptance, to permit installation of electrical, telephone, data and sound system wiring. Replace temporary firestopping with permanent, after wiring systems are completed.
- B. Furnish and install firestopping/smoke seals at construction joints occurring at tops of fire resistance rated partitions, smoke partitions, and temporary partitions between top of partition and underside of deck above.
- C. Furnish and install all firestopping, firesafing, and smoke seals at perimeter of floor/roof construction and exterior wall systems, as indicated and where required by applicable codes.
- D. Furnish and install all firestopping, firesafing, and smoke seals at expansion joints in chase walls where expansion joints are not exposed to view.
- E. Furnish and install all firestopping, firesafing, and smoke seals at masonry partition infills for acoustical sealant.
- F. Furnish and install all firestopping, firesafing, and smoke seals where required by applicable codes and as additionally required by authorities having jurisdiction at no additional cost to the Owner.

1.2 RELATED REQUIREMENTS

- A. Section 01 45 29 – TESTING LABORATORY SERVICES: Requirements for testing, observations, and inspections of completed firestopping work.
- B. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- C. Section 01 73 00 - EXECUTION: Procedural and administrative requirements for cutting and patching.
- D. Section 04 20 00 - UNIT MASONRY: Masonry partitions.
- E. Section 09 29 00 - GYPSUM BOARD: Gypsum wallboard fireproofing.

- F. Division 21 - FIRE SUPPRESSION: Fire protection system penetrations through fire resistance rated construction.
- G. Division 22 - PLUMBING: Plumbing system penetrations through fire resistance rated construction.
- H. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Heating, ventilating and air conditioning system penetrations through fire resistance rated construction.
- I. Division 26 - ELECTRICAL: Electrical penetrations through fire resistance rated construction.

1.3 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM E-84 - Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E-119 - Method for Fire Tests of Building Construction and Materials.
 - 3. ASTM E-814 - Test Method of Fire Tests of Through-Penetration Firestops.
 - 4. NFPA 70 - National Electrical Code.
 - 5. UL - Fire Resistance Directory.
 - 6. UL 1479 - Fire Tests of Through Penetration Firestops.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide materials and work to conform to Building Code Requirements in fire resistant wall and floor assemblies.
- B. Manufacturer's certified product test requirements:
 - 1. All firestop/smokeseal material shall be tested by a recognized, independent testing agency and shall conform to both Flame (F-rating) and Temperature (T-rating) requirements of ASTM E-814.
 - 2. Conform to UL Fire Hazard Classification Requirements.
 - 3. Tested and classified non-combustible per ASTM E-84.
- C. Firestops in place shall be of sufficient thickness, width, and density to provide a fire resistance rating at least equal to the floor, wall, or partition construction into which it is installed.
- D. Non-combustible dams shall be constructed:
 - 1. As necessary to achieve fire rating as tested and rated.
 - 2. In conformance with installation requirements for type of floor, wall, and partition construction.
 - 3. As recommended by firestop/smokeseal manufacturer.

- E. Combustible damming materials, if used, must be removed after proper curing.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Manufacturer's representative to provide for review a complete review of the project, all scheduled penetrations and required firestopping materials based on the required ratings and locations, for all trades and work scope and provide a complete submission outlining the locations and recommended products. The intent is that each trade shall provide and install their required firestopping, however to all use the same manufacturer.
 - 2. Literature: Manufacturer's product data sheets, specifications, performance data, and physical properties.
 - a. Indicate requirements for manufacturer's descriptive data for products and related materials with FM, UL or Warnock-Hersey illustrations showing systems and approval of materials in systems.
 - 3. Certification: Manufacturer's written certification stating that firestopping materials, meet or exceed the requirements specified under this Section and that all fire-resistive requirements for the indicated combustibility, Flame (F-rating) and Temperature (T-rating) Ratings have been met.
 - 4. Manufacturer's installation instructions.
 - 5. Test reports: Submit fire test reports from recognized, independent testing agent(s) indicating the following:
 - a. Fire test report of firestop material applied to substrate and penetration materials similar to project conditions. Tests to indicate both Flame (F-rating) and Temperature (T-rating) Ratings.
 - b. Test reports of products to be used shall indicate conformance to ASTM E-814.
 - 6. On-site sample installation to be included in Work: Minimum thirty days prior to application in any area, provide samples of firestop and smoke seal materials and installation in accordance with the following requirements.
 - a. Apply one sample of appropriate firestop and smoke seal material for each different penetration and fire rating required for the work.
 - b. Sample areas will comply with thickness, fire resistance ratings, and finished appearance of the project and applicable fire code.
 - c. Acceptance samples will constitute standard of acceptance for method of application, thickness, and finished appearance for firestop and smoke seal application. The sample(s) shall remain visible during completion of the work and shall remain as part of the completed work.
 - 7. Shop drawings indicating requirements for penetrations in wall/deck intersections, change of planes, control joints, expansion joints and blank openings.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

- B. Sole Source: Obtain firestop and smoke seal products from a single manufacturer, except as otherwise approved by Architect.
- C. Special Inspections: Allow for 3 percent of each type of firestopping system to be removed and inspected for conformance with approved submittals.
 - 1. All firestopping shall be inspected prior to installation of suspended ceilings or concealed by other materials.
- D. Qualifications:
 - 1. Installer: a specialized subcontractor having not less than 3 years documented experience demonstrating previously successful work of the type specified herein.
 - a. The manufacturer of the firestop material shall submit written certification that the firm to be used for the firestop products has been trained in the application of the products by the manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store firestopping materials in original, sealed, packages showing manufacturer's identification and date of packaging.
- B. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.

1.8 WARRANTIES

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following, or approved equal:
 - 1. Bio Fireshield (A Division of Rectroseal), Houston TX.
 - 2. Dow Corning Corporation, Midland MI.
 - 3. Hilti, Inc. Tulsa OK.
 - 4. 3M Company, Saint Paul MN.
 - 5. Specified Technologies, Inc., Somerville NJ.
 - 6. Metacaulk, (A Division of Rectroseal), Houston TX.
 - 7. Tremco, Inc., Beachwood OH.

2.2 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire resistance ratings and surface burning characteristics.
- B. Obtain certificate of compliance from authority having jurisdiction indicating approval of combustibility.

2.3 MATERIALS

- A. Firestop mortar: asbestos free, cementitious mortar, U.L. classified as a "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM/UL1479.
 - 1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "Novasit K-10".
 - b. Specified Technologies, Inc., product "Spec Seal Mortar".
 - c. Tremco Inc., product "Tremstop M".
- B. Silicone Firestop sealant: Single component, non-combustible silicone elastomer firestop sealant, U.L. classified as a "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
 - 1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product product "Biotherm 100" (Gun Grade) or "Biotherm 200" (Self Leveling).
 - b. Specified Technologies, Inc., product "Spec Seal Pensil 300 Sealant (gun grade)" or "Spec Seal Pensil 300SL" (Self Leveling).
 - c. 3M Company, product "Fire Barrier Silicone Sealants".
 - d. Tremco Inc., product product "Tremsil" (Gun Grade) or "Tremsil S/L" (Self Leveling).
 - 2. Sealants will not dissolve in water.
- C. Intumescent firestop sealant and caulks: Acrylic based, water resistant sealant, which will not re-emulsify after drying.
 - 1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "Biostop 500".
 - b. Specified Technologies, Inc., product "Spec Seal Triple-S Sealant".
 - c. 3M Company, product "Fire Barrier Caulk CP25WB+".
 - d. Tremco Inc., product "Tremstop 1A".
- D. Firestop putty: sticks or pads.
 - 1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "Moldable Putty".
 - b. Specified Technologies, Inc., product "Spec Seal Putty Bars and Pads".
 - c. 3M Company, product "Fire Barrier Moldable Putty".
 - d. Tremco Inc., product "Flowable Putty".
- E. Firestop collars: Pre-manufactured fire protective pipe sleeve, UL classified as "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
 - 1. Provide separated (two piece) firestop collar for application when plastic pipe system is already in place. Provide non-separated firestop collar for application prior to installation of plastic pipe system.
 - 2. Acceptable products, or approved equal:
 - a. 3M Company, Inc., product "Fireshield Firestop Sleeve".

- b. Specified Technologies, Inc., product "Spec Seal Collars".
 - c. 3M Company, product "Fire Barrier PPD's".
 - d. Tremco Inc., product "Fyrecan sleeve".
- F. Firestop pillows: UL Classified as "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
 - 1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "Fireshield Firestop Pillows".
 - b. Specified Technologies, Inc., product "Spec Seal Pillows".
 - c. Tremco Inc., product "Tremstop P.S".
- G. Wrap strips:
 - 1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "FS-195".
 - b. Specified Technologies, Inc., product "Spec Seal Wrap Strip".
 - c. 3M Company, product "Fire Barrier FS195 Wrap Strip".
 - d. Tremco Inc., product "Tremco W.S".
- H. Mineral wool fiber / ceramic wool non-combustible insulation (fire safing):
Conforming to ASTM C665, Type 1, ASTM C612, and ASTM C553 with a minimum density of 4 pounds per cubic foot.
 - 1. Flame Spread Classification: Material shall be classified non-combustible per ASTM E-814.
 - 2. Recycled content of slag:: Use maximum available percentage of material (slag). Mineral wool insulation products incorporated into the work shall contain not less than 75 percent of recycled material (slag) by weight.
 - 3. Acceptable products include:
 - a. Fibrex Insulations Inc. Sarnia Ontario, Canada, product: "Fibrex FBX" Industrial board.
 - b. Rock Wool Manufacturing Company, Leeds, AL, product: "Delta Safing Mineral Wool".
 - c. Roxul, Inc., product "Roxul Safe".
 - d. Thermafiber, Inc. product "Safing 4.0 pcf".
 - 4. Accessories: Provide galvanized steel safing clips as required for installation of insulation.
- I. Elastomeric Firestopping: Non halogenated latex based elastomeric coating applied by airless spray.
 - 1. Acceptable products, or approved equal:
 - a. Specified Technologies, Inc., product "Spec Seal Elastomeric Firestop Spray".
 - b. Bio Fireshield (A Division of Rectroseal), product "Flamesafe FS900+"
 - c. Hilti, Inc., product "CP 601S."

2.4 ACCESSORIES

- A. Forming and damming materials: Mineral fiberboard or other type as recommended by firestopping manufacturer.
- B. Primer, sealant and solvents: As recommended by manufacturer.
- C. Woven wire mesh: Galvanized 20 gage woven wire mesh "chicken wire" or "poultry fencing", 1 inch spacing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect areas and conditions where firestops are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
 - 1. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 PREPARATION

- A. Surface to receive firestops shall be free of dirt, dust, grease, oil, form release agents, or other matter that would impair the bond of the firestop material to the substrate or penetrating item(s).
- B. Voids and cracks in substrate shall be filled and unnecessary projection removed prior to installation of firestops.
- C. All penetrating items shall be permanently installed prior to firestop installation.
- D. Substrate shall be frost free and, when applicable, dry.

3.3 INSTALLATION

- A. General
 - 1. Installation of firestops shall be performed by applicators/installers qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
 - 2. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations. Meet building code requirements.
 - 3. Coordinate with plumbing, mechanical, electrical, and other trades to assure that all pipe, conduit, cable, and other items which penetrate fire rated construction have been permanently installed prior to installation of firestops. Schedule and sequence the work to assure that partitions and other construction which would conceal penetrations are not erected prior to the installation of firestops.
 - a. Ensure that all firestopping is inspected prior to installation of suspended ceilings or concealed by other finished materials.
- B. Dam construction

1. Install dams when required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Combustible damming material must be removed after appropriate curing. Incombustible damming material may be left as a permanent component of the firestop system.
 2. Placement of dams shall not interfere with function or adversely affect the appearance of adjacent construction.
- C. Installation of single component silicone firestop
1. Apply with manual or powered caulking gun.
 2. Apply minimum 1/2-inch thickness for 2-hour rating. Apply 1/2 inch to both sides of wall penetrations; one side only in floor penetrations.
 3. Use incombustible insulation as required to achieve fire resistance rating.
 4. Surface of gun grade silicone firestop may be tooled using clean, potable water.
 5. Clean excess material off of adjacent surfaces and tools within 10 minutes using either water or Xylol where the use of such would not be hazardous.
 6. At surfaces scheduled to receive painted finish, provide a smooth and even surface, that flush with adjacent finish and tight to the penetrating material.
- D. Installation of cementitious firestop mortar.
1. Add dry powder to water and mix with mechanical mixer or hand mixing tools as recommended by firestop mortar manufacturer. Allow a average mixing time is 3 minutes and provide a average wet density of 70 pounds per cubic foot, plus or minus 5 PCF.
 2. Do not apply if ambient or substrate temperature is less than 35 degrees Fahrenheit during 24 hours after application.
 3. Wet all surfaces prior to application of firestop mortar.
 4. Mortar may be hand applied or pumped into the opening.
 5. Exposed surfaces shall be finished using conventional plastering tools prior to curing.
 6. When installation around layered cables, it is recommended to increase the fluidity of the firestop mortar to provide a better fill around the cables. Vibrate or move the cables slightly to prevent voids from forming between the cables.
 7. Allow 48 hours for initial cure prior to form removal. For full cure allow 27 days.
 8. Wet material may be cleaned with water. Dry material may require scraping or chipping.
- E. Installation of firestop collars (plastic pipe only)
1. Firestop collars may be surface mounted to a slab or wall or imbedded in Firestop Mortar to a maximum depth of 2 inches.
 2. For wall penetrations with ABS pipe firestop collars must be installed on both sides of the penetration to provide a 2 hour F and T Rating. All other applications required installation on one side only to provide a 2 hour F and T Rating.
- F. Firesafing insulation: Install firestopping safing insulation on safing clips spaced as needed between each stud and floor slab, leaving no voids. Secure safing clips to

slab using fasteners recommended by insulation manufacturer. Install sealant over mineral wool in accordance with test requirements.

- G. Conclusion of work day: Wherever work is performed in areas which abut or are adjacent to Owner occupied areas, at the conclusion of the work day ensure that all penetrations and perimeter construction joints are firestopped and that there are no openings, penetrations or construction joints left unprotected.

3.4 LABELING

- A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems.

1. Include the following information on labels

WARNING: THROUGH-PENETRATION FIRESTOP SYSTEM-DO NOT DISTURB.
NOTIFY FACILITY MANAGER OF ANY DAMAGE.

- Contractor's name, address, and phone number.
- Through-penetration firestop systems designation of applicable testing and inspecting agency.
- Date of installation.
- Through-penetration firestop systems manufacturer's name.
- Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect through-penetration firestop systems and to prepare test reports.
1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.
- B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.
- C. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

3.6 SCHEDULE

- A. General: Typical penetrations are indicated below with list of standard firestopping/smokeseal approaches. Actual firestopping materials and combination of materials will vary with size of penetration and with individual firestopping manufacturer's approved UL Design System Requirements. Use only UL Design System materials for each penetration that best matches the wall and floor construction.
1. Where penetrations occur for which no listed UL or WH Design System test exists, obtain from the firestop system manufacturer an engineered system acceptable to the authorities having jurisdiction for firestopping such penetrations. Engineered system from manufacturer shall include a detail drawing showing the engineered system and shall contain no disclaimers.
- B. Single metal pipe (non-insulated) and conduit penetrations through floors:

1. Firestop mortar.
 2. Silicone Firestop sealant.
 3. Intumescent firestop sealant.
 4. Firestop putty, sticks or pads.
 5. Mineral fiber / ceramic wool non-combustible insulation (fire safing) in conjunction with a firestop sealant.
- C. Single metal pipe (non-insulated) and conduit penetrations through walls:
1. (masonry and concrete walls only) Firestop mortar and putty.
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 3. Intumescent firestop sealant with wrap strips.
- D. Multiple metal pipe and conduit penetrations through floors:
1. Firestop mortar and wrap strips.
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- E. Multiple metal pipe and conduit penetrations through walls:
1. Firestop mortar and putty.
 2. (through masonry walls only) Firestop pillows with woven wire mesh.
 3. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- F. Insulated metal pipe penetrations through floors:
1. Firestop mortar and wrap strips.
 2. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 3. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 4. Silicone Firestop sealant over wrap strip.
 5. Mineral fiber / ceramic wool non-combustible insulation (fire safing) in conjunction with a firestop sealant.
- G. Insulated metal pipe penetrations (single and multiple) through walls:
1. Firestop mortar with wrap strips.
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 3. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) and Wrap strips.
 4. (multiple penetrations through masonry walls only) Firestop pillows with woven wire mesh.
- H. Duct penetrations through floors or walls:
1. Rectangular and square ducts: Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing), and steel flanges provided under Division 15.

2. Round ducts: Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- I. Combustible plastic pipe and conduit penetrations through floors:
 1. Firestop mortar with wrap strips.
 2. Firestop mortar with firestop putty and firestop collars.
 3. Silicone firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 4. Silicone firestop sealant and firestop collars.
 5. Intumescent firestop sealant and firestop collars.
 6. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) with firestop collars.
 7. (maximum pipe size 2 inches) Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) with wrap strips.
- J. Combustible plastic pipe and conduit penetrations through walls:
 1. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 2. Intumescent firestop sealant with firestop collars.
- K. Cable penetrations through floors:
 1. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- L. Cable penetrations through walls:
 1. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 3. (single penetrations only) Firestop putty.
 4. (electrical boxes) Firestop pads.
 5. Firestop putty over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- M. Bus ducts through floors:
 1. Firestop mortar and wrap strips.
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) and 28 gage (minimum) steel cover plate.
- N. Blank openings:
 1. Firestop mortar.
 2. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- O. Fire rated joints:
 1. Silicone Firestop sealant over backer rod or bond breaker.

- P. Construction joints at head of wall/floor assemblies:
 - 1. Silicone Firestop sealant/mastic over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 - 2. Elastomeric spray over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- Q. Smoke barrier sealant for dampers, fire door frames:
 - 1. Silicone Firestop sealant.
- R. Temporary sealing of openings and penetrations:
 - 1. Firestop putty, sticks or pads.
 - 2. Firestop pillows.

End of Section

Section 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. General: The work of this Section consists of sealants and backing materials where shown on the Drawings, as specified herein, and as required for a complete and proper installation.
 - 1. This Section specifies general requirements, definition of joint sealer types, and application requirements for sealant work specified within and for all other individual specification sections, unless specifically noted otherwise in the trade sections for internal or specialized requirements
 - 2. Each trade shall provide sealants associated with their work, and coordinate the product and color selection through the CM to the Architect
- B. Prepare sealant substrate surfaces.
- C. Furnish and install sealant and backing materials.
- D. Interior and exterior perimeter of hollow metal door and frame, and other louvers and similar penetrations assemblies.
- E. Interior and exterior perimeter of all aluminum curtain wall systems.
- F. Masonry to masonry joints.
- G. Concrete expansion joints, at all locations and where abutting columns, walls, and other materials
- H. Plumbing fixtures at walls and floors

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing finishes, partitions and walls as indicated in the Drawings
- C. Section 04 20 00 - UNIT MASONRY.
- D. Section 07 21 00 – Thermal Insulation: Application of expanding foam sealant as indicated in the scope of work of that Section.
- E. Section 07 53 23 – ETHYLENE PROPYLENE DIENE MONOMER (EPDM) ROOFING: Sealant used in conjunction with roofing system.
- F. Section 07 84 00 - FIRESTOPPING: Firestopping sealants and related backing materials.

- G. Section 08 11 13 – HOLLOW METAL DOORS & FRAMES: Sealant used at the perimeter of the metal frames and adject surfaces.
- H. Section 08 44 13 – Glazed ALUMINUM CURTAIN WALLS: Sealant used in conjunction with the installation of metal frames.
- I. Section 08 80 00 - GLAZING: Sealant used in conjunction with setting glass.
- J. Section 09 29 00 - GYPSUM BOARD: Application of concealed acoustical sealant used in conjunction with gypsum board work at abutting surfaces (perimeter of partitions and walls).
- K. Section 09 30 13 - CERAMIC TILING – Sealant used between tile and non-similar materials.
- L. Section 09 77 33 – SANITARY WALL PANELS: Sealant used in conjunction with joints between wall panels.
- M. Section 09 91 00 - PAINTING: Caulks used in preparation of applied finish coatings.

1.3 REFERENCES

- A. The standards referenced herein are included to establish recognized quality only. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
- B. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C 717 - Standard Terminology of Building Seals and Sealants.
 - 2. ASTM C 790 – Guide for Use of Latex Sealants
 - 3. ASTM C 804 - Use of Solvent-Release Type Sealants.
 - 4. ASTM C 834 - Latex Sealing Compounds.
 - 5. ASTM C 919 - Use of Sealants in Acoustical Applications.
 - 6. ASTM C 920 - Elastomeric Joint Sealants.
 - 7. ASTM C 962 - Use of Elastomeric Joint Sealants.
 - 8. ASTM C 1193 - Guide for Use of Joint Sealants.
 - 9. ASTM D 1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
 - 10. ASTM D 3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
 - 11. FS TT-S-001543A - Sealing Compound, Silicone Rubber Base.
- C. The following reference materials are hereby made a part of this Section by reference thereto:
 - 1. SWRI – Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, chemical and physical properties and installation instructions for each item furnished hereunder.
 - 2. Selection Samples: Sample card indicating Manufacturer's full range of colors available for selection by Architect.
 - 3. Verification Samples: 12 inch long samples of sealant for verification of color, installed where directed by Architect.
 - 4. Certificates: Manufacturer's certification that the Products supplied meet or exceed specified requirements.
 - 5. Test and Evaluation Reports:
 - a. Compatibility and adhesion test reports: Test reports from sealant manufacturer indicating that sealant proposed for use have been tested for compatibility and adhesion with actual samples of substrates to be used on this project. Include sealant manufacturer's interpretation of test results, and recommendations for primers and substrate preparation specific to this Project.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 - 1. Bonds and Warranty Documentation: Manufacturer's standard Warranties and Guarantees.

1.5 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Provide sealants from a single manufacturer for all work of this Section to the greatest extent possible. Each individual type of sealant installed in the Work shall be from a single manufacturer.
- C. Qualifications:
 - 1. Testing Agencies: To qualify for acceptance, an independent testing laboratory must demonstrate to Architect's satisfaction that it has the experience and capability to conduct satisfactory testing indicated without delaying progress of the Work.
- D. Preconstruction Compatibility and Adhesion Testing: Submit samples of all materials that will contact or affect joint sealers to joint sealer manufacturers for compatibility and adhesion testing, as indicated below:
 - 1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealers to joint substrates.

- a. Perform tests under normal environmental conditions that will exist during actual installation.
 2. Contractor shall submit for testing, and sealant manufacturer shall test at least 9 pieces of each type of material, including joint substrates, shims, and joint backer rods.
 3. Schedule testing so that it does not delay the work.
 4. Investigate materials failing these tests and obtain joint sealer manufacturer's written recommendations for corrective measures, including use of specially formulated primers.
 5. The Architect may waive part or all of these specific testing requirements if the sealant manufacturer is able to provide written certification, demonstration to the Architect's satisfaction, that sealant and substrates are compatible and that sealant performance and adhesion will not be compromised by project conditions.
- E. Product Testing: Provide comprehensive test data for each type of joint sealer based on tests conducted by a qualified independent testing laboratory on current product formulations within 24-month period preceding date of Contractor's submittal of test results to Architect.
1. Test elastomeric sealant for compliance with requirements specified by reference to ASTM C920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C719), low-temperature flexibility, modulus of elasticity at 100% strain, effects of heat aging, and effects of accelerated weathering.
 2. Include test results performed on joint sealers after they have cured 1 year.
- F. Preconstruction Field Testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:
1. Locate test joints where indicated or, if not indicated, as directed by Architect.
 2. Conduct field test for each type of elastomeric sealant and joint substrate indicated.
 3. Arrange for tests to take place with both Architect and joint sealer manufacturer's technical representative present.
 4. Test Method: Test joint sealers by hand pull method described below:
 - a. Install joint sealant in 5-foot joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed Work. Allow sealant to cure fully before testing.
 - b. Make knife cuts as follows: A horizontal cut from one side of joint to the other followed by 2 vertical cuts approximately 2 inches long at side of joint and meeting horizontal cut at top of 2-inch cuts. Place a mark 1-inch from top of 2-inch piece.
 - c. Use fingers to grasp 2-inch piece of sealant above 1 in. mark; pull firmly down at 90-degree angle or more while holding a straightedge along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than

that equaling specified maximum movement capability in extension; hold this position for 10 seconds.

5. Evaluation of field test results:
 - a. For sealant evidencing adhesive failure, determine if primer is required. If so, re-test using primer.
 - b. Sealant not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory.
 - c. Do not use sealant which fails to adhere to joint substrates during testing.
6. Submit report to Architect with description of test, results, and recommended installation procedures to obtain proper adhesion.
 - a. Report whether or not sealant in joint connected to pull-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Each container and package must bear an unbroken seal, test number and label of the manufacturer upon delivery to the site. Failure to comply with these requirements shall be sufficient cause for rejection of the material in question, by the Architect and his requiring its removal from the site. New material conforming to said requirements, shall be promptly furnished at no additional cost to the Contract.

1.7 SITE CONDITIONS

- A. Do not install single component solvent curing sealant in enclosed building spaces.
- B. Environmental Requirements: Maintain temperature and humidity recommended by the sealant manufacturer during and 24 hours after installation. Do not proceed with installation of joint sealers under the following conditions:
 1. When ambient and substrate temperature conditions are below 40 degrees F.
 2. When joint substrates are wet due to rain, frost, condensation, or other causes.
- C. Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from substrates.

1.8 WARRANTY

- A. Provide 5 year warranty under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranty shall include coverage of installed sealant and accessories which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturers and Products: To establish a standard of quality, design and function desired, Drawings and specifications have been based on the products specified under this section for each individual sealant type, for the applications scheduled at the end of Section, and as may be additionally identified on the Drawings.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Pecora Corporation, Harleysville PA.
 - 2. Sika Corp, Lyndhurst NJ.
 - 3. Sonneborn Building Products Inc., Minneapolis MN.
 - 4. Tremco, Inc., Beachwood OH.

2.2 SEALANT MATERIALS

- A. Sealant Materials, General Requirements:
 - 1. Only use sealant and primers that comply with the following limits for VOC content:
 - a. Architectural Sealants: 250 g/L.
 - b. Roofing Sealants: 450 g/L.
 - c. Roadway Sealants: 250 g/L.
 - d. Sealant primer: 250 g/L.
 - 2. Sealants containing PCB's, aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds or asbestos are not permitted.
- B. Joint Sealer Type AA (Acrylic acoustical): One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable.
 - 1. Tremco, product "Acoustical Sealant".
 - 2. USG, product "USG Acoustical Sealant".
 - 3. Pecora, product "AC-20 FTR".
- C. Joint Sealer Type AP (Acrylic painters caulk): One component acrylic latex caulking compound, conforming to FS 19-TP-21M and ASTM C 834, paintable within 24 hours after application, with a minimum movement capability of ± 12.5 percent, equal to one of the following:
 - 1. Sonneborn, product, "Sonolac".
 - 2. Tremco, product, "Tremflex 834".
 - 3. Bostik, product, "Chem-Calk 600".

4. Pecora, product "AC-20+".
- D. Joint Sealer Type HL2 (Horizontal-self-Leveling, 2-component): Pouring grade self-leveling multi-component urethane sealant, conforming to FS TT-S-000227E, Type I, Class A, and ASTM C 920, with a minimum movement capability of ± 25 percent, equal to the following:
1. Sika, product, "Sikaflex 2CSL".
 2. Sonneborn, product, "SL2".
 3. Tremco, product, "THC-900 / THC-901".
- E. Joint Sealer Type HT (Horizontal-Trowel): Trowel grade multi-component modified-urethane or neutral-cure silicone paste sealant, conforming to FS TT-S-000227E, Type I, Class A, and ASTM C 920, with a minimum movement capability of ± 25 percent, equal to the following:
1. GE silicones, product "Tosseal 811" (silicone).
 2. Pecora, product "Dynatred" (urethane).
 3. Sika, product "Sikaflex 2CTG" (urethane).
 4. Sonneborn, product "SL2 (slope grade)" (urethane).
 5. Tremco, product "THC-901" (urethane).
- F. Joint Sealer Type SC (Silicone, general construction): One-part medium modulus, natural cure, synthetic sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, NS, Class 25, use NT, G, A, M, O with a minimum movement capability of ± 50 percent, equal to the following:
1. Dow Corning, product, "791".
 2. GE Silicones, product, "Silpruf".
 3. Pecora, product, "895".
 4. Sika, product, "Sika Sil-C 995".
 5. Sonneborn, product, "Sonolastic - OmniSeal".
 6. Tremco, product, "Spectrem 2".
- G. Joint Sealer Type SE (Silicone, Exterior construction): One-part low modulus, moisture curing, synthetic rubber sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, NS, Class 25, FS TT-S-001543A, Type, Class A with a minimum movement capability of +100 percent and -50 percent, equal to the following:
1. Dow Corning, product, "790".
 2. GE Silicones, product, "SCS9000 SilPruf NB".
 3. Sika, product "Sika Sil-C 990".
 4. Tremco, product "Spectrem 1".

- H. Joint Sealer Type SF (Silicone, Food contact): one component silicone rubber, acceptable to local health officials, conforming to U.S. Food and Drug Administration regulation 21 CFR 175.105 and 175.300, FS TT-S-001543A, Type Non-Sag, Class A, and ASTM C 920, Type NS, Class 25, Use NT, G, O and A with a minimum movement capability of ± 25 percent, and a Shore A minimum hardness of 20, equal to the following:
 - 1. Dow Corning, product, "732".
 - 2. GE Silicones, product "Series SCS1000".
- I. Joint Sealer Type SM (Silicone, Mildew-resistant): USDA approved one component acetoxysilicone rubber, mildew resistant, acceptable to local health officials, conforming to U.S. Food and Drug Administration regulation 21 CFR 177.2600, FS TT-S-001543A, Type Non-Sag, Class A, and FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Class 25, Grade NS, use NT, G and A with a minimum movement capability of ± 25 percent, and a Shore A hardness of 20, equal to the following:
 - 1. Dow Corning, product "786".
 - 2. GE Silicones, product "Sanitary 1700".
 - 3. Sonneborn, product "Sonolastic - OmniPlus".
 - 4. Tremco, product "Tremsil 200".
 - 5. Pecora, product "898".
- J. Joint Sealer Type SX (Silicone, Exterior construction): One-part low modulus, neutral curing, low to no bleed silicone, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, NS, Class 50, FS TT-S-00230C, Type II, Class A with a minimum movement capability of +50 percent and -50 percent, equal to the following:
 - 1. Dow Corning, product, "790".
 - 2. GE Silicones, product, "SCS2700 SilPruf LM".
 - 3. Sika, product "Sikasil-WS-290".
 - 4. Tremco, product "Spectrem 4TS".

2.3 ACCESSORIES

- A. Compressible joint bead back-up: Compressible closed cell polyethylene, extruded polyolefin or polyurethane foam rod complying with ASTM C 1330, Type C, 1/3 greater in diameter than width of joint. Shape and size of compressible back-up shall be as recommended by manufacturer for the specific condition used. Provide one of the following, or equal.
 - 1. Nomaco, Inc., Zebulon, NC, product "Green Rod".
 - 2. Industrial Thermo Polymers Ltd., Brampton, Ontario CN, product "ITP Standard Backer Rod".
 - 3. BASF Sonneborn Building Products Inc., Minneapolis MN, product "Sonolastic Closed Cell Backer Rod".

4. W.R. Meadows Inc., Hampshire, IL, product "Sealtight Kool-Rod".
- B. Primers: Furnish and install joint primers of the types, and to the extent, recommended by the respective sealant manufacturers for the specific joint materials and joint function.
- C. Bond-breaker tape, and temporary masking tape: Of types as recommended by the manufacturer of the specific sealant and caulking material used at each application, and completely free from contaminants which would adversely affect the sealant and caulking materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Inspect existing joints to be renovated.
 1. Verify joint sealants, backing, and other materials containing PCBs and other hazardous materials have been removed.
 2. Verify joint substrates and adjoining materials are structurally sound.
 3. Verify joints to be renovated can be satisfactorily repaired with specified methods and materials.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General:
 1. Weather conditions must be dry and of the temperature, as recommended by sealant manufacturer, during application operations.
 2. Surface receiving work of this section must be absolutely dry and dust free. All joints receiving sealant/caulking materials and primers shall be subject to the approval of the sealant manufacturer for proper use of specified materials.
- B. Thoroughly clean all joints, removing all loose mortar, oil, grease, dust, frost, and other foreign materials that will prevent proper adhesion of primers and sealant materials.
 1. Clean ferrous metals of all rust and coatings by wire brush, grinding or sandblasting. Remove oil, grease and protective coatings with cleaners recommended by sealant manufacturer.
 2. Where sealant is indicated to replace existing, thoroughly remove existing sealant and backing, scrape and clean surfaces. Renovate sealant joints in accordance with manufacturer's instructions and reviewed shop drawings. Remove all existing sealant residue from joint surfaces using chemical cleaners and solvents which are acceptable to sealant manufacturer.

- C. Prime joint substrates with full coverage, as recommended in writing by joint-sealant manufacturer, as based on preconstruction joint-sealant-substrate tests or as based upon prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- D. Verify that joint backing and release tapes are compatible with sealant.
- E. Perform preparation in accordance with ASTM C 804 and C 790 for solvent and latex base solvents, respectively.

3.3 PREPARATION FOR REPLACEMENT OF EXISTING SEALANT

- A. Remove existing joint sealants and backing as shown on drawings and identified during pre-installation conference and inspection (Article 3.1 herein above). Do not remove silicone joints to be recapped and joints to be covered with silicone seals.
- B. Cut existing sealant close to joint edges.
- C. Clean joint with power or hand wire brush, grinding, saw cutting, or solvent cleaning to depth at which replacement backing and sealant are to be installed.
- D. Blow out dust, loose particles, and debris with moisture and oil-free compressed air. Remove any pieces of caulk and backer rod lodged in joint.
- E. Repair deteriorated or damaged substrates as recommended by sealant manufacturer to provide suitable substrate for new sealant. Allow patching materials to fully cure.

3.4 INSTALLATION

- A. General: Conform to SWRI requirements, and sealant manufacturer's written requirements for installation.
- B. Install joint bead back-up in all joints in excess of 5/8-inch depth, and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.
 - 1. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
 - 2. Do not stretch back-up material into joints.
- C. Install bond breaker in joints where shown in the Drawings and wherever recommended by the sealant manufacturer to prevent bond of the sealant to surfaces where such bond might impair the Work.
- D. Apply masking tape or other precautions to prevent migration or spillage of materials onto adjoining surfaces.
- E. Apply urethane sealant and latex caulking materials into joints in accordance with manufacturer's instructions, using mechanical or power caulking gun equipped with nozzle of appropriate size, with sufficient pressure to completely fill the joints.

1. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
 2. Maintain the outer edge of the sealant and caulking materials, where side faces of joints are in the same plane, back 1/8-inch from the faces.
 3. Apply sealant in continuous beads without open joints, voids or air pockets so as to provide a watertight and airtight seal for the entire joint length.
 4. After placement of the sealant and caulking materials, concave-tool the surfaces to uniform density, using a water-wet tool. Do not use detergents or soapy water for the tooling operations.
 5. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.
- F. Take care not to block-off weep tubes or any through wall opening constructed to allow weeping of accumulated water.
- G. Apply pouring self-leveling urethane sealant (Sealant designation HL) into horizontal joints in accordance with manufacturer's instructions, to a level approximately 1/16 inch below adjacent surfaces.
1. Apply sealant without open joints, voids or air pockets so as to provide a watertight and airtight seal for the entire joint length.
 2. After placement of the sealant and caulking materials, concave-tool the surfaces to uniform density, using a water-wet tool. Do not use detergents or soapy water for the tooling operations.
 3. Remove the temporary masking tape immediately after tooling, and before the sealant has taken initial set.

3.5 CLEANING

- A. Clean all surfaces of adjacent surfaces which have been marked or soiled by the work of this Section, removing all excess sealant and caulking materials with solvents which will not damage the surfaces in any way.

3.6 PROTECTION

- A. During the operation of sealant work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

3.7 SCHEDULE

- A. General: Seal joints indicated and all interior and exterior joints, seams, and intersections between dissimilar materials. Unless otherwise noted, all scheduled joint sealants shall be provided under this section.
- B. Sealant Colors:
1. Colors for Sealant Types "HL2": Match colors furnished by the Architect, or match other building materials as directed. Should such custom colors not be available from the approved manufacturer, except at additional charge, provide all such colors at no change in Contract Sum.
 2. Colors for Sealant Types "HT", "SC", "SE", "SM" and "SX": As selected by the Architect from manufacturer's standard colors.

3. Color for Sealant Types "AA" and "AP": White.
4. In concealed installation, and in partially or fully exposed installation where so approved by the Architect, standard gray or black sealant may be used.
- C. Specialty Joint Conditions: None.
- D. Exterior joints (Listed by primary building material abutting sealant joints):
 1. Concrete (including precast):

Joint Condition	Sealant Type
a. Concrete to concrete, vertical control joints:	SE
b. Concrete foundation walls to abutting concrete, and other non-bituminous pavements, steps, platforms, and ends of ramp, (horizontal joints):	HL2
c. Concrete slabs on grade to abutting non-bituminous pavements (horizontal joints, including pedestrian traffic surfaces):	HL2
d. Concrete to concrete saw cut and tooled control and isolation joints in horizontal surfaces including pedestrian traffic surfaces:	HL2
e. Concrete and non-bituminous sloped (5% to 12%) pavement ramps (horizontal joint) at abutting concrete or masonry foundation walls:	HT
f. Concrete to all items which penetrate exterior concrete walls, including, but not necessarily limited to, door frames, louver frames, pipes, vents, and similar items:	SE
g. Precast concrete to abutting materials (vertical joints):	SE
 2. Exterior Masonry:

Joint Condition	Sealant Type
a. Masonry to masonry, expansion and control joints:	SE
b. Masonry to abutting masonry or concrete:	SE
c. Masonry to abutting non-porous materials (painted metals, anodized aluminum, mill finished aluminum, PVC, glass, and similar materials): Sealant of aluminum windows to masonry shall be provided by 08 51 13 Aluminum Windows. Sealant of aluminum curtain wall systems to masonry shall be provided by 08 44 13.	SE or SX
d. Masonry to all items which penetrate exterior masonry walls, including, but not necessarily limited to, door frames, louver frames, pipes, vents, and similar items:	SE
e. Masonry to through-wall flashing shall be provided by Section 04 20 00.	
 3. Exterior Metal:

Joint Condition	Sealant Type
a. Metal to metal: Sealant of aluminum windows to metal panel shall be provided by 08 51 13 aluminum Windows. Sealant of aluminum curtainwall systems to metal panel shall be provided by 08 44 13.	SX
b. Metal to glass:	SX
- E. Interior joints (Listed by primary building material abutting sealant joints):

1. Interior Concrete:		
	<u>Joint Condition</u>	<u>Sealant Type</u>
a.	Concrete to concrete (including precast), vertical joints:	SC
b.	Concrete to concrete: horizontal walkable surfaces:	HL2
c.	Concrete and non-bituminous pavement ramps (5 to 12 Percent) horizontal joints at abutting vertical concrete or masonry surfaces:	HT
d.	Concrete to all items which penetrate concrete walls, including, but not necessarily limited to, door frames, louver frames, pipes, vents, and similar items:	SC
e.	Precast concrete to abutting materials (vertical joints):	SC
2. Interior Masonry:		
* Includes interior side of exterior masonry walls.		
	<u>Joint Condition</u>	<u>Sealant Type</u>
a.	Masonry to masonry control joints*:	SC
b.	Masonry* to gypsum board:	SC
c.	Masonry to all items which penetrate masonry walls, including, but not necessarily limited to, window frames, door frames, louver frames, and similar items:	SC
d.	Masonry to all pipes, conduit and vents which penetrate non-rated masonry walls*:	SC
3. Gypsum Board:		
	<u>Joint Condition</u>	<u>Sealant Type</u>
a.	Gypsum board to metal or wood trim:	AP
b.	Gypsum board to abutting surfaces at exposed tops and bottoms partitions and walls: Shall be provided by 09 29 00 Gypsum Board.	AA
c.	Gypsum board to masonry:	SC
d.	Gypsum board to interior door and window frames, penetrating conduits and piping, light-fixtures, electrical cover plates, building specialty items, ductwork, grilles, supply diffusers, faucets, piping, escutcheon plates and similar items:	AP
e.	Gypsum board to plumbing fixtures:	SM
4. Architectural millwork and casework:		
	<u>Joint Condition</u>	<u>Sealant Type</u>
a.	Casework to abutting materials, kitchens, toilet rooms and similar "wet spaces":	SM
b.	Casework to abutting surfaces (except in "wet" spaces):	AP
c.	Countertops to abutting wall surfaces and to abutting casework:	SM
d.	Countertops to plumbing fixtures and fittings:	SM
5. Interior metal:		
	<u>Joint Condition</u>	<u>Sealant Type</u>
a.	Metal to metal:	SC
6. Interior floor drains:		
	<u>Joint Condition</u>	<u>Sealant Type</u>

	a.	Floor drains to concrete slab:	SE
	b.	Floor drains to resilient sheet flooring:	SE
7.	Acoustical ceilings:		
	Joint Condition		Sealant Type
	a.	Acoustical ceiling edge angle to irregular wall surface	AP
8.	Tile:		
	Joint Condition		Sealant Type
	a.	Tile to tile vertical, and horizontal non-traffic joints:	SM
	b.	Tile to tile, horizontal pedestrian traffic joints:	HL2
	c.	Tile to interior door and window frames, penetrating conduits and piping, light-fixtures, electrical cover plates, building specialty items, ductwork, grilles, supply diffusers, faucets, piping, escutcheon plates and similar items:	AP
9.	Interior Wood:		
	Joint Condition		Sealant Type
	a.	Wood to wood (natural or stained finishes)	SC
	b.	Wood to wood (painted opaque finishes)	AP
	c.	Wood to metal	SC
	d.	Wood base to wall surfaces	SC
10.	Resilient Flooring		
	Joint Condition		Sealant Type
	a.	Resilient flooring to dissimilar surfaces including hollow metal frames, plastic laminate, solid surface	#L 2

End of Section

Section 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish the following products to be installed under the designated Sections:
 - 1. Hollow metal frames for doors, UL-Labeled and non-labeled, complete with internal reinforcing; installed under Section 06 10 00 - ROUGH CARPENTRY. Grout fill shall be provided under Section 04 20 00 – UNIT MASONRY.
 - 2. Hollow metal frames for fixed-glazed window conditions, complete with internal reinforcing installed by: Section 06 10 00 - ROUGH CARPENTRY.
 - 3. Glazing beads, loosely attached to hollow metal frames and doors, where so indicated, for removal and permanent installation during glazing operations; installed by: Section 08 80 00 - GLAZING.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 06 10 00 - ROUGH CARPENTRY:
 - 1. Wood blocking, and nailers.
 - 2. Installation of hollow metal door frames.
 - 3. Placement and temporary bracing of hollow metal frames built-into masonry.
- C. Section 06 20 00 - FINISH CARPENTRY: Wood casing and trim; installation of doors and hardware.
- D. Section 07 21 00 – THERMAL INSULATION: Low-expanding, closed cell, spray foam installation full depth of exterior hollow metal frames.
- E. Section 07 92 00 - JOINT SEALANTS.
- F. Section 08 14 16 - FLUSH WOOD DOORS: Furnishing wood and laminate clad doors to be installed in hollow metal frames.
- G. Section 08 71 00 - DOOR HARDWARE: Furnishing finish hardware, and installation templates for hardware cut-outs and reinforcing.
- H. Section 08 80 00 - GLAZING: Furnishing and installing glass located in interior doors and frames.
- I. Section 09 91 00 - PAINTING: Applied finish coatings.
- J. Division 26 – ELECTRICAL:
- K. Building-in of frame anchors to wall and partition construction: By trade responsible for wall and partition erection.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcing.
 3. ANSI A250.8 (formerly SDI 100) - Recommended Specifications for Standard Steel Doors and Frames.
 4. ASTM E 152 - Methods of Fire Tests of Door Assemblies.
 5. ASTM A 109 - Steel, Strip, Carbon, Cold Rolled.
 6. ASTM A 415 - Specification for Hot-Rolled Carbon Steel Sheets, Commercial.
 7. ASTM A 568 - Steel, Carbon and High Strength Low Alloy Hot Rolled Strip, and Cold Rolled Sheet.
 8. ASTM A 653 Structural Quality Grade 37 (A 653M), Steel Sheet, Zinc-Coated, (galvanized) by the Hot-Dip Process.
 9. ASTM A 924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 10. ASTM A 1008 - Steel Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy with Improved Formability.
 11. SDI 111 Series (111A-111F): Recommended Details, Steel Doors and Frames.
 12. SDI 117-93: Manufacturing Tolerances for Standard Steel Doors and Frames.
 13. NFPA publication 80 - Fire Doors and Windows.
 14. NFPA publication 105 – Standard for the Installation of Smoke Door Assemblies.
 15. UL publication 10B - Fire Tests of Door Assemblies.
 16. UL 1784 – Air Leakage Tests of Door Assemblies.
 17. All applicable federal, state and municipal codes, laws and regulations for exits.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, for doors, frames and shop applied finishes.
 2. Certification: Manufacturer's written certification stating that doors, frames, and all related items to be furnished hereunder, meet or exceed the requirements specified under this Section; that specified galvanized and shop priming has been performed; and that all UL fire-resistive requirements for the indicated Labels have been met.

3. Shop drawings: A complete schedule of doors and frames, to be furnished hereunder, coordinated with the door and frame schedule contained in the Contract Drawings. Large scale details of each type door and frame construction, indicating all gages, cut-outs for glazing in doors, reinforcing, and anchorage.

1.5 REGULATORY REQUIREMENTS

- A. Fire rated door construction shall conform to UL publication 10B.
- B. Install fire rated door assemblies in compliance with NFPA 80.
- C. Corridor doors shall be tested and listed per UL 1784.

1.6 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing doors and frames.
- B. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.
- C. Do not fabricate doors or frames before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and accepted by the Architect. Verify that issued templates are coordinated with the approved schedule; immediately notify the Architect, in writing, of any conflicts.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Prior to shipping, identify each frame and door with a removable metal or plastic label which corresponds with door schedule identifying opening number and location.
- B. Deliver doors and frames boxed or crated to provide protection during transit and job storage.
- C. Inspect doors and frames upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
- D. Store doors and frames at the building site upright and under cover. Place the units on wood dunnage and cover in a manner that will prevent rust and damage.

1.8 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Amweld Building Products, Inc., (A Division of Amweld International, LLC), Coppel TX.
 - 2. Ceco Door Products (A Division of Assa Abloy Group Company), Milan TN.
 - 3. Curries Company A Division of Assa Abloy Group Company), Mason City IA.
 - 4. Essex Industries, Inc. New Haven CT.
 - 5. Republic Doors and Frames, McKenzie TN.
 - 6. Steelcraft (A Division of Ingersoll-Rand Company), Cincinnati OH.
 - 7. Metal Products, Inc., Corbin, KY.
- B. Unless otherwise specifically accepted by Architect, all doors and frames shall be of one manufacturer.

2.2 HOLLOW METAL FRAMES

- A. General: Refer to the Drawings for various types of frames, sizes, and profiles, UL fire-resistive Label frames, and other characteristics of frames and related items.
 - 1. Frame type: Shop welded frames with mitered joints arc-welded, reinforced and ground smooth.
- B. Materials for frames, reinforcement, anchors, anchor clips and related items: commercial grade cold-rolled steel conforming to ASTM A109 or commercial grade hot-rolled and pickled steel conforming to ASTM A415.
 - 1. Frame gage:
 - a. Interior frames: 16-gage, 0.053 inch thick (1.3 mm), except as otherwise required for specific U.L. Label.
 - 2. Hinge, lock and strike reinforcement: 7 gage (4.4 mm) thick.
 - 3. Door closer reinforcement: 12 gage, minimum 0.093 inch (2.3 mm) thick.
 - 4. Floor clips: 16 gage (1.3 mm) thick.
 - 5. Splice plates or channels: same gage as door frame.
 - 6. Glazing stops: 16 gage, minimum 0.053 inch (1.3 mm) thick, except as otherwise required for specific U.L. Label.
 - 7. Mortar guards: 26 gage, minimum 0.016 inch (0.4 mm) thick.
- C. Frame construction:
 - 1. General: Frame depth not to exceed 8".
 - 2. Fire-rated frame assemblies: Modify specified construction to meet all construction requirements required for fire-resistive rating.
 - a. Affix appropriate UL, FM or Warnock Hersey labels to each rated frame assembly, indicating applicable rating.
 - 3. Shop-fabricate frames as whole single units per door opening, except when frame size is too large to ship as a single unit. Oversized frames may be

shipped in large sections as practicable for field assembly with concealed splice plates or channels.

4. Frame corner construction: As specified in paragraph A, above.
5. Reinforcements, stiffeners, and base angle clips: Welded to interior surfaces of frames to provide a stable base and so as to not interfere with installation of hardware.
6. Provide mortar boxes, welded to frame, at back of hardware cut-outs where mortar or other materials may obstruct hardware operation.
7. Appearance of finished frames: Strong, rigid, completely free from warp and buckle, with miters well-formed and in true alignment, and with surfaces smooth and free from defects of any kind.
8. Silencer holes: Punch three holes in stop of strike jamb of door frames for application of silencers.
9. Glazing beads: Carefully place to properly accommodate the various thicknesses of glass and glazing materials, and loosely-attach to frames with flathead galvanized steel screws through pre-drilled holes having countersunk depressions.

D. Anchorage:

1. Anchor clips for frames in metal stud partitions: 16-gage steel z-shaped clips, 1-1/2 inch upturned and downturned legs, or equivalent type standard with the manufacturer, contained within the frames, for screw attachment to metal studs under Section 09 22 16 - NON-STRUCTURAL METAL FRAMING.
2. Anchor clips for frames in cold-formed metal framed exterior walls: 12-gage steel z-shaped clips, 1-1/2 inch upturned and downturned legs, or equivalent type standard with the manufacturer, contained within the frames, for screw attachment to metal studs under Section 05 40 00 - COLD-FORMED METAL FRAMING.
3. Anchors for frames in masonry walls: Adjustable, T-shaped, positively engaging the retainers on both flanges of each jamb member, when placed. The stem of the anchors shall be 2 inches wide by 12 gage, minimum, corrugated or perforated for mortar bond, and extend 10 inches into the masonry, unless otherwise indicated.
4. Anchors for fire-resistive rated frames: Conform to all UL requirements for the specific fire-resistive ratings.
5. Typical frames: Provide not less than 3 anchors, clips, or bolts (as applicable), per jamb.
 - a. Frames exceeding 3 feet in width, and cross corridor frames: Provide not less than 4 anchors, clips, or bolts (as applicable), per jamb.

2.3 FABRICATION TOLERANCES

- A. Maximum variation for doors and frames: Maximum diagonal distortion 1/16 inch measured with straight edge, corner to corner.

2.4 FACTORY FINISHING

- A. Preparation: Pressure-sand all surfaces of all doors, frames, accessory items, anchors, and related items, to remove blemishes and foreign matter and provide paint grip. Spot-fill imperfections with metallic filler, and sand smooth. Thoroughly

clean the surfaces by applying hot or cold phosphate treatment standard with the manufacturer.

- B. Following cleaning apply one dip or spray coat of rust-inhibitive metallic oxide, zinc chromate, or synthetic resin primer to all surfaces, including those which will be concealed after erection. Bake, or oven dry, the primer at time and temperature recommended by the manufacturer for developing maximum hardness and resistance to abrasion.

PART 3 - EXECUTION

3.1 ERECTION AND INSTALLATION

- A. Installation of frames and doors, including all accessories and related items furnished hereunder, will be performed under Section 06 10 00 - ROUGH CARPENTRY, and Section 06 20 00 - FINISH CARPENTRY.
 - 1. Section 06 10 00 - ROUGH CARPENTRY shall place frames in correct position within specified tolerances, and provide temporary bracing at locations where frames are indicated to be built-into masonry. Section 04 20 00 - UNIT MASONRY shall build and grout frames into masonry work.
- B. Final installation of loosely-attached glazing stops will be performed under Section 08 80 00 - GLAZING.

End of Section

Section 08 14 16
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish the following products to be installed under the designated Sections:
 - 1. Flush solid core wood veneer and plastic laminate clad wood doors, complete with necessary blocking, hardware cut-outs; and provided with openings for glazing and louvers, where so indicated, for installation under: Section 06 20 00 - FINISH CARPENTRY.
 - 2. Glazing beads, loosely attached to glazing cutouts in doors for removal and permanent installation under: Section 08 80 00 - GLAZING.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, and nailers; installation of steel door frames.
- C. Section 06 20 00 - FINISH CARPENTRY: Wood thresholds, frames, casing and trim; installation of doors and hardware.
- D. Section 06 40 00 - ARCHITECTURAL WOODWORK.
- E. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Hollow metal frames scheduled to receive wood doors.
- F. Section 08 71 00 - DOOR HARDWARE: Furnishing finish hardware, and installation templates for hardware cut-outs.
- G. Section 08 80 00 - GLAZING: Installation of glazing in doors.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
 - 2. ANSI A 208.1 - Wood Particleboard.
 - 3. ASTM E 152 - Methods of Fire Tests of Door Assemblies.
 - 4. ASTM D 523 - Specular Gloss.
 - 5. ASTM D 5456 -Evaluation of Structural Composite Lumber Products..
 - 6. FSC (Forest Stewardship Council): "FSC Certification Program"
 - 7. NFPA publication 80 - Fire Doors and Windows.

8. WDMA Industry Standard IS 1A-13.
9. UL 10B - Fire Tests of Door Assemblies.
10. UL 10C – Positive Pressure Fire Door Test Method.
11. Warnock-Hersey - Certification Listings for fire doors.
12. All applicable federal, state and municipal codes, laws and regulations for exits.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Fabricator's product data sheets, specifications, and performance data.
 2. Certification:
 - a. General: Fabricator's written certification stating that doors, meet or exceed the requirements specified under this Section; that specified shop finishing has been performed; and that all fire-resistive requirements for the indicated Labels have been met.
 - b. Provide signed certification by agent of door manufacturer stating that machining, glazing and finishing of doors shall be performed by only by the manufacturer in its facilities.
 3. Certificates: Wood products lacking acceptable documentation for the following will be rejected and their removal required.
 - a. Chain-of-Custody: Written documentation providing evidence of compliance with Chain-of-Custody supply of wood products, and compliance with FSC standards.
 - 1) Demonstrate that products are FSC-certified by providing vendor invoices. Invoices will contain the vendor's chain of custody number and identify each chain of custody certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.
 - b. Composite Wood and Agrifiber Products: Include certification indicating compliance with the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda for all composite wood and agrifiber products.
 4. Door schedule: All doors specified under this Section, coordinated with the schedule contained in the Contract Drawings.
 - a. Indicate doors to be factory finished and finish requirements.
 - b. Indicate fire protection ratings for fire rated doors.
 5. Shop drawings: Elevations, and large scale sections and details of door construction, indicating profiles, core construction, joinery, edges, and cut-outs for hardware and glazing.
 - a. Indicate dimensions and locations of mortises and holes for hardware.
 - b. Indicate dimensions and locations of cutouts.
 - c. Indicate requirements for veneer matching.

6. Selection samples: Plastic laminate sample chain.
7. Verification samples:
 - a. Corner section of specified flush type door, showing core construction and joinery.
 - b. For transparent finishes: submit two 8 by 10 inch mounted finished samples of each specie of veneer specified.
 - c. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.
 - d. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.5 QUALITY ASSURANCE

- A. All materials and workmanship shall conform in all respects to the specified grades of the Window and Door Manufacturer's Association (WDMA) Industry Standard IS 1A-13, except as modified herein.
- B. Sustainability Standards Certifications:
 1. Chain of Custody wood doors: All wood products furnished under this Specification Section shall be "FSC certified" according to the rules of the Forest Stewardship Council (FSC).
 - a. FSC Certification includes the following certification bodies of forests and forest products:
 - 1) Certification Systems.
 - 2) SmartWood.
 - 3) SGS Qualifor.
 - 4) Soil Association.
 - b. Wood doors lacking acceptable documentation for Chain of Custody, will be rejected and their removal required.

1.6 REGULATORY REQUIREMENTS

- A. Fire rated door construction shall conform to UL 10C.
- B. Install doors in compliance with NFPA publication 80.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing wood doors.
- B. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.
- C. Do not fabricate doors before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and approved by the Architect. Verify that issued templates are coordinated with the approved schedule; immediately notify the Architect, in writing, of any conflicts.

1.8 DELIVERY, STORAGE AND HANDLING

- A. The Contractor is responsible to make certain that wood doors are not delivered until the building and storage areas are sufficiently dry so that the doors will not be damaged by excessive changes in ambient humidity and relative moisture content.
- B. Deliver wood doors in resilient non-staining moistureproof packaging, provide protection during transit and job storage. Clearly identify doors with door opening number, matching those indicated on the approved Door Schedule.
- C. Inspect doors upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
- D. Store doors flat on a level surface, in protected, elevated, dry areas; protect from exposure from all sources of light and moisture. When required to maintain manufacturer's warranty, seal top and bottom edges if stored more than one week. Break packaging seal on-site to permit ventilation.

1.9 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.10 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Warranties shall include delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction, all as defined by AWI Quality Standards.
 - 1. Warranty length:
 - a. Interior doors: Manufacturer's lifetime warranty.
 - 2. Warranty coverage shall include all labor and material costs of delivery, re-hanging, re-finishing, glass and glazing to produce a complete installation of replaced or repaired doors.

PART 2 - PRODUCTS

2.1 FLUSH FACED DOORS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Algoma Hardwoods, Inc., Algoma WI.
 - 2. Marshfield DoorSystems™, Inc., Marshfield WI.
 - 3. Eggers Industries, Architectural Door Division, Two Rivers WI.
 - 4. Lambton Doors, Lambton Quebec Canada.
 - 5. VT Industries Inc., Holstein IA.
- B. Sustainable Forest Certification: All doors shall be "Chain-of-Custody" certified as FSC Certified.

- C. General requirements: Conform to the requirements set forth in the designated Sections of the (WDMA) Industry Standard IS 1-A-97, and the applicable requirements of U.S. Commercial Standard CS 171, as amended. Refer to the Drawings for sizes, locations of each type door, glazing cutouts in doors, and other characteristics of doors to be furnished hereunder.
 - 1. Door Grade: Premium.
 - 2. Door Facing:
 - a. Face veneer: WDMA Industry Standard, "A" Grade veneer minimum 1/50 inch (0.6 mm) thick, mechanically splice Select White Maple (*Acer saccharum*) {sapwood}, Plain Sliced, Grade A with book matched grain, No heartwood will be accepted.
 - 1) Matching of adjacent pieces of veneer: Slip matched.
 - 2) Panel face assembly: Center Balanced.
 - b. Face veneer: Decorative Laminate Facing, NEMA LD-3 General Purpose type laminate, 0.050 inch (1.3 mm) thick in color selected by Architect from full range available.
 - 3. All doors PC-5 ply with edges matching face.
 - 4. Acoustical ratings: STC-30 and STC-40, where indicated in the Schedule

2.2 FIRE-RESISTANCE RATED 45, 60 AND 90 MINUTE LABEL DOORS

- A. General Construction: WDMA Industry Standard I.S. 1-A-97, S-21 Veneer, Fire Rated Mineral Core, Premium Grade Door.
 - 1. Door thickness: 1-3/4 inches, unless indicated otherwise.
 - 2. WDMA Specification Descriptions.
 - a. 45 minute "C" label doors: Type "FD-45 MIN-5".
- B. Door facing: As specified herein above under Article – "Flush Faced Doors".
- C. Core construction:
 - 1. Core: Non-combustible asbestos free, mineral composite with a minimum of 28 pounds per cubic foot density complying with ASTM C303 having 10 percent maximum absorption by weight with core in equilibrium at 90 percent relative humidity and 70 degrees Fahrenheit.
 - 2. Stiles: multiple-ply stiles with 1/4 inch solid hardwood outer ply matching face veneers for species and color.
 - 3. Top and bottom rails: Maple, birch, Structural Composite Lumber (SCL) or UL approved composite material to meet label requirements.
 - 4. Blocking:
 - a. For doors scheduled to receive screw-mounted surface closers, provide solid wood blocking.
 - b. For doors scheduled to receive surface mounted fire exit devices or vertical rods, provide top, intermediate and bottom rail blocking for screw mounting.
 - c. Provide additional blocking for all other surface mounted hardware.
- D. Adhesives: Type 1 (waterproof) for both face and core assembly.

- E. Accessories: For all fire-rated doors installed in pairs with both leaves active, provide 20-gage formed steel edges, without astragal, wrapped with veneer matching faces of doors.

2.3 NON-RATED SOLID-CORE DOORS

- A. General Construction: WDMA Industry Standard I.S. 1-A-97, S-9 Veneer, Particleboard Core Bonded, Premium Grade Door.
 - 1. WDMA Specification Description: "PC-5".
 - 2. Door thickness: 1-3/4 inches, unless indicated otherwise.
- B. Door facing: As specified herein above under Article – "Flush Faced Doors".
- C. Core construction:
 - 1. Core: Particleboard complying with ANSI A208.1 Type 1, Grade 1-LD-2 having a density of 33 pounds per cubic foot.
 - a. Provide only formaldehyde free particleboard, equal to Rodman Industries, Oconomowoc, WI. Furnish certification of formaldehyde free products.
 - 2. Stiles: Laminated strand lumber or hardwood mill option for inner ply of styles, continuously bonded to core with adhesives and abrasively planed before veneering, minimum of 1-3/8 inches after trimming, with 1/16 inch solid hardwood outer ply matching face veneer.
 - 3. Top and bottom rails: Maple, Birch, Structural Composite Lumber (SCL) or UL approved composite material to meet label requirements, minimum 1-1/8 inch width.
- D. Adhesives: Type 1 (waterproof) for both face and core assembly.

2.4 GLAZING BEADS

- A. Glazing beads 45, 60 and 90 minute fire rated doors, wood veneered bead:
 - 1. Algoma's style number W-9, labeled, with 1/2 inch sight line.
 - 2. Eggers #100 style.
 - 3. Marshfield DoorSystems veneer clad light bead.
 - 4. V-T type VT1F.
- B. Glazing beads for 20 minute fire rated and non-fire rated doors:
 - 1. Algoma's style number W-4 wood bead with 3/8 inch sight line.
 - 2. Eggers style number 100, 5/8 inch sight line.
 - 3. Marshfield DoorSystems style number W-6, 3/8 inch sight line.

2.5 FABRICATION

- A. Fabricate doors in accordance with specified manufacturer's requirements. Fabricated rated doors in compliance with WHI, or UL requirements as appropriate.
- B. Laminate door facing, cross banding and assembled core in a hot press.
- C. Bond stiles and rails to cores, sand for uniform thickness. Factory sand assembled door leaf.

- D. Factory-machine doors to receive hardware from templates furnished under Section 08 71 00 - DOOR HARDWARE. Do not machine for surface hardware.
 - 1. Provide inner blocks at lock edge and top of door for closer hardware reinforcement.
 - 2. Cut and configure door edges to receive scheduled gasketing.
- E. Factory fabricate doors for undercut where scheduled.
- F. Factory cut all louver and glazed openings as scheduled. Field cutting of openings is prohibited.
- G. Fabrication tolerances: Maximum diagonal distortion (warp): 1/4 inch (6 mm) measured with straight edge from corner to corner over a maximum 42 by 84 inch surface area.
- H. Drill all pilot holes for lock fronts and butt hinges at the factory.

2.6 FACTORY FINISHING

- A. General: Factory finish to be to comply with EPA Title 5 guidelines for Volatile Organic Compound (VOC) emissions limitations.
- B. Transparent finish: AWI Premium Grade Factory Finish System 9, having water based stain and ultraviolet (UV) cured polyurethane sealer and topcoat, with a satin sheen of 31° to 35° gloss units per ASTM D523.
 - 1. Finish system shall include the following:
 - a. Finish sanding.
 - b. Stain application.
 - c. Stain curing.
 - d. Sealer application - first coat.
 - e. Sealer gel cure.
 - f. Sealer application - second coat.
 - g. Sealer gel cure
 - h. Sealer application - third coat
 - i. Sealer full cure
 - j. Sealer sanding
 - k. Topcoat application - first coat
 - l. Topcoat application - second coat
 - m. Topcoat full cure
- C. Seal top and bottom edges of all doors at the factory.
 - 1. Seal full perimeter of all field cut-outs.

2.7 ACCESSORIES

- A. Letter Drop Box at Door B136 (SPED Office): Basis of design "WSR-162 Protex Through-The-Door Letter Drop Box" or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation of wood doors, including all accessories and related items furnished hereunder, will be performed under Section 06 20 00 - FINISH CARPENTRY.
- B. Final installation of loosely-attached glazing stops will be performed under Section 08 80 00 - GLAZING.

3.2 TOUCH-UP FINISHES

- A. Field touch-up of doors, scheduled for transparent finishes, will be performed by door installer. Touch-up includes refinishing surfaces resulting from fitting, or job inflicted scratches and marks.

End of Section

Section 08 31 00
ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Fire resistive rated and non-rated access panels and frames, as specified under this Section, furnished by Sections requiring the same and installed under the following Sections:
 - 1. Section 09 29 00 - GYPSUM BOARD: Installation of access panels into drywall assemblies.
 - 2. Section 09 30 13 - TILING: Installation of access panels into tiled walls.
 - 3. Section 09 77 33 – Sanitary Wall Panels: Installation of access panels onto sanitary wall panels finishes.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 04 20 00 – UNIT MASONRY: Installation of access panels into masonry assemblies.
- C. Section 09 29 00 - GYPSUM BOARD: Installation of access panels into drywall assemblies.
- D. Section 09 30 13 - TILING: Installation of access panels into tiled walls.
- E. Division 21 - FIRE SUPPRESSION: Furnishing access panels required for fire protection systems.
- F. Division 22 - PLUMBING: Furnishing access panels required for plumbing systems.
- G. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Furnishing access panels required for heating/cooling systems.
- H. Division 26 - ELECTRICAL: Furnishing access panels required for electrical systems.

1.3 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications and installation instructions.
 - 2. Schedule: Submit Schedule of all access panels to be furnished hereunder, indicating locations for each size and type of access door.
 - a. The Contractor is responsible to ensure that all of the types/styles of panels and frames specified herein can be furnished by the manufacturer submitted.
 - b. Prior to submitting schedule, coordinate with the work of Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATING AND AIR CONDITIONING and Division 26 - ELECTRICAL and

meet with the Architect to determine exact quantities and locations required for the installation of access panels.

3. Shop drawings: Large scale details of access doors, indicating all sizes, gages and thickness; provide complete installation details, coordinated to the specific receiving conditions.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver access doors to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Store access door units inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1.5 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Acudor Products Inc., Cedar Grove, NJ
 2. Recessed Accesss Door, Best Access Doors New York, New York
 3. Cesco Products, North Brooklyn Park MN.
 4. J.L. Industries, Bloomington MN.
 5. Karp Associates Inc., Maspeth NY.
 6. Miami-Carey Corp., Monroe OH.
 7. Nystrom Products Company, Minneapolis MN.
 8. Milcor, Inc. Lima OH.
 9. Larson Manufacturing Co., Brookings SD.
 10. Williams Brothers Corporation of America, Front Royal, VA.
- B. Single Source: All work of this Section shall be produced by a single manufacturer, unless otherwise approved by the Architect.

2.2 ACCESS PANELS - FOR FIRE RESISTANCE RATED CONSTRUCTION

- A. For fire-resistance rated wall and ceiling surfaces: Standard flush panel door meeting the following requirements:
 1. Panel and frame rating: UL "B" label for 90 minutes.
 2. Frame type:

- a. For ceramic tile walls: 16 gage Type 304 stainless steel flanged frame, with flange exposed to view 1 inch or less, equal to:
 - 1) Acudor FW-5050 series
 - 2) Karp KRP-150FR series.
 - 3) Nystrom IT series.
 - 4) Williams WB-FRSS Regular series.
- b. For masonry walls: 16 gage galvanized bonderized steel flanged frame, with flange exposed to view 1 inch or less.
 - 1) Acudor FW-5050 series
 - 2) Karp KRP-150FR series.
 - 3) Nystrom IT series.
 - 4) Williams WB-FR series.
- c. For gypsum board walls and ceilings: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel drywall bead.
 - 1) Acudor FW-5050DW
 - 2) Karp KRP-350FR series.
 - 3) Nystrom IW series.
 - 4) Williams WB-FR series.
- 3. Door: Insulated Flush panel door as follows:
 - a. Typical wall types : Flush door, Sandwich construction with 2 inch thick mineral wool fiber insulation between two layers of 20 gage galvanized bonderized steel.
 - b. For ceramic tile walls only: Flush door, Sandwich construction with 2 inch thick mineral wool fiber insulation between two layers of 20 gage Type 304 stainless steel.
- 4. Hinge: Flush continuous piano hinge with stainless steel pin.
- 5. Closer: Spring closer.
- 6. Latch: Flush cam latch, operated by Allen or Torx head screwdriver.

2.3 ACCESS PANELS - FOR NON- RATED CONSTRUCTION

- A. For non-rated wall and ceiling surfaces: Flush panel door type meeting the following requirements:
 - 1. Frame type:
 - a. For tiled walls: 16 gage Type 304 stainless steel flanged frame, with flange exposed to view 1 inch or less, equal to:
 - 1) Acudor UF-5000 series.
 - 2) Karp DSC-214SM series.
 - 3) Nystrom NT series.
 - 4) Williams WB-GP series.
 - b. For masonry walls: 16 gage galvanized bonderized steel flanged frame, with flange exposed to view 1 inch or less.
 - 1) Acudor UF-5000 series.
 - 2) Karp DSC-214SM series.
 - 3) Nystrom NT series.
 - 4) Williams WB-GP series.

- c. For gypsum board walls and ceilings: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel drywall bead.
 - 1) Acudor DW-5040 series.
 - 2) Karp KDW series.
 - 3) Nystrom NW series.
 - 4) Williams WB-PL series.
 - 2. Door: Flush panel door as follows:
 - a. Typical all wall types, except tile: 14 gage galvanized bonderized steel.
 - b. For tiled walls: 14 gage type 304 stainless steel.
 - 3. Hinge:
 - a. Typical: Concealed spring hinge enabling door to open 175 degrees and permit removal of door from frame.
 - b. Panels greater than 24 by 36 inches: Flush continuous piano hinge with stainless steel pin.
 - 4. Latch: Flush cam latch, operated by Allen or Torx head screwdriver.
- B. For acoustic gypsum board ceiling surfaces: WB AT 600 Series Acoustical Tile access door or approved equal. Acoustic gypsum board cut to fit within recess; J-bead at perimeter.
- 1. Trim: 16 gauge steel
 - 2. Door: 16 gauge steel. Door is recessed to meet sound barriers
 - 3. Finish: White baked enamel, Paintable Surface
 - 4. Hinge: Continuous piano hinge (opens 180°)
 - 5. Latch: Flush Stainless steel cam latch

2.4 FACTORY FINISHING

- A. Panel assemblies fabricated from stainless steel: N°. 4 satin finish.
- B. Panel assemblies fabricated from galvanized bonderized steel: Baked on rust inhibitive gray primer finish.
- C. Panel assemblies fabricated from cold rolled steel: Phosphate dipped with baked on rust inhibitive gray primer finish.

PART 3 - EXECUTION

3.2 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that prepared openings are ready to receive the work of this Section and opening dimensions are as indicated on the shop drawings. Verify that all blocking is set in place and secure.
- B. Beginning of installation means acceptance of project conditions.

3.3 INSTALLATION

- A. Install access panels in accordance with manufacturer's instructions and direction from authorities having jurisdiction. Install miscellaneous specialties absolutely level and in true line, with units securely anchored to the surrounding construction.
- B. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.

End of Section

Section 08 42 29
SLIDING AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install the following:
 - 1. Interior, single slide, sliding automatic entrances.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Fundamental product requirements, substitutions and product options, delivery, storage and handling.
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, and nailers.
- C. Section 06 20 00 - FINISH CARPENTRY: Requirements for installation of doors and hardware.
- D. Section 07 92 00 - JOINT SEALERS: Caulking to the extent not specified in this section.
- E. Section 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS: Entrances furnished and installed separately.
- F. Section 08 71 00 - DOOR HARDWARE: Furnishing finish hardware, and installation templates for hardware cut-outs and reinforcing.
- G. Section 08 80 00 - GLAZING: Materials and installation requirements for glazing for automatic entrances.
- H. Division 26 – ELECTRICAL: Electrical connections provided separately, including conduit and wiring for power to, and control of, automatic sliding entrances.

1.3 DEFINITIONS

- A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.
- B. Knowing Act: Consciously initiating the opening of a power operated door using acceptable methods including wall mounted switches such as push plates and controlled access devices such as keypads, card reader and key switches.
- C. Safety Device: Device that prevents a door from opening or closing, as appropriate.

1.4 REFERENCES

- A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referenced to by issuing authority abbreviation and standard designation.
- B. American Architectural Manufacturers Association (AAMA)

1. AAMA 607.1 – Clear Anodic Finishes for Architectural Aluminum
 2. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum
 3. AAMA 701 – Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weatherseals
- C. American Association of Automatic Door Manufacturers (AAADM).
- D. American National Standards Institute (ANSI) / Builders' Hardware Manufacturers Association (BHMA):
1. ANSI/BHMA A156.10: Standard for Power Operated Pedestrian Doors
 2. ANSI/BHMA A156.5: Standard for Auxiliary Locks and Associated Products
- E. American Society for Testing and Materials (ASTM):
1. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wires, Profiles and Tubes
 2. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- F. Federal Standard (FED-STD):
1. FED-STD-209E Airborne Particulate Cleanliness Classes in Clean Rooms and Clean Zones
- G. International Code Council (ICC):
1. IBC: International Building Code
- H. International Organization for Standardization (ISO):
1. ISO 9001 – Quality Management Systems
 2. ISO 14025 – Environmental Labels and Declarations – Type III Environmental Declarations – Principles and Procedures
 3. ISO 14040 – Environmental Management – Life Cycle Assessment – Principles and Framework
 4. ISO 14044 – Environmental Management – Life Cycle Assessment – Requirements and Guidelines
 5. ISO 21930 – Sustainability in Buildings and Civil Engineering Works – Core Rules for Environmental Product Declarations of Construction Products and Services
- I. National Fire Protection Association (NFPA):
1. NFPA 101 – Life Safety Code
 2. NFPA 70 – National Electrical Code
- J. National Association of Architectural Metal Manufacturers (NAAMM):
1. Metal Finishes Manual for Architectural and Metal Products
- K. Underwriters Laboratories (UL):
1. UL 325 – Standard for Door, Drapery, Gate, Louver and Window Operators and Systems
- L. United Nations Central Product Classification (UNCPC):

1. UNCPC 4212 – Product Category Rules for Preparing an Environmental Product Declaration for Power-Operated Pedestrian Doors and Revolving Doors

M. All applicable federal, state and municipal codes, laws and regulations for exits

1.5 COORDINATION

- A. Templates: Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrances to comply with indicated requirements.
- B. Electrical System Roughing-In: Coordinate layout and installation of automatic entrance door assemblies with connections to power supplies and remote activation devices.

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Shop drawings: Include plans, elevations, sections, details, hardware mounting heights and attachments to other work.
 2. Color Samples: For selection of factory-applied color finishes.
 3. Closeout Submittals:
 - a. Owner's Manual
 - b. Warranties
 4. Reports: Based on evaluation performed by a qualified agency, for automatic entrance door assemblies.
 - a. Environmental Product Declaration
 - b. Evaluation Report for compliance with IBC

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing doors and frames.
- B. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.
- C. Do not fabricate doors or frames before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and accepted by the Architect. Verify that issued templates are coordinated with the approved schedule; immediately notify the Architect, in writing, of any conflicts.

1.8 QUALITY ASSURANCE

- A. Source Limitations; Obtain automatic entrance door assemblies through one source from a single manufacturer.
- B. Qualifications:
 1. Installer Qualifications: Manufacturer's authorized representative, with certificate issued by AAADM, who is trained for installation and maintenance of units required for this Project.

2. Manufacturer Qualifications: A qualified manufacturer with a manufacturing facility compliant with ISO 9001.
 3. Manufacturer shall have in place a national service dispatch center providing 24 hours a day, 7 days a week, emergency callback service.
- C. Certifications:
1. Automatic sliding door systems shall be certified by the manufacturer to meet performance design criteria in accordance with the following standards:
 - a. ANSI/BHMA A156.10
 - b. FED-STD-209E: Class 1
 - c. IBC
 - d. NFPA 101
 - e. UL 325 listed
 2. Environmental Product Declaration (EPD): EPD for automatic sliding entrances shall be certified by the manufacturer to comply with the following:
 - a. Prepared under Product Category Rule (PCR) UNCPC 4212
 - b. Confirm to ISO Standards 14025, 14040, 14044 and 21930
 - c. Life Cycle Assessment Basis: Cradle to Gate, minimum.

1.9 FIELD CONDITIONS

- A. Field Measurements: General Contractor shall verify openings to receive automatic entrance door assemblies by field measurements before fabrication and indicate measurements on Shop Drawings.
- B. Mounting Surfaces: General Contractor shall verify all surfaces to be plumb, straight and secure; substrates to be of proper dimensions and material.
- C. Other Trades: General Contractor shall advise of any inadequate conditions or equipment.

1.10 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Automatic Entrances shall be free of defects in material and workmanship for a period of (1) year from the date of substantial completion.
- C. During the warranty period the Owner shall engage a factory-trained technician to perform service and effect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.
- D. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Stanley Access Technologies
 - 2. ASSA ABLOY Entrance Systems
 - 3. Horton Automatic Doors

2.2 AUTOMATIC ENTRANCES

- A. Basis of Design: Stanley Access Technologies Dura-Glide 2000 Series Clean Room sliding automatic entrances.
- B. Substitutions: Subject to compliance with requirements of the contract documents, the following named products may be substituted on this project:
 - 1. ASSA ABLOY VersaMax 2.0 Touchless Sliding ICU Door
 - 2. Horton Automatics HD-Slide Series 2000 Belt Drive, UltraClean Atmospheric I
- C. Product Options: Drawings indicate sizes, profiles, and dimensional requirements of automatic entrance door assemblies and are based on the specific system indicated.

2.3 AUTOMATIC DOOR ASSEMBLIES

- A. General: Provide manufacturer's standard automatic entrance door assemblies including doors, sidelights, framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.
- B. Sliding Single Slide Automatic Entrances:
 - 1. Configuration: One sliding leaf and one partial panel; single slide
 - 2. Traffic Pattern: Two-way
 - 3. Emergency Breakaway Capability: Sliding leaf only
 - 4. Mounting: Surface applied

2.4 PERFORMANCE CRITERIA

- A. General: Provide automatic entrance door assemblies capable of withstanding loads and thermal movements based on testing manufacturer's standard unit assemblies similar to those indicated for this project.
- B. Operating Range: Minus 30 deg F (Minus 34 deg C) to 130 deg F (54 deg C)
- C. Opening Force Requirements for Egress Doors: Forces shall be adjustable; but, not more than 50 lbf (222 N) required to manually set swinging egress door panel(s) in motion.
- D. Closing Force Requirements: Not more than 30 lbf (133 N) required to prevent door from closing

- E. Sliding automatic entrances shall be certified for installation and operation in Class 1 (ISO 3) clean rooms in accordance with FED-STD-209E.

2.5 REGULATORY REQUIREMENTS

- A. Emergency Exit Door Requirements: Comply with the requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.
- B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

2.6 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Headers, stiles, rails and frames: 6063-T6
 - 2. Extruded bars, rods, profiles and tubes: ASTM B 221
 - 3. Sheet and Plate: ASTM B 209
- B. Sealants and Joint Fillers: Performed under Section 07 92 00 - JOINT SEALERS.

2.7 COMPONENTS

- A. Framing Members: Manufacturer's standard extruded aluminum reinforced as required to support imposed loads.
 - 1. Nominal size: 1 3/4 inch by 4 1/2 inch (44 by 115 mm)
 - 2. Concealed Fastening: Framing shall incorporate a concealed fastening pocket, and continuous flush insert cover, extending full length of each framing member.
- B. Stile and Rail Doors and Sidelights: Manufacturer's standard 1-3/4 inch (45 mm) thick glazed doors with extruded aluminum tubular stile and rail members. Incorporate concealed tie-rods that span full length of top and bottom rails.
 - 1. Glazing Stops and Gaskets: Snap-on, extruded-security aluminum stops and preformed gaskets.
 - 2. Stile Design: Narrow Stile; 2 inch (51 mm) nominal width
 - 3. Bottom Rail Design: Minimum 4 inch (102 mm) nominal height
 - 4. Muntin Bars: Horizontal tubular rail member for each door; 2 inch (51 mm) nominal height.
- C. Glazing: Manufacturer installed 1/4-inch (6mm) tempered.
- D. Headers: Fabricated from extruded aluminum and extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panel to prevent unauthorized access.
 - 1. Mounting: Concealed, with one side of header flush with framing
 - 2. Capacity: Capable of supporting up to 220 lbs (100 kg) per panel
- E. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment of at least 1/8 inch (3 mm); consisting of

urethane with precision steel lubricated ball-bearing wheels, operating on a continuous roller track. Support panels from carrier assembly by load wheels and anti-riser wheels with factory adjusted cantilever and pivot assembly. Minimum two ball-bearing load wheels and two anti-rise rollers for each active leaf. Minimum load wheel diameter shall be 2 1/2 inch (64 mm); minimum anti-riser roller diameter shall be 2 in (51 mm).

- F. Thresholds: None
- G. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
- H. Signage: Provide signage in accordance with ANSI/BHMA A156.10.

2.8 DOOR OPERATORS

- A. General: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term operation under normal traffic load for type of occupancy indicated.
- B. Electromechanical Operators: Self-contained overhead unit powered by a minimum of 1/4 horsepower, permanent-magnet DC motor with gear reduction drive, microprocessor controller, and encoder.
 - 1. Operation: Power opening and power closing
 - 2. Features:
 - a. Adjustable opening and closing speeds
 - b. Adjustable open check and close check speeds
 - c. Adjustable hold-open time between 0 and 30 seconds
 - d. Obstruction recycle
 - e. On-Off switch to control electric power to operator
 - f. Energy conservation switch that reduces door-opening width
 - g. Closed loop speed control with active braking and acceleration
 - h. Adjustable obstruction recycle time delay
 - i. Self-adjusting stop position
 - j. Self-adjusting closing compression force
 - k. Onboard sensor power supply
 - l. Onboard sensor monitoring
 - m. Optional Switch to Open/Switch to Close operation
 - n. Fire alarm interface, configurable to safely open or close the entrance on signal from fire alarm system
 - 3. Mounting: Concealed
 - 4. Drive System: Synchronous belt type
- C. Electrical service to door operators shall be provided under Division 26 – ELECTRICAL. Minimum service to be 120 VAC, 5 amps.

2.9 ELECTRICAL CONTROLS

- A. Electrical Control System: Electrical control system shall include a microprocessor controller and a high-resolution position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position and speed.
 - 1. The high-resolution encoder shall have a resolution of not less than 1024 counts per revolution. Systems utilizing external magnetic switches are not acceptable.
 - 2. Electrical control system shall include a 24 VDC auxiliary output rated at 1 amp.
- B. Performance Data: The microprocessor shall collect and store performance data as follows:
 - 1. Counter: A non-resettable counter to track operating cycles.
 - 2. Event Reporting: Unit shall include non-volatile event and error recording including number of occurrences of events and errors, and cycle count of most recent events and errors.
 - 3. LED Display: Display presenting the current operating state of the controller.
- C. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:
 - 1. Automatic Reset Upon Power Up
 - 2. Main Fuse Protection
 - 3. Electronic Surge Protection
 - 4. Internal Power Supply Protection
 - 5. Resettable sensor supply fuse protection
 - 6. Motor Protection, over-current protection
- D. Soft Start/Stop: A "soft-start" "Soft-stop" motor driving circuit shall be provided for a smooth normal opening and recycling.
- E. Obstruction Recycle: Provide system to recycle the sliding panels when an obstruction is encountered during the closing cycle. If an obstruction is detected, the system shall search for that object on the next closing cycle by reducing door closing speed prior to the previously encountered obstruction location, and will continue to close in check speed until the doors are fully closed, at which time the doors will reset to normal speed. If obstruction is encountered again, the door will come to a full stop. The doors shall remain stopped until obstruction is removed and operate signal is given, resetting the door to normal operation.
- F. Programmable Controller: Microprocessor controller shall be field programmable.
 - 1. The following parameters may be adjusted:
 - a. Operating speeds and forces as required to meet specified ANSI/BHMA standard
 - b. Adjustable and variable features specified
 - c. Reduced opening position
 - 2. Manual programming shall be available through local interface which has a two-digit display with a selection control including three push buttons.

2.10 ACTIVATION AND SAFETY DEVICES

- A. Touchless Activation Switch: Provide touchless activation switches for activation of automatic door operators. Face plates shall be stainless steel, engraved with a waving hand logo and "Wave to Open" text.
 - 1. Switches shall be wall mounted within single gang electrical boxes and hardwired to door operator controls
 - 2. Units shall incorporate microwave frequency to detect all motion in the detection zone. Detection zone shall be adjustable from 4 inch to 24 inch (102 mm to 610 mm)
 - 3. Dual color, illuminated center for activation confirmation.
 - 4. Relay shall be rated at 1 A at 60 VAC/VDC.
 - 5. Relay hold time adjustable from 0.5 to 30 seconds.
 - 6. IP55 rated enclosure
 - 7. Touchless activation switches shall be equal to or better than BEA 10MS41-S
- B. Combined Activation and Safety Sensors: Combined activation and safety sensors shall, in a single housing, detect motion and presence in accordance with ANSI/BHMA A156.10. Motion shall be detected using K-band microwave technology, presence by active infrared reflection technology.
 - 1. Mounting Height: Up to 11.5 feet (3.5 m) above finish floor
 - 2. Temperature Range: Between minus 31 deg F (minus 35 deg C) and 131 deg F (55 deg C) in all environmental conditions.
 - 3. Relays: Form C, 50V at 0.3A for both activation and safety. Hold time less than 0.5 seconds.
 - 4. Detection Pattern: When detection is made in the activation zone, and the entrance opens, the safety zone shall extend through the threshold on each side, creating an X-pattern. When activation and safety zones are cleared and the entrance closes the sensor will ignore the X-pattern safety zones.
 - 5. Motion activation is secondary to knowing act activation.
 - 6. Combined motion and presence sensors shall be equal to or better than X-Zone Sensor by Optex.
- C. Photoelectric Beams: In addition to the threshold sensor include a minimum of two (2) doorway holding beams. Photoelectric beams shall be pulsed infrared type, including sender receiver assemblies for recessed mounting. Beams shall be monitored by electrical controls for faults and shall fail safe.
- D. Presence Sensor Monitoring: Sliding automatic entrances control system shall include a means to verify the functionality of all active presence sensors in accordance with ANSI/BHMA A156.10. A detected fault shall cause automatic operation to cease until the fault is corrected.

2.11 HARDWARE

- A. General: Provide units in sizes and types recommended by the automatic entrance door and hardware manufacturers for entrances and uses indicated.
- B. Emergency Breakaway feature: Provide release hardware that allows panel(s) to swing out in direction of egress to full 90 degrees from any position in sliding mode.

Maximum force to open panel shall be 50 lbf (22 N) according to ANSI/BHMA A156.10. Interrupt powered operation of panel operator while in breakaway mode.

1. Emergency breakaway feature shall include at least one adjustable detent device mounted in the top of each breakaway panel to control panel breakaway force.
 2. Limit Arms: Limit arms shall be provided to control swing of sliding panels on break-out, swing arm shall not exceed 90 degrees. Limit arms shall be spring loaded to prevent shock and include adjustable friction damping.
- C. Deadlocks: None.
- D. Control Switch: Provide manufacturer's standard header mounted rocker switches and door dual position switch to allow for full control of the automatic entrance door. Controls to include:
1. One-way traffic
 2. Reduced opening
 3. Open/Closed/Automatic
- E. Power Switch: Sliding automatic entrances shall be equipped with a two position "On/Off" illuminated rocker switch to control power to the door.
- F. Sliding Weather Stripping: Manufacturer's standard replaceable components complying with AAMA 701; made of vinyl

2.12 FABRICATION

- A. General: Factory fabricate automatic entrance door assembly components to designs, sizes, and thickness indicated and to comply with indicated standards.
1. Form aluminum shapes before finishing
 2. Use concealed fasteners to greatest extent possible
 - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads or vibration, use self-locking devices
 - b. Reinforce members as required to receive fastener threads
- B. Framing: Provide automatic entrances as prefabricated assemblies
1. Fabricate tubular and channel frame assemblies with manufacturer's standard mechanical or welded joints. Provide sub-frames and reinforcement as required for a complete system to support required loads.
 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 3. Form profiles that are sharp, straight, and free of defects or deformations.
 4. Prepare components to receive concealed fasteners and anchor and connection devices
 5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion
- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

- D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
- E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated
- F. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at project site

2.13 ALUMINUM FINISHES

- A. General: Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designing finishes. Finish designations prefixed by AA comply with system established by Aluminum Association for designing finishes.
- B. Class II, Clear Anodic Finish: AA-M12C22A31 Mechanical Finish: as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.40 mils minimum complying with AAMA 611-98, and the following:
 - 1. AAMA 607.1
 - 2. Applicator must be fully compliant with all applicable environmental regulations and permits, including wastewater and heavy metal discharge

PART 3 - EXECUTION

3.1 INPECTION

- 1. Examine conditions for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Do not install damaged components. Fit frame joints to produce joints free of burrs and distortion. Rigidly secure non-movement joints.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 - 1. Install surface-mounted hardware using concealed fasteners to the greatest extent possible.
 - 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
- C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 – ELECTRICAL.
- D. Glazing: Installed by manufacturer in accordance with glazing types specified under 08 80 00 – GLAZING.
- E. Sealants: Comply with requirements specified in Section 07 92 00 - JOINT SEALERS.

3.3 FIELD QUALITY CONTROL

- A. Testing Services: Factory trained installer shall test and inspect each automatic entrance door to determine compliance of installed systems with applicable ANSI standards.

3.4 REPAIR

- A. Repair damaged finish to match original finish.

3.5 ADJUSTING

- A. Adjust door operators, controls, and hardware for smooth and safe operation, for tight closure, and complying with requirements in ANSI/BHMA A156.10.

3.6 CLEANING

- A. Clean glass and aluminum surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Comply with requirements in Section 08 80 00 – GLAZING for cleaning and maintaining glass.

End of Section

Section 08 44 13
GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this Section consists of glazed aluminum curtain walls where shown on the Drawings, as specified herein, and for a complete and proper installation. Design, engineer, furnish and install exterior and interior aluminum framed glazed curtain wall system. Work includes, but is not limited to:

1. Prefinished aluminum curtainwall framing system, including all angles, clips, and other items required to anchor the systems to the building structure
2. Prefinished aluminum formed brake-metal closures, flashings in conjunction with curtain wall framing.
3. Stainless steel sill flashing glazed into curtain wall at all grade conditions.
4. Metal to metal sealing of glazed aluminum curtain wall assemblies.
5. Curtain wall transition membrane, adhesives and sealants connecting curtain wall framing to air barrier flashing connection.
6. Full perimeter backer rod and sealant (primary seal) between curtain wall frame and air barrier - adjacent to the interior side of curtain wall transition membrane.
7. Extruded head, jamb and sill mullion covers with fiberglass pressure plates.
8. Integral steel reinforcing in mullions and heavy duty mullions as determined by the curtain wall manufacturers structural engineers calculations.
9. Prefinished interior (non-thermal), exterior (thermal) aluminum entrance doors and hardware specified under this Section.
10. Anchor brackets and fasteners for attachment to structure.
11. Air and water field testing services by a third party testing agency, paid for by this Section.
12. Structural engineer licensed in the State of Massachusetts, stamped prepared calculations and other performance criteria for interior and exterior aluminum glazed curtain wall systems.
13. Custom color finishes.
14. Glass and glazing materials.
15. Insulated metal glazing panels.

- B. Install the following furnished under the designated Sections:

1. Mineral wool insulation at curtain wall base between insulated metal panel and brake metal closure furnished by Section 07 21 00 –THERMAL INSULATION.
2. Hardware furnished under Section 08 71 00 – DOOR HARDWARE.

- C. Provide Mock-Up Sealant Adhesion Testing: Testing performed by manufacturers technical representative hired by the Glazed Aluminum Curtain Wall Contractor.

1.2 RELATED REQUIREMENTS

- A. Section 04 20 00 - UNIT MASONRY: Preparation of adjacent masonry work to receive work of this Section.
- B. Section 05 40 00 - COLD-FORMED METAL FRAMING: Structural stud framing at exterior walls.

- C. Section 06 10 00 - ROUGH CARPENTRY: Wood blockings, nailers.
- D. Section 07 42 13 - METAL WALL PANELS: Preparation of adjacent metal wall panel work to receive work of this Section.
- E. Section 07 92 00 - JOINT SEALANTS: Requirements for sealant and back-up materials furnished and installed by this Section.
- F. Section 08 80 00 - GLAZING: General requirements for glass referenced within this Section.

1.3 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards shall be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. AA – Aluminum Design Manual 2015.
 - 2. AAMA - Metal Curtain Wall, Window, Storefront and Entrance Guide Specification Manual.
 - 3. AAMA - Aluminum Curtain Wall Design Guide Manual, (2005 edition).
 - 4. AAMA - Curtain Wall Manual #10.
 - 5. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.
 - 6. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems
 - 7. AAMA 503 - Field Testing of Newly Installed Storefronts, Curtain Walls, and Sloped Glazing Systems
 - 8. AAMA 511 - Voluntary Guideline for Forensic Water Penetration Testing of Fenestration Products
 - 9. AAMA 1503.1 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
 - 10. ANSI/NFRC 100 – Procedure for Determining Fenestration Product U-factors
 - 11. ANSI/NFRC 400 – Procedure for Determining Fenestration Product Air Leakage
 - 12. ASTM A167 - Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - 13. ASTM E283 - Rate of Air Leakage through Exterior Entrance and storefront, Curtains Walls and Doors.
 - 14. ASTM E330 Structural Performance of Exterior Entrance and storefront, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 - 15. ASTM E331 - Test method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 - 16. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

17. ASTM E1105 – Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
18. AAMA 2605 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
19. ASCA 96 - Voluntary Specification for Performance of Organic Coatings on Architectural Aluminum Curtainwall, Extrusions and Miscellaneous Aluminum Components.
20. FS QQ-S-766D – Steel Plates, Sheets and Strip, Corrosion Resisting.

B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:

1. AAMA SFM-1 - Aluminum Storefront and Entrance Manual.
2. GANA Laminated Glazing Reference Manual (2009 edition).
3. GANA - Glazing Manual (50th Anniversary edition).
4. SIGMA - Vertical Glazing Guidelines, Number A3000-87.
5. Consumer Product Safety Commission (CPSC) 16CFR 1201 Code of Federal Regulations for Architectural Glazing Materials.

C. Definitions:

1. Leakage: Uncontrolled water that accumulates in any area with or around the fenestration that is not designed to accommodate, control, and direct such water to the building exterior

1.4 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, fabrication methods, finishes, performance data, and installation instructions for each item furnished hereunder.
 - a. Provide additional information for glazing and sealant products, including chemical, functional, and environmental characteristics, size limitations, special application requirements.
2. Sample Warranties: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
3. Certifications:
 - a. Sealed glass unit manufacturer's certificate indicating conformance with standards specified herein and in Section 08 80 00 - GLAZING.
4. Shop drawings:
 - a. 1/4-inch scale elevations and plans.
 - 1) Indicate all types and thickness of glass.
 - b. Large scale design details of curtain wall systems; indicating sizes, types, and gauges of all metal components; expansion provisions and glazing details.
 - 1) Provide details of perimeter conditions and typical joinery. Indicate which framing members run through and how joints are sealed.

- 2) Provide details of transition areas and modifications to standard system components.
 - 3) Provide details of bracing and stabilizing members; attachment clips and brackets; and complete installation details.
 - 4) Indicate building column line reference dimensions.
- c. Design engineering shall be the responsibility of the framing systems manufacturer and may vary from those indicated on the Contract Drawings, but basic sight lines shall be retained.
- 5. Selection Samples:
 - a. Custom color finish and appearance: Provide three (3) minimum custom colors as provided by Architect including colors designated by the coating manufacturer as "bright," "premium," or "metallic". Colors shall be in configuration approved by the Architect.
 - b. Provide physical samples as requested by Architect for initial selection of colors and finishes
 - c. Manufacturer's sample boards for sealant colors, for selections by the Architect.
- 6. Verification Samples:
 - a. After receipt of selected custom colors from the Architect, submit at least two 12-inch-long pieces of major metal extruded components of the systems, and 12 by 12-inch samples of finished aluminum sheet used for formed brake metal components, prefinished in the specified finish system in selected custom colors.

1.5 QUALIFICATIONS

- A. Installer, with a minimum of 5 years documented experience, demonstrating previously successful work of the type specified herein and approved by product manufacturer.

1.6 PRE-INSTALLATION CONFERENCE

- A. Installer of the Work of this Section is required to attend pre-installation conference specified under Section 04 20 00 - UNIT MASONRY.

1.7 PERFORMANCE REQUIREMENTS

- A. General: Design, fabricate, assemble and erect curtainwall system, and interfacing conditions with contiguous work, to ensure continuity of building enclosure vapor and air barriers and that all segments of the assemblies shall be free from leakage under every condition of weather and exposure. In addition to the specified performance requirements, curtain wall assembly shall conform to, or exceed the requirements of the applicable building code and referenced industry standards for air infiltration, water infiltration, operating forces, deflection and deformation under load.
- B. Engineering criteria: The manufacturer for each curtain wall system shall employ the services of a qualified structural engineer, registered to practice in the Commonwealth of Massachusetts, to prepare all calculations and other performance criteria for the respective systems, including sunshades, perforated metal wall panel assembly and bear all costs therefor. All shop drawings for the

metal components of the respective systems shall bear the registration stamp of the engineer.

1. Wind loading: Curtain wall system installation shall be designed to conform to the 2021 International Building Code with Massachusetts Building Code, Tenth Edition amendments (780 CMR 1609):
 - a. Basic Wind Speed (Worcester, MA), Vult = 127 mph (Vasd = 98 mph)
 - b. Building Risk Category = III
 - c. Exposure category = B
 - d. Internal Pressure Coefficient = ± 0.18

1.8 LABORATORY TESTING AND PERFORMANCE REQUIREMENTS

A. Test Units

1. Air, water, and structural test unit size shall be a minimum of two stories high and three lites wide.
2. Thermal test unit sizes shall be 80" (2032 mm) wide x 80" (2032 mm) high with one intermediate vertical mullion and two lites of glass.

B. Test Procedures and Performance

1. Air Infiltration Test
 - a. Test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf (300 Pa).
 - b. Air infiltration shall not exceed .06 cfm/SF (.31 l/s•m²) of unit.
2. Water Resistance Test
 - a. Test unit in accordance with ASTM E 331.
 - b. The test for static water penetration (ASTM E 331) shall be conducted at an air pressure difference of 15.0 psf (720 Pa). There shall be no water leakage as defined by AAMA 501.1, paragraph 5.5.
3. Uniform Load Deflection Test
 - a. Test in accordance with ASTM E 330.
 - b. Deflection under design load shall not exceed L/175 for spans less than 162" (4114 mm).
 - c. Deflection under design load shall not exceed L/240 + 1/4" (6 mm) for spans greater than 162" (4114 mm).
4. Uniform Load Structural Test
 - a. Test in accordance with ASTM E 330 at a pressure 1.5 times the design wind pressure in 1.05.B.3.b.
 - b. At conclusion of the test there shall be no glass breakage, permanent damage to fasteners, curtain wall parts, or any other damage that would cause the curtain wall to be defective.
5. Condensation Resistance Test (CRF)
 - a. Test unit in accordance with AAMA 1503.1.
 - b. Condensation Resistance Factor (CRF) shall not be less than 74 (frame) when glazed with 0.12 center of glass U-Factor.
7. Thermal Transmittance Test (Conductive U-Factor)
 - a. With ventilators closed and locked, test unit in accordance with NFRC 100-2010.

- C. Conductive thermal transmittance (U-Factor) shall not be more than 0.24 BTU/hr•ft²•°F when glazed with 0.12 center of glass U-Factor.

- D. Entrance doors:

1. Air infiltration through assembly, tested in accordance with NFRC 400 or ASTM E283 at 1.57 psf (75Pa).
 - a. For single doors, air infiltration shall not exceed 1.00 cfm per linear foot of perimeter crack.
 - b. For double doors, air infiltration shall not exceed 1.00 cfm per linear foot of perimeter crack.
 - c. Thermal transmittance; maximum conductive thermal transmittance: "U-Value" of 0.63 BTU/ft² x h x F, per 2021 IECC.

1.9 FIELD TESTING AND PERFORMANCE REQUIREMENTS

- A. The 08 44 13 – Glazed Aluminum Curtain Walls Trade Contractor shall employ and pay for services of an approved independent testing laboratory to perform inspection and testing specified.

B. Test Procedures and Performance for In-Place testing

1. Air Infiltration Test

- a. AAMA 503
 - 1) Test unit in accordance with ASTM E783 for field testing. The unit test shall be conducted at a minimum uniform static test pressure differential of at least 1.57 psf (75 Pa), but at a pressure differential not to exceed 6.24 psf (300 Pa).
 - 2) The maximum allowable rates of air leakage for field testing shall not exceed 1.5 times the project specification rate specified in the Laboratory Testing and Performance Requirements of this Section.
 - 3) End Result:
 - a) Air infiltration shall not exceed .09 cfm/SF.

2. Water Resistance Test

- a. AAMA 503
 - 1) Test unit in accordance with ASTM E1105 for field testing.
 - 2) The field water penetration resistance tests shall be conducted at a static test pressure of two-thirds of the specified project water penetration test pressure specified in the Laboratory Testing and Performance Requirements of this Section. (15.0 psf), but not less than 10 psf (479 Pa)
 - 3) Test unit at a static test pressure of 10 psf.
 - 4) End Test Result:
 - a) There shall be no uncontrolled water leakage.
- b. AAMA 501.2
 - 1) Test unit in accordance with ASTM 501.2 for field testing.
 - 2) The field water penetration resistance tests shall be conducted using a hand held spray assembly employing a type B25 #6.030 brass nozzle, pressure gauge, control valve and a ¾" hose. The water pressure to the nozzle shall be adjusted to produce 30 psi at the nozzle inlet.
 - 3) End Result:
 - a) There shall be no uncontrolled water leakage.

3. Failed Tests

- a. Failed tests shall result in additional testing of the failed specimens and an additional specimen at the cost of the Trade Contractor. Testing shall be concluded only when satisfactory results are achieved. Any required re-testing that is a result of deficient installation shall not be considered a justified reason for a claim of delay or for a time extension by the Construction Manager or Trade Contractor.
- C. In-Place on Building Testing (one unit total)
 - 1. Testing Unit
 - a. One full curtain wall unit, selected by the Architect
- 1.10 DELIVERY, STORAGE AND HANDLING
 - A. Protect pre-finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
 - B. Store framing and glazing materials in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
- 1.11 ENVIRONMENTAL REQUIREMENTS
 - A. Do not install sealant when ambient temperature is less than 40 degrees Fahrenheit.
 - B. Maintain this minimum temperature during and 48 hours after installation of sealant.
- 1.12 FIELD MEASUREMENTS
 - A. Verify that field measurements are as indicated on shop drawings.
- 1.13 SEQUENCING AND SCHEDULING
 - A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
 - B. Do not order or deliver any materials until all submittals, required hereunder, have been received and approved by the Architect.
 - C. Arrange keying, and schedule delivery of keys, with Owner.
- 1.14 WARRANTY
 - A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
 - 1. Manufacturer's written extended warranty for curtainwall systems, covering repair or replacement of any system which leaks, or exhibits defects in materials, finish, design, within 10 years from date of Substantial Completion of the Building Project.
 - 2. Glass manufacturer's standard 10-year guarantee covering insulating glass against defects in materials and workmanship, including failure of seals commencing at date of original factory shipment to site.

3. Finish System Warranty: polyvinylidene fluoride enamel finish 10-year coating warranty assigned specifically to project.
4. Extended Correction Period (Installer's Warranty): Deliver to the Owner upon substantial completion of the general project, an unconditional warranty or performance bond for the work of this Section agreeing to promptly repair aluminum glazed curtain wall as necessary. Warranty/bond to cover repair or replacement of any unit which leaks, or exhibits defects in materials, finish, design through it for a period of two (2) years following Substantial Completion of the Building Project.
 - a. Specified Extended Correction Period terminology must appear in warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on EFCO Corporation, Monett, MO curtain wall assemblies as specified herein below.
- B. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. EFCO Corp., Monett, MO.
 2. Kawneer Manufacturing Company, Norcross GA.
 3. YKK AP America Inc. Austell, GA
 4. Wausau Window and Wall Systems, Wausau, WI

2.2 FRAMING SYSTEM

- A. Curtain wall framing system: Integrated flush glazed with thermal break and insulated glass. Vertical and horizontal framing members shall have screw spline construction with a nominal face width and total depth as noted on the Drawings.
 1. EFCO product: "5600X", with "Duracast" fiberglass pressure plates.
 2. Kawneer product: "1600UT (Ultra-Thermal) Series System 1".
 3. YKK AP America product "YCW 750 XT"
 4. Wausau product "6250 Superwall" with "XLT" composite fiberglass pressure plates.

2.3 MATERIALS

- A. Extruded Aluminum: ANSI/ASTM B221; G.S.10A alloy, T-5 temper.
- B. Sheet Aluminum: ASTM B209; alloy for forming and finishing.
- C. Sheet Steel: ANSI/ASTM A446; galvanized.
- D. Steel Sections: ANSI/ASTM A36; shapes to suit mullion sections.
- E. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 302/304, dead soft, fully annealed; with smooth, flat surface and having 2D Finish (dull, cold rolled) having a minimum thickness as specified for the applications indicated:

2.4 FRAMING MATERIALS

- A. Provide and install all miscellaneous formed aluminum work in conjunction with the aluminum framework as detailed and to complete the work including but not limited to sills, mullion covers, closures, flashings.
- B. Aluminum sections shall be of sizes and profiles indicated on the approved shop drawing details; shall present straight, sharply defined lines and arises; and shall be free from defects impairing strength, durability, or appearance.
- C. Formed flashings and closures shall be of aluminum alloy/temper 5005-H34, minimum of 0.063 inch thick, complying with ASTM B 209.
 - 1. Provide and install all miscellaneous formed aluminum work in conjunction with the aluminum framework as detailed and to complete the work including but not limited to sills, mullion covers, closures, flashings.
- D. Aluminum sections shall be of sizes and profiles indicated on the approved shop drawing details; shall present straight, sharply defined lines and arises; and shall be free from defects impairing strength, durability, or appearance.
- E. System shall provide flush glazing on all sides for the indicated thickness of glass, with no projected glazing stops.
- F. All anchors and fasteners, including screws, nuts, bolts, rivets, and other fastening devices shall be of tempered aluminum or non-magnetic type 302/304 stainless steel, compatible with the aluminum frame members. All such devices shall be of suitable type and adequate capacity for each intended purpose. The aluminum work shall generally be constructed and erected without use of exposed fasteners. However, where exposed, the fasteners shall be finished to match the finish of surrounding aluminum.

2.5 ENTRANCE DOORS (THERMAL)

- A. Aluminum doors shall be thermally broken extruded aluminum, pre-glazed, single acting, hinged doors, wide stile-and-rail type. Subject to compliance with the requirements specified herein, products which may be incorporated in the work include, the following:
 - 1. EFCO model "D502 (TS) ThermaStile" door.
 - 2. Kawneer model: "560 Insulclad" door.
 - 3. Oldcastle model "WS-500 Thermal Wide Stile," door.
 - 4. Wausau "Thermal Block, Wide Stile" door.
 - 5. YKK: "50XT Megatherm Door.
- B. Entrance doors:
 - 1. Wall thickness of stile and rail extrusions: not less than 0.125 inch.
 - 2. Wall thickness of glazing stops: not less than 0.050 inch.
 - 3. Thickness of door: 2 inches.
 - 4. Width of door stiles: 5 inches minimum.
 - 5. Width of top rail: 5 inches minimum.
 - 6. Width of bottom rail: 12 inches minimum (in conformance with 2012 ADA).

7. Fabricate doors with hairline joints at corners of stiles and rails; provide heavy concealed reinforcement brackets secured with screws and welded.

2.6 ENTRANCE DOORS (NON-THERMAL)

- A. Aluminum doors at interior curtain wall systems shall be extruded aluminum, pre-glazed, single acting, hinged doors, wide stile-and-rail type. Subject to compliance with the requirements specified herein, products which may be incorporated in the work include, the following or approved equal:
 1. EFCO model "D500 Wide Stile Door.
 2. Kawneer model: "500".
 3. YKK AP America: "50D" series.
- B. Entrance doors:
 1. Wall thickness of stile and rail extrusions: not less than 0.125 inch.
 2. Wall thickness of glazing stops: not less than 0.050 inch.
 3. Thickness of door: 1-3/4 inches.
 4. Width of door stiles, top and bottom rails: As indicated on the Drawings.
 5. Fabricate doors with hairline joints at corners of stiles and rails; provide heavy concealed reinforcement brackets secured with screws and welded.
 6. Weatherstripping: Wool pile type.
 7. Interior side of thresholds abutting walk off mats to be trimmed square.
- C. Door frame: Nominal 2-inch width by 4-1/2 inches deep.
 1. Wall thickness of frame extrusions: not less than 0.125 inch.
 2. Utilize shear block type construction throughout. No visible raw edges are permitted at joints.
 3. Weatherstripping: Wool pile type.

2.7 DOOR HARDWARE

- A. Hardware shall be furnished under Section 08 71 00 - DOOR HARDWARE, unless otherwise indicated to be furnished by this Section and installed by aluminum entrance, glazed aluminum curtain wall, conforming to governing laws and building codes.
 1. Install all reinforcing required and prepare doors for finished hardware specified.
- B. The following hardware shall be furnished and installed by aluminum entrance, curtainwall, conforming to governing laws and building codes. The model numbers specified below are to establish the standards of design and quality, equal products of other manufacturers may be submitted to the Architect for approval, finish shall match doors where possible:
 1. Sill sweep strips: Manufactures standard.
 2. Weatherstripping: Replaceable compressible neoprene or molded PVC type gaskets or replaceable wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing as suitable for type of door operation, manufacturers standard.

3. Thermal separators on exterior doors: Fiberglass reinforced polyamide strut.

2.8 GLASS AND GLAZING MATERIALS, TYPES AND LOCATIONS

- A. General: For locations of glass types, comply with the following descriptions and refer to interior and exterior aluminum curtain wall, interior and exterior aluminum entrance doors, Door Types and Schedules as well as Interior and Exterior Elevations for additional locations, and as additionally noted on Drawings.
 1. Insulated Glass Type "IG-1": 1-inch thick Double-Pane laminated safety IGU with "Low-E" coatings and Argon Fill
 - a. Basis of Design: Vitro Architectural Glass (formerly PPG Glass), "Solarban 60"
 - b. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following, or approved equal:
 - 1) AGC Glass Company North America, Alpharetta GA.
 - 2) Cardinal Glass Industries, Inc., Eden Prairie MN.
 - 3) Guardian Industries Corporation, Auburn Hills, MI.
 - 4) Oldcastle Building Envelope, Santa Monica, CA.
 - 5) Vitro Architectural Glass (formerly PPG Glass), Cheswick, PA.
 - 6) Viracon Inc., Owatonna, MN.
 2. Components
 - a. Outer Lite (Exterior Face):
 - 1) 1/4 inch (6 mm) thick, Clear, fully-tempered safety glass
 - 2) Coating: Low E sputter coating Solarban 60® on surface #2.
 - b. Air space:
 - 1) 1/2 inch (13 mm) thick.
 - 2) Gas fill: 90% Argon/10% Air.
 - 3) Spacer: Warm-edge, stainless steel, black finish.
 - c. Inner Lite (Interior face):
 - 1) Thickness: 1/4 inch (6 mm) thick, laminated safety glass:
 - 2) Glass Ply 1: 1/8" (3mm) thick Clear heat strengthened
 - 3) Interlayer: 0.060 PVB (Polyvinyl Butyral)
 - 4) Glass Ply 2: 1/8" (3mm) thick Clear fully-tempered glass
 3. Performance Requirements: Glass units shall be equal to or have greater performance than the following:
 - a. Visible transmittance: 70 percent
 - b. Solar Heat Gain Coefficient (SHGC): 0.38
 - c. Light to Solar Gain (LSG): 1.84
 - d. Reflectance (Visible out): 11 percent
 - e. Reflectance (Visible in): 12 percent
 - f. U Value (Winter / Summer): 0.24/ 0.22
 4. Locations: All exterior glazed aluminum curtain wall entrance doors.
- B. Insulated Glass Type "IG-2": Nominal 1 5/8-inch thick Triple-Pane Laminated Safety IGU with "Low-E" coatings and Argon Fill.

1. Basis of Design: Vitro Architectural Glass (formerly PPG Glass), "Solarban 60"
 - a. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following, or approved equal:
 - 1) AGC Glass Company North America, Alpharetta GA.
 - 2) Cardinal Glass Industries, Inc., Eden Prairie MN.
 - 3) Guardian Industries Corporation, Auburn Hills, MI.
 - 4) Oldcastle Building Envelope, Santa Monica, CA.
 - 5) Vitro Architectural Glass (formerly PPG Glass), Cheswick, PA.
 - 6) Viracon Inc., Owatonna, MN.
2. Components
 - a. Outer Lite (Exterior Face):
 - 1) 1/4 inch (6 mm) thick, laminated safety glass
 - 2) Glass Ply 1: 1/8 inch (3mm) clear fully-tempered glass.
 - 3) Interlayer: 0.060 PVB (Polyvinyl Butyral)
 - 4) Glass Ply 2: 1/8 inch (3mm) thick clear heat strengthened glass
 - 5) Coating: Low-E sputter coating Solarban 60® on surface #4.
 - b. First Air space:
 - 1) Thickness: 7/16 inch (11 mm) thick.
 - 2) Gas fill: 90% Argon/10% Air.
 - 3) Spacer: Warm-edge, stainless steel, black finish.
 - c. Middle Lite:
 - 1) 1/4 inch (6mm) thick, heat strengthened glass
 - 2) Coating: Low-E sputter coating Solarban 60® on surface #6.
 - d. Second Air space:
 - 1) Thickness: 7/16 inch (11 mm) thick.
 - 2) Gas fill: 90% Argon/10% Air.
 - 3) Spacer: Warm-edge, stainless steel, black finish.
 - e. Inner Lite (Interior face):
 - 1) 1/4 inch (6 mm) thick, laminated safety glass
 - 2) Glass Ply 1: 1/8 inch (3mm) clear heat strengthened glass
 - 3) Interlayer: 0.060 PVB (Polyvinyl Butyral)
 - 4) Glass Ply 2: 1/8 inch (3mm) thick clear fully-tempered glass.
3. Performance Requirements: Glass units shall be equal to or have greater performance than the following:
 - a. Visible transmittance: 56 percent
 - b. Solar Heat Gain Coefficient (SHGC): 0.31
 - c. Light to Solar Gain (LSG): 1.80
 - d. Reflectance (Visible out): 12 percent
 - e. Reflectance (Visible in): 14 percent
 - f. U Value (Winter): 0.13
4. Locations: At exterior curtain wall where noted, see Curtain Wall Types & DETAILS sheet. Flashing

- C. Insulated Glass Type "LG-2": Nominal 9/16-inch (14mm) thick Single-Pane Laminated Safety Glass.
 - 1. Components:
 - a. Glass Ply 1: 1/4 inch (6mm) clear fully-tempered glass
 - b. Interlayer: 0.060 inch PVB (Polyvinyl Butyral)
 - c. Glass Ply 2: 1/4 inch (6mm) clear fully-tempered glass
 - 2. Locations: At interior aluminum curtain wall frame and aluminum non-rated doors; refer to drawings and schedules

D. INSULATED METAL GLAZING PANELS

- A. Manufacturers:
 - 1. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Mapes Industries, Lincoln, NE, Product: Mapes-R Insulated Composite Panels.
 - 2. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Columbia Architectural Products Inc., Beltsville, MD.
 - b. Laminators Inc., Hatfield PA
- B. Insulated Metal Glazing Panel Type IM-1:
 - 1. Panels are fabricated with reveal edges designed to be glazed into hollow metal door systems.
 - 2. Panel thickness: 1 inch.
 - 3. R-value: 6.43.
 - 4. U-Value: 0.1555.
 - 5. Panel Components:
 - a. Exterior: High density 3/16-inch tempered hardboard faced with aluminum face having an AAMA 2605 PVDF custom color finish to match HM door.
 - b. Interior: High density 3/16-inch tempered hardboard faced with aluminum and having a AAMA 2605 PVDF custom color finish to match HM door.
 - c. Core: 1.7-pound density polyisocyanurate foam insulation
 - 6. Panel fabrication:
 - a. Tolerances - .8% of panels dimension length and width - (+/-) 1/16" thickness."

2.9 ACCESSORIES

- A. Steel Primer: FS TT-P-31; red; brown; for shop application and field touch-up.
- B. Fasteners: All anchors and fasteners, including screws, nuts, bolts, rivets, and other fastening devices shall be of tempered aluminum or non-magnetic type 302/304 stainless steel, warranted by the manufacturer to be non-corrosive and compatible with aluminum frame members and other components of the curtain wall assemblies. All such devices shall be of suitable type and adequate capacity for each intended purpose.
 - 1. Perimeter Anchors: Aluminum or steel that is properly insulated from aluminum.

- C. Shims: "U" shaped structural shims complying with the following:
 - 1. Material: High impact polystyrene, interlocking or non-interlocking to achieve necessary thicknesses.
 - 2. Sizes: 1-1/2 by 2 inch by 1/16 inch thick, Part No. WS 1060 (blue); 1-1/2 by 2 inch by 1/8 inch thick, Part No. WS 1125 (red); 1/2 by 2 inch by 1/4 inch thick, Part No. WS 1250 (black).
 - 3. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. AccuTrex Products, Inc. Canansburg, PA.
 - b. Accushim, Lyons, IL.
 - c. Mr. Shims, Villa Park, IL.
- D. Sealant and backer Materials
 - 1. Sealant used within system: As recommended by manufacturer.
 - 2. Exterior perimeter Sealant: Joint Sealer Type PUM50 (Polyurethane, Multi-component, 50 percent movement): Low modulus type, multi-component non-sagging gun-grade polyurethane sealant, conforming to ASTM C 920, Type M, Class 50, Grade NS, use NT, M, A and O with a minimum movement capability of ± 50 percent, equal to the following:
 - a. BASF (Sonneborn), product "Masterseal NP2".
 - b. Tremco, product "Dymeric 240FC".
 - c. Pecora, product "Dynatrol II".
 - 3. Compressible joint bead back-up: Compressible closed cell polyethylene, extruded polyolefin or polyurethane foam rod 1/3 greater in diameter than width of joint. Provide one of the following, or equal.
 - a. Nomaco, Inc., Zebulon NC, product "HBR".
 - b. Sonneborn Building Products Inc., Minneapolis MN, product "Sonolastic" closed-cell backer-rod.
 - c. Tremco, Beachwood OH, product "Tremco Backer Rod".
- E. Air Barrier Tie-in Membrane:
 - 1. Air Barrier Tie-in Membrane and Adhesive Sealant: Manufacturer's standard pre-formed extruded pre-engineered pre-cured, low-modulus silicone-rubber extrusion, sized to fit opening widths, with a single-component, neutral-curing, 40 durometer. Class 100/50 low-modulus) translucent silicone sealant for bonding extrusions to substrates.
 - a. Basis of design: Tremco Commercial Sealants & Waterproofing, Beachwood, OH. Product: "Proglaze ETA, System 3."
 - 1) Width: Determined by field conditions
 - 2) Acceptable products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a) Tremco Commercial Sealants & Waterproofing, Beachwood, OH, product: "Proglaze ETA, System 3."
 - b) Dow Corning Corporation, Midland, MI, product: "123 Silicone Seal."

- c) Pecora Corporation, Harleysville, PA, product: "XL-Span."
- d) Elbex Corporation, Kent, OH, product "Elbex HS222" (0.030 inch thick).

F. FLASHING

- 1. Flashing (084413-01): One (1) piece sill flashing, 26-gauge, Type 302/304 stainless steel with a profile as detailed or 6 inches minimum. Interior leg to be sealed and glazed into curtain wall glazing pocket.
- 2. Flashing (084413-02): .063 Aluminum brake metal. Finish to match curtain wall.

2.10 FABRICATION

- A. Check dimensions of openings for curtain wall systems in the actual construction by accurate field measurement before fabrication. When necessary to proceed with the fabrication without field measurements, coordinate and control installation tolerances to ensure proper fit of the aluminum curtain wall systems.
- B. Before shipment, complete fabrication, assembly, finishing, and other work to the greatest extent possible. Disassemble only for shipment and installation.
- C. Perform fabrication, including cutting, fitting, forming, drilling and grinding to prevent damage to exposed finish surfaces.
- D. Welding: Comply with AWS recommendations; grind exposed welds smooth and restore mechanical finish.
- E. Dissimilar Metals: Separate dissimilar metals with zinc chromate primer, bituminous paint, or other separator.
- F. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.
- G. Notch mullion screw raceways at perimeter to accept self-adhered membrane transition flashing connection to AVB flashings.

2.11 EXTRUDED AND FORMED SHEET METAL ALUMINUM BRAKE METAL WORK

- A. Fabricate and install all extruded aluminum and formed sheet aluminum brake-metal work in conjunction with the aluminum curtain wall work as detailed and as reasonably required to complete the work including sill extensions, snap trim pieces, closures, coverings, flashings and other miscellaneous extruded and formed brake-metal work in conjunction with Work of this Section.
 - 1. Provide extruded shapes wherever possible, reserving formed work for conditions where extrusions are not applicable.
 - 2. Provide sheet metal panning not less than 0.060 inch thick.
 - 3. Fasten trim clips, at no more than 16 inches on center.
- B. Protect surfaces from marring when forming work. Provide sufficient material thickness with all necessary concealed reinforcement and anchorage to prevent "oil canning" or deformation of the finished work. Material deemed defective by the architect shall be replaced at no cost to the Owner.

2.12 FACTORY FINISHING

- A. Shop-applied, fully oven cured Polyvinylidene Flouride (PVDF) resin based, high performance thermoplastic organic coating applied to all exposed surfaces, including all exposed screws, fastenings. Conform to AAMA 2605, NAAMM - Metal Finishes Manual, and the following:
 - 1. Resin base of 70 percent PVDF by weight, Arkema, Inc., product "Kynar 500" or Solvay Solexis, Inc. product "Hylar 5000".
 - 2. Finish Coating shall be manufactured as one of the following products:
 - a. Akzo Nobel; product: "Trinar Ultra TEC."
 - b. PPG. Industries Ohio Inc.; product "Duranar XL."
 - c. Valspar Corp., product: "Fluropon Classic."
 - 3. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with acid chromate-fluoride-phosphate conversion coating, in accordance with Aluminum Association method AA-C12C42.
 - 4. Primer: Corrosion resistant, epoxy or urethane-based primer compatible with finish coating, averaging 0.2 to 0.3 mils dry film thickness.
 - 5. Finish Coat (Color Coat): Polyvinylidene flouride enamel averaging 1.0 to 1.2 mils dry film thickness.
 - 6. Top Coat: Polyvinylidene flouride enamel clear top coat averaging 0.4 to 0.6 mils dry film thickness
 - 7. Total system dry film thickness: 1.6 to 2.2 mils.
 - 8. Color and Appearance: Provide up to three custom colors as provided by Architect including colors designated by the coating manufacturer as "bright," "premium," "pearlescent," or "metallic". Colors shall be in configuration approved by the Architect.
 - a. Custom Color Match:
 - 1) Alpolic/Mitsubishi Chemical color: "PEX Metallic Pewter" PVDF Finish.
 - 2) EFCO Corp. color: "EFCO color reference PNTKYC27, custom - applied using 3-coat system to match Ultrapon 2-Coat Hartford Green Sample.
 - b. Gloss: Medium, measured by ASTM D523, 35 plus minus 5 at 60 degrees geometry.
 - c. Selected colors shall match verified color samples submittal furnished to Architect.
- B. Concealed Steel Items: Galvanized in accordance with ASTM A386 to 2.0 ounces per square foot.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

- B. Beginning of installation means acceptance of existing project conditions.
- C. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.
- D. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

3.2 ERECTION

- A. Coordinate the installation of the curtain wall systems, and related items to be furnished hereunder with the work of the other trades responsible for providing receiving and interfacing materials and ensure that all receiving and supporting surfaces have been completed and ready to receive the work of this Section.
- B. Perform the installation work in strict accordance with the approved shop drawings, and the manufacturers' installation instructions, the applicable provisions of AAMA Aluminum Curtain Wall Design Guide Manual and referenced standards. Erect the various systems and items plumb and true, in proper alignment and relation to established lines and grades.
- C. All shims shall be aluminum. Wood shims shall not be acceptable.
- D. Provide sheet aluminum closures as indicated or required to complete the Work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install and set thresholds in bed of water caulk mastic and secure.
- G. Perform all glazing work in accordance with GANA Glazing Manual and SIGMA standards, and with the curtain wall system manufacturers' recommended glazing procedures.
- H. All glass at frames shall be set by use of resilient glazing gaskets between both interior and exterior stops and glass, weathertight, in strict accordance with the printed glazing instructions of the manufacturers of aluminum work and glazing materials.
- I. Ensure that all metal-to-metal and metal-to-glass joints are completely weathertight, and that adequate provisions have been made to permit expansion and contraction in the metal.
- J. No permanent exposed to view labels of any kind shall be permitted to remain on the frames or glass.
- K. Aluminum frame cut edges: File sharp edges and touch-up with matching color.
- L. All mullion covers shall be installed with no wider than 1/32-inch joint at adjacent covers.
- M. Air Barrier transition tie-ins: Install silicone transition sheet following manufacturer's instructions and recommendations, and as additionally specified herein:

1. Preparation: Solvent wipe clean with isopropyl alcohol (IPA) using a clean, white, lint-free rag of all surfaces to receive silicone sheet transition strip from all dirt, debris, and contaminants that may affect the bond of performance of the sealant and silicone sheet. Dry wipe using a clean, white, lint-free rag.
2. Use manufacturer's pre-made corners where applicable.
3. Lap sheets to shed water and seal all laps and transitions.
4. Bed silicone transition sheet in a minimum 1-inch bed of approved sealant. Sealant shall extend to the outboard edge of the silicone sheet, and the counterflash from the wall AWB onto the face of the silicone sheet.
5. Bed silicone sheet into sealant in the glazing pocket of curtain wall framing. If the silicone sheet has a dart, fully engage dart into receiver in curtain wall system. Counterflash edge of silicone sheet with sealant such that the sealant extends from the curtain wall framing onto the face of the silicone sheet. Provide continuous pressure against silicone sheet with curtain wall framing components.
6. Transitions shall be subjected to all testing conducted for air, vapor and water barriers, as well as all fenestration testing for fenestrations to which the silicone sheet is applied.

3.3 GLAZING

- A. Field glaze in accordance with FGMA Glazing Manual SIGMA and LSGA standards for glazing and installation methods and with the curtain wall, entrance framing system manufacturers' recommended glazing procedures. Do not glaze when ambient temperature is below 40 degrees Fahrenheit. Additionally:
 1. All tempered glass units shall be installed with draw marks oriented in the same direction.
 2. Prior to installing glass, clean glazing channels and framing members.
 3. Remove coatings not completely bonded to substrates.
 4. Remove lacquer from metal surfaces where in contact with glazing sealant.
 5. Protect glass from edge damage at all times. Utilize roller blocks and suction cups.
 6. Replace glass from edge damage or other imperfections which would weaken glass.
 7. Install setting and side blocks in locations recommended by referenced standards.
 8. Center glass in openings. Provide minimum bite and clearances as recommended by referenced standards. Install in manner to permit easy replacement of glass without dismantling frames.
 9. Prevent metal to glass contact at all locations. Protect edges of insulated units from moisture and solvents.
 10. Clean, prime and install stops.
- B. Glaze curtainwall system by use of resilient glazing gaskets between both interior and exterior stops and glass, weathertight, in strict accordance with the printed glazing instructions of the manufacturers of aluminum work and glazing materials.

- C. Ensure that all metal-to-metal and metal-to-glass joints are completely weathertight, and that adequate provisions have been made to permit expansion and contraction in the metal.
- D. Upon completion of the installation, thoroughly clean and polish all surfaces. Touch-up all scratches, abrasions, and other defects in the prefinished metal surfaces.

3.4 TOLERANCES

- A. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities. Erect the aluminum systems plumb and level, free of warp or twist.
 - 1. Install 1/16 inch per 10 feet, non-cumulative, maximum variation from plumb.
 - 2. Install 1/32-inch maximum misalignment of two adjoining members abutting in plane.

3.5 PROTECTION AND CLEANING OF CURTAIN WALL SYSTEM

- A. Clean all curtain wall system promptly after installation, exercising care to avoid damage. Thoroughly clean all metal and glass surfaces free from dirt, handling marks, packing tapes, and foreign matter; remove excess sealant. Remove labels from glass surfaces, and clean and polish same.
- B. Touch-up all scratches, abrasions, and other defects in the prefinished metal surfaces with shop-coat finish material, supplied with the various items to be furnished hereunder. Touch-up surfaces are to be sanded smooth, primed and air brushed with custom mixed paint to match. A repair mock-up shall be provided and approved prior to remedial work.
- C. The manufacturer shall advise the Contractor of protective treatment and other precautions through the remainder of construction to ensure that the work of this Section shall be without damage or deterioration at the time of Substantial Completion of the General Contract.

3.6 CLEANING OF GLASS

- A. Clean glass surfaces promptly after installation, exercising care to avoid damage to the same. Remove excess sealing compounds, mortar, paint, dirt, and other contaminants.
- B. All exposed edges of sealant and gaskets shall be left smooth, uniform in line, and with edges neatly struck.

3.7 GLASS BREAKAGE

- A. Replace in kind and thickness all glass breakage caused by the work performed under this Section and bear all costs therefor.
- B. Replace in kind and thickness all glass breakage, caused by other trades, because of negligence or any other reasons, with the costs being borne by the trade at fault, or the Contractor, as applicable.

3.8 PROTECTION

- A. Protect finished metal surfaces from damage during fabrication, shipping, storage, and erection; advise the Contractor of protective treatment and other precautions required through the remainder of construction.

End of Section

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes

- 1. Furnishing and installation of all mechanical and electrical finish hardware necessary for all doors, and hardware as specified herein and as enumerated in hardware sets and as indicated and required by actual conditions at the building. The hardware shall include the furnishing of all necessary screws, bolts, expansion shields, drop plates, and all other devices necessary for the proper application of the hardware. Installation shall include field modification and preparation of existing doors and/or frames for new hardware being installed. Provide necessary fillers, Dutchmen, reinforcements, and fasteners for mounting new hardware and to cover existing door/frame preps.

B. Related Sections

- 1. Division 6 Section - Finish Carpentry
- 2. Division 8 Section - Hollow Metal Doors and Frames
- 3. Division 8 Section - Wood Doors
- 4. Division 8 Section - Aluminum Framed Storefronts
- 5. Division 8 Section - Glass and Glazing
- 6. Division 26 Section - Electrical
- 7. Division 27 Section - Communications
- 8. Division 28 Section - Electronic Security and Safety

- C. Specific Omissions: Hardware for the following is specified or indicated elsewhere, unless specifically listed in the hardware sets:

- 1. Windows
- 2. Cabinets of all kinds, including open wall shelving and locks.
- 3. Signage, except as noted.
- 4. Complete toilet accessories including coat hooks, unless noted otherwise.

5. Overhead doors, unless noted otherwise.

1.03 REFERENCES

- A. Applicable state and local building codes and standards.

- B. FIRE/LIFE SAFETY

1. NFPA - National Fire Protection Association
 - a. NFPA 70 – National Electric Code
 - b. NFPA 80 - Standard for Fire Doors and Fire Windows
 - c. NFPA 101 - Life Safety Code
 - d. NFPA 105 - Smoke and Draft Control Door Assemblies

- C. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

- D. Accessibility

1. ADA - Americans with Disabilities Act.
2. Massachusetts Architectural Access Board Regulation – 521 CMR.

- E. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware

- F. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI A156.31 - Standards for Hardware and Specialties

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 requirements. Prior to submittal field verify existing doors and/or frames receiving new hardware and/or existing conditions receiving new openings. Verify new hardware is compatible with the existing door/frame preparation and/or existing conditions. Advise architect within the submittal package of incompatibility or issues.
- B. Catalog Cuts: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

- C. Final Hardware Schedule Content: Submit schedule with hardware sets in vertical format as illustrated by the Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening. Include the following information:
1. Door Index; include door number, heading number, and Architects hardware set number.
 2. Opening Lock Function Spreadsheet; list locking device and function for each opening.
 3. Type, style, function, size, and finish of each hardware item.
 4. Name and manufacturer of each item.
 5. Fastenings and other pertinent information.
 6. Location of each hardware set cross-referenced to indications on Drawings.
 7. Explanation of all abbreviations, symbols, and codes contained in schedule.
 8. Mounting locations for hardware.
 9. Door and frame sizes and materials.
 10. Name and phone number for the local manufacturer's representative for each product.
 11. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and/or access control components). Operational description should include how the door will operate on egress, ingress, and/or fire/smoke alarm connection.
- D. Key Schedule: After a keying meeting between representatives of the Owner, Architect, hardware supplier, and, if requested, the representative for the lock manufacturer, provide a keying schedule, listing the levels of keying, as well as an explanation of the key system's function, the key symbols used, and the door numbers controlled. Utilize ANSI A156.28 "Recommended Practices for Keying Systems" as a guideline for nomenclature, definitions, and approach for selecting the optimal keying system.
- E. Samples: If requested by the Architect, submit production sample or sample installations as requested of each type of exposed hardware unit in the finish indicated, and tagged with a full description for coordination with the schedule.
1. Samples will be returned to the supplier in like-new condition. Units that are acceptable to the Architect may, after final check of operations, be incorporated into the Work, within limitations of key coordination requirements.
- F. Templates: After final approval of the hardware schedule, provide templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware.
- G. Riser and Wiring Diagrams: After final approval of the hardware schedule, submit riser and wiring diagrams as required for the proper installation of complete electrical, electromechanical, and electromagnetic products.

- H. Operations and Maintenance Data: Provide in accordance with Division 1 and include the following:
1. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 2. Catalog pages for each product.
 3. Name, address, and phone number of local representative for each manufacturer.
 4. Parts list for each product.
 5. Copy of final approved hardware schedule, edited to reflect "As installed."
 6. Copy of final keying schedule.
 7. As installed "Wiring Diagrams" for each opening connected to power, both low voltage and 110 volts.
 8. One (1) complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
 9. Copy of warranties including appropriate reference numbers for manufacturers to identify the project.
- I. Certificates of Compliance: Upon request of Architect or Authority Having Jurisdiction certificates of compliance for fire-rated hardware and installation instructions shall be made available.

1.05 QUALITY ASSURANCE

- A. Substitutions: Products are to be those specified to ensure a uniform basis of acceptable materials. Requests for substitutions must be made in accordance with Division 1 requirements. If proposing a substitute product, submit product data for the proposed item with product data for the specified item and indicate basis for substitution and savings to be made. Provide sample if requested. Certain products have been selected for their unique characteristics and particular project suitability.
1. Items specified as "no substitute" shall be provided exactly as listed.
 2. Items listed with no substitute manufacturers listed have been requested by the Owner or Architect to match existing for continuity and/or future performance and maintenance standards or because there is no known equal product.
 3. If no other products are listed in a category, then "no substitute" is implied.
- B. Supplier Qualifications: A recognized architectural hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides a certified Architectural Hardware Consultant (AHC) available to the Owner, Architect, and Contractor, at reasonable times during the course of the Work for consultation.
- C. Single Source Responsibility: Obtain each type of hardware (latch and locksets, hinges, exit devices, closers, etc.) from a single manufacturer.

- D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwrites Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to the authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and door frame labels.
- E. Electronic Security Hardware: When electrified hardware is included in the hardware specification, the hardware supplier must employ an individual knowledgeable in electrified components and systems, who is capable of producing wiring diagrams and consulting as needed. Coordinate installation of the electronic security hardware with the Architect and electrical engineers and provide installation and technical data to the Architect and other related subcontractors. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Tag each item or package separately with identification related to the final hardware schedule, and include installation instructions with each item or package.
- B. Each article of hardware shall be individually packaged in manufacturer's original packaging.
- C. Contractor will provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Items damaged in shipment shall be replaced promptly and with proper material and paid for by whomever did the damage or caused the damage to occur.
- E. Hardware shall be handled in a manner to avoid damage, marring, or scratching. Irregularities that occur to the hardware after it has been delivered to the Project shall be corrected, replaced, or repaired by the Contractor. Hardware shall be protected against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. No direct shipments will be allowed unless approved by the Contractor.

1.07 WARRANTY

- A. Provide manufacturer's warranties as specified in Division 1 and as follows:
 - 1. Closers: 30 years, except electronic closers, 2 years.
 - 2. Exit Devices: 3 years, except electrified devices, 1 year.
 - 3. Locksets: 3 years, except electrified locksets, 1 year.
 - 4. Continuous Hinges: Lifetime warranty.
 - 5. Other hardware: 1 year.
- B. No liability is to be assumed where damage or faulty operation is due to improper installation, improper use, or abuse.

- C. Products judged to be defective during the warranty period shall be replaced or repaired in accordance with the manufacturer's warranty, at no additional cost to the Owner.

1.08 MAINTENANCE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The Awarding Authority has determined that certain products should be selected for their unique characteristics and particular project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute" (NO OTHER PRODUCTS WILL BE CONSIDERED FOR THOSE LISTED IN PROJECTS DOCUMENTS.)
- B. Approval of manufacturers other than those listed shall be in accordance with paragraph 1.05.A.
- C. Note that even though an acceptable substitute manufacturer may be listed, the product must provide all the functions and features of the specified product or it will not be approved.

Item	Scheduled Manufacturer	Acceptable Substitute
Hinges	Ives (IVE)	Best, Hager
Continuous Hinges	Ives (IVE)	Best, Markar
Electric Power Transfer	Von Duprin (VON)	Dormakaba, Sargent
Locksets	Schlage (SCH)	Best, Sargent
Exit Devices	Von Duprin (VON)	Best, Sargent
Power Supplies	Von Duprin (VON) Schlage Electronics (SCE)	Dormakaba, Sargent
Door Closers	LCN (LCN)	Best, Sargent
Electro-Hydraulic Automatic Operators	LCN (LCN)	Besam, Norton
Door Trim	Ives (IVE)	Trimco, Rockwood
Protection Plates	Ives (IVE)	Trimco, Rockwood
Overhead Stops	Glynn-Johnson (GLY)	Dormakaba, Sargent
Stops & Holders	Ives (IVE)	Trimco, Rockwood
Thresholds & Weatherstrip	Zero (ZER)	National Guard, Reese
Silencers	Ives (IVE)	Trimco, Rockwood
Cylinders & Keying	Schlage (SCH)	No Substitute

- D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- E. Where the hardware specified is not adaptable to the finished shape or size of the members requiring hardware, furnish suitable types having the same operation and quality as the type specified, subject to the Architect's approval.

2.02 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent that no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Hardware shall be installed with the fasteners provided by the hardware manufacturer.

B. Hinges

1. Provide five-knuckle, ball bearing hinges of type, material, and height as outlined in the following guide for this specification:
 - a. 1-3/4 inch thick doors, up to and including 36 inches wide:
Exterior: standard weight, bronze/stainless steel, 4-1/2 inches high
Interior: standard weight, steel, 4-1/2 inches high
 - b. 1-3/4 inch thick doors over 36 inches wide:
Exterior: heavy weight, bronze/stainless steel, 5 inches high
Interior: heavy weight, steel, 5 inches high
 - c. 2 inches or thicker doors:
Exterior: heavy weight, bronze/stainless steel, 5 inches high
Interior: heavy weight, steel, 5 inches high
2. Provide three hinges per door leaf for doors 90 inches or less in height, and one additional hinge for each 30 inches of additional door height.
3. Where new hinges are specified for existing doors and/or existing frames, the new hinge size must be identical to hinge preparation present in the existing door and/or existing frame.
4. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
5. The width of hinges shall be 4-1/2 inches at 1-3/4 inch thick doors, and 5 inches at 2 inches or thicker doors. Adjust hinge width as required for door, frame, and/or wall conditions to allow proper degree of opening.

6. Provide hinges with electrified option where specified. Provide with sufficient number and gage of concealed wires to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to the electrified locking component.
7. Provide mortar guard for each electrified hinge specified, unless specified in hollow metal frame specification.
8. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches or less in height. Provide one additional bearing hinge for each 30 inches of additional door height.
9. Acceptable manufacturers and/or products: Ives 5BB series, Best FBB series, Hager BB series.

C. Continuous Hinges

1. Provide aluminum geared continuous hinges conforming to ANSI A156.25, Grade 2.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum, with .25-inch diameter Teflon coated stainless steel hinge pin.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Hinges shall be capable of supporting door weights up to 450 pounds and shall be successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by a testing agency acceptable to the authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option where specified. Provide with sufficient number and gage of concealed wires to accommodate electric function of specified hardware.
7. Install hinges with fasteners supplied by manufacturer. Hole pattern shall be symmetrically patterned.
8. Acceptable manufacturers and/or products: Ives, Best, Markar.

D. Electric Power Transfer

1. Provide power transfer sufficient for number and gage of wires to accommodate electric function of specified hardware.
2. Electric power transfer is to be located per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.
3. Acceptable manufacturers and/or products: Von Duprin, Dormakaba, Sargent.

E. Mortise Locks

1. Provide mortise locks certified as ANSI A156.13, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Lock case shall be multi-function and field reversible for handing without opening the case. Cylinders: Refer to 2.04 KEYING.
2. Provide locks with a standard 2-3/4 inches backset with a full 3/4 inch throw stainless steel mechanical anti-friction latchbolt. Deadbolt shall be a full 1 inch throw, constructed of stainless steel.
3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
4. Provide electrical options as scheduled. Provide electrified locksets with micro switch (RX) option that monitors the retractor crank, and is actuated when rotation of the inside or outside lever rotates the retractor hub. Provide normally closed contacts or normally open contacts as required by security system.
5. Lever trim shall be solid brass, bronze, or stainless steel, cast or forged in the design specified, with wrought roses and external lever spring cages. Levers shall be thru-bolted to assure proper alignment, and shall have a 2-piece spindle.
 - a. Lever design shall be Schlage 07A.
 - b. Lever trim on the secure side of doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.
6. Acceptable manufacturers and/or products: Schlage L9000 series, Best 45H series, Sargent 8200 series.

F. Exit Devices

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit and/or Fire Exit Hardware. Cylinders: Refer to 2.04 KEYING.
2. Exit devices shall be touchpad type, fabricated of brass, bronze, stainless steel, or aluminum, plated to the standard architectural finishes to match the balance of the door hardware.
3. Touchpad shall extend a minimum of one half of the door width. Touch-pad finish shall be compatible to exit device finish. Compression springs will be used in devices, latches, and outside trims or controls, tension springs also acceptable.
4. Devices to incorporate a deadlatching feature for security and/or for future addition of alarm kits and/or other electrical requirements.
5. Provide manufacturer's standard strikes.
6. Provide exit devices cut to door width and height. Locate exit devices at a height recommended by the exit device manufacturer, allowable by governing building codes, and approved by the Architect.
7. Mechanism case shall sit flush on the face of all flush doors, or spacers shall be furnished to fill gaps behind devices. Where glass trim or molding projects off the face of the door, provide glass bead kits.

8. Non-fire-rated exit devices shall have cylinder dogging.
9. Removable mullions shall be a 2 inches x 3 inches steel tube. Where scheduled, mullion shall be of a type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
10. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to a 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
 - a. Lever style will match the lever style of the locksets.
 - b. Lever trim on doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.
11. Exit devices for fire rated openings shall be UL labeled fire exit hardware.
12. Field drill weep holes per manufacturer's recommendation for exit devices used in full exterior application, highly corrosive areas, and where noted in the hardware sets.
13. Provide electrical options as scheduled.
14. Acceptable manufacturers and/or products: Von Duprin 99/33 series, Best Apex series, Sargent 80 series with deadlatching.

G. Power Supplies

1. Provide power supplies, recommended and approved by the manufacturer of the electrified locking component, for the operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring a power supply.
2. Provide the appropriate quantity of power supplies necessary for the proper operation of the electrified locking component and/or components as recommended by the manufacturer of the electrified locking components with consideration for each electrified component utilizing the power supply, the location of the power supply, and the approved wiring diagrams. Locate the power supplies as directed by the Architect.
3. Provide a power supply that is regulated and filtered 24 VDC, or as required, and UL class 2 listed.
4. Provide a power supply, where specified, with the internal capability of charging optional sealed backup batteries 24 VDC, or as required, in addition to operating the DC load.
5. Provide a power supply complete requiring only 120VAC to the fused input and shall be supplied in an enclosure.
6. Provide a power supply with emergency release terminals, where required, that allow the release of all devices upon activation of the fire alarm system complete with fire alarm input for initiating "no delay" exiting mode.
7. Acceptable manufacturers and/or products: Von Duprin PS900 series, Dormakaba DKPS series, Sargent 3500 series, Schlage Electronics PS900 series.

H. Door Closers

1. Provide door closers certified to ANSI/BHMA A156.4 Grade 1 requirements by a BHMA certified independent testing laboratory. Closers shall be ISO 9000 certified. Units shall be stamped with date of manufacture code.
2. Door closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder, and shall utilize full complement bearings at shaft. Cylinder body shall be 1-1/2 inch diameter, and double heat-treated pinion shall be 11/16 inch diameter.
3. Provide hydraulic fluid requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F. Fluid shall be fireproof and shall pass the requirements of the UL10C "positive pressure" fire test.
4. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force as required by accessibility codes and standards. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and backcheck.
5. Provide closers with a solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
6. Closers shall not incorporate Pressure Relief Valve (PRV) technology.
7. Closer cylinders, arms, adapter plates, and metal covers shall have a powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or shall have special rust inhibitor (SRI).
8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other finish hardware items interfering with closer mounting.
9. Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
10. Door closers meeting this specification: LCN 4040XP series, Sargent 281/281P10 series factory assembled (without PRV), Best QDC100 series.

I. Electro-Hydraulic Automatic Operators

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI A156.19 where automatic operators are specified.
2. Provide hydraulic fluid of a type requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F. Fluid shall be fireproof and shall pass the requirements of the UL10C "positive pressure" fire test.
3. Provide units with conventional door closer opening and closing forces unless the power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door

4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide units with conventional door closer opening and closing forces unless the power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check valve, sweep valve, latch valve to control door.
6. Provide drop plates, brackets, or adapters for arms as required for details.
7. Provide hard-wired actuator switches for operation as specified. Actuators shall be weather-resistant type at exterior applications.
8. Provide key switches, with LED's, recommended and approved by the manufacturer of the automatic operator as required for the function as described in the operation description of the hardware group with the provisions below. Cylinders: Refer to 2.04 KEYING.
9. Where automatic operators are scheduled, provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by the manufacturer of the automatic operator for each individual leaf. Actuators shall control both doors simultaneously at pairs. Exterior and vestibule doors with automatic operators shall be sequenced to allow ingress or egress through both sets of openings as directed by the Architect. Locate the actuators, key switches, and other controls as directed by the Architect.
10. Provide units with vestibule inputs, which allow sequencing operation of two units, and a SPDT relay for interfacing with latching or locking devices.
11. Acceptable manufacturers and/or products: LCN 4600 series, Norton 6900 series, Besam Power Swing.

J. Door Trim

1. Provide push plates 4 inches wide x 16 inches high x 0.050 inch thick and beveled 4 edges. Where width of door stile prevents use of 4 inches wide plate, adjust width to fit.
2. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
3. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide pull plates 4 inches wide x 16 inches high x 0.050 inch thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches wide plate, adjust width to fit.
5. Acceptable manufacturers and/or products: Ives, Trimco, Rockwood.

K. Protection Plates

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch thick as scheduled. Furnish with machine or wood screws, finished to match plates. Sizes of plates shall be as follows:

- a. Kick Plates – 10 inches high x 2 inches less width of door on single doors, 1 inch less width of door on pairs
- b. Mop Plates – 4 inches high x 2 inches less width of door on single doors, 1 inch less width of door on pairs
- c. Armor Plates – 36 inches high x 2 inches less width of door on single doors, 1 inch less width of door on pairs

2. Acceptable manufacturers and/or products: Ives, Trimco, Rockwood.

L. Overhead Stops and Overhead Stop/Holders

1. Provide heavy duty concealed mounted overhead stop or overhead stop/holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy or medium duty and concealed or surface mounted overhead stop or overhead stop/holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking a wall, open against equipment, casework, sidelights, and/or where conditions do not allow a wall stop or a floor stop presents a tripping hazard.
3. Where overhead holders are specified provide friction type at doors without a closer and positive type at doors with a closer.
4. Acceptable manufacturers and/or products: Glynn-Johnson, Dormakaba, Sargent.

M. Door Stops and Holders

1. Provide door stops for all doors in accordance with the following requirements:
 - a. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
 - b. Where wall stops cannot be used, provide dome type floor stops of the proper height.
 - c. At any opening where a wall or floor stop cannot be used, a medium duty surface mounted overhead stop shall be used.
2. Acceptable manufacturers and/or products: Ives, Trimco, Rockwood.

N. Thresholds, Seals, Door Sweeps, Automatic Door Bottoms, and Gasketing

1. Provide thresholds, weatherstripping (including door sweeps, seals, astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items as closely as possible. Size of thresholds shall be as follows:
 - a. Exterior Saddle Thresholds – 1/2 inch high x jamb width x door width
 - b. Interior Saddle Thresholds – 1/4 inch high x jamb width x door width
 - c. Bumper Seal Thresholds – 1/2 inch high x 5 inches wide x door width
2. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
3. Acceptable manufacturers and/or products: Zero, National Guard, Reese.

O. Silencers

1. Provide "Push-in" type silencers for each hollow metal or wood frame. Provide three for each single frame and two for each pair frame. Omit where gasketing is specified or required by code.
2. Acceptable manufacturers and/or products: Ives, Trimco, Rockwood.

2.03 FINISHES

A. Finish of all hardware shall be US26D (BHMA 626/652) with the exceptions as follows:

1. Continuous Hinges: Clear Anodized Aluminum.
2. Push Plates, Pulls, and Push Bars: US32D (BHMA 630).
3. Protection Plates: US32D (BHMA 630).
4. Overhead Stops and Holders (Exterior Doors): US32D (BHMA 630).
5. Overhead Stops and Holders (Interior Doors): Powder Coat to Match.
6. Door Closers: Powder Coat to Match.
7. Weatherstripping: Clear Anodized Aluminum.
8. Thresholds: Mill Finish Aluminum.

2.04 KEYING

1. Provide cores and cylinders for the Owner's Existing Schlage key system conforming to the following requirements:
2. Provide restricted patented removable core cylinders at all keyed devices, locksets, cylinder dogging, removable mullions, and exit device trim. Provide construction cores with construction master keying for use during construction. The Owner or Owner's Representative shall replace temporary construction cores with permanent cores upon completion of the project. The temporary construction cores are to be returned to the hardware supplier.
3. Provide permanent cores and cylinders keyed by the manufacturer or authorized distributor into the existing key system as directed by the Owner. Provide owner with a copy of the bitting list, return receipt requested.
4. The hardware supplier, accompanied by a qualified factory representative for the manufacturer of the cores and cylinders, shall meet with Owner and Architect to review keying requirements and lock functions prior to ordering finish hardware. Submit a keying schedule to Architect for approval.
5. Provide keys as follows
 - a. Ten grand master keys for each set.

- b. Ten master keys for each set.
 - c. Three keys per core and/or cylinder.
 - d. Two construction core control keys
 - e. Two permanent core control keys
 - f. Six construction master keys for each type (Contractor is to provide one set of construction keys to Architect)
- 6. Visual key control:
 - a. Keys shall be stamped with their respective key set number and stamped "DO NOT DUPLICATE".
 - b. All keys shall be stamped with their respective key set letters.
 - c. Do not stamp any keys with the factory key change number.
 - d. Do not stamp any cores with key set on face (front) of Core. Stamp on back or side of cores so not to be visible when core is in cylinder.
- 7. Deliver all keys and/or key blanks from the factory or authorized distributor directly to the Owner in sealed containers, return receipt requested. Failure to comply with these requirements may be cause to require replacement of all or any part of the keying system that was compromised at no additional cost to the Owner.
- 8. Approved products: Schlage Everest 29T FSIC – T135 keyway (B Grand Master with a building Master Symbol of BL), No Substitute.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of any hardware, examine all doors, frames, walls and related items for conditions that would prevent proper installation of finish hardware. Correct all defects prior to proceeding with installation.

3.02 INSTALLATION

- A. Coordination:
 - 1. Prior to installation of hardware, schedule and hold a meeting for the purpose of instructing installers on proper installation and adjustment of finish hardware. Representatives of locks, exit devices, closers, automatic operators, and electrified hardware shall conduct training; provide at least 10 days notice to representatives. After training a letter of compliance, indicating when the training was held and who was in attendance, shall be sent to the Architect.
 - 2. Prior to ordering electrified hardware, schedule and hold a meeting for the purpose of coordinating finish hardware with security, electrical, doors and frames, and other related suppliers. A representative of the supplier of finish hardware, and doors and frames, the electrical subcontractor, and the Owner's security contractor shall meet with the Owner, Architect, and General Contractor prior to ordering finish hardware. After meeting a letter of compliance, indicating when the training was held and who was in attendance, shall be sent to the Architect.

- B. Hardware will be installed by qualified tradesmen, skilled in the application of commercial grade hardware. For technical assistance if necessary, installers may contact the manufacturer's rep for the item in question, as listed in the hardware schedule.
- C. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
- D. Install each hardware item in compliance with the manufacturer's instructions and recommendations, using only the fasteners provided by the manufacturer.
- E. Do not install surface mounted items until finishes have been completed on the substrate. Protect all installed hardware during painting.
- F. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- G. Operating parts shall move freely and smoothly without binding, sticking, or excessive clearance.
- H. Existing Doors and/or Frames: Remove existing hardware being replaced, tag, and store according to contract documents. Field modify and prepare existing door and/or frame for new hardware being installed. Provide necessary fillers, Dutchmen, reinforcements, and fasteners for mounting new hardware and to cover existing door/frame preps.
- I. Wire (including low voltage), conduit, junction boxes, and pulling of wire is by Division 26, Electrical. Electrical Contractor shall connect wire to door position switches and run wire to central room or area as directed by the Architect. Wires shall be tested and labeled with the Architects opening number. Connections to/from power supplies to electrified hardware and any connection to fire/smoke alarm system, and/or smoke evacuation system where specified is by Division 26 Electrical.

3.03 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door, to insure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly.
- B. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make a final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- C. Clean adjacent surfaces soiled by hardware installation.
- D. Instruct Owner's personnel in the proper adjustment, lubrication, and maintenance of door hardware and hardware finishes.

3.04 FIELD QUALITY CONTROL

- A. Prior to Substantial Completion, the installer, accompanied by representatives of the manufacturers of locks, exit devices, closer, and any electrified hardware, shall perform the following work:

1. Examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements.
2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
3. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units.
4. Prepare a written report of current and predictable problems of substantial nature in the performance of the hardware.
5. At completion of project, a qualified factory representative for the manufacturers of locksets, closer, exit devices, and access control products shall arrange and hold a training session to instruct the Owner's personnel on the proper maintenance, adjustment, and/or operation of their respective products. After training a letter of compliance, indicating when the training was held and who was in attendance, shall be sent to the Architect.

3.05 PROTECTION

- A. Provide for the proper protection of complete items of hardware until the Owner accepts the project as complete. Damaged or disfigured hardware shall be replaced or repaired by the responsible party.

3.06 HARDWARE SCHEDULE

- A. Provide hardware for each door to comply with requirements of Section "Finish Hardware," hardware set numbers indicated in door schedule, and in the following schedule of hardware sets.
- B. It is intended that the following schedule includes complete items of finish hardware necessary to complete the work. If a discrepancy is found in the schedule, such as a missing item, improper hardware for a frame, door or fire codes, the preamble will be the deciding document.
- C. Locksets, exit devices, and other hardware items are referenced in the Hardware Sets for series, type, and function. Refer to the preamble for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets

HEADING # 01 - (EXTERIOR ALUMINUM SINGLE WITH EXIT ONLY RIM PANIC HARDWARE X CLOSER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	PANIC HARDWARE	LD-99-EO	626	VON
1	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	630	GLY
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA (AS NEEDED)	689	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	DOOR SWEEP	BY ALUMINUM DOOR SUPPLIER		
1	EA	THRESHOLD	8655A (VERIFY JAMB DEPTH)	A	ZER
1	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		

ALL WIRING AND CONNECTIONS BY DIVISION 26.
OPERATIONAL DESCRIPTION:
DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 02 - (EXTERIOR ALUMINUM SINGLE WITH ELECTRIC RIM PANIC HARDWARE X AUTO OPERATOR X CARD READER X VIDEO INTERCOM)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-OP	626	VON
1	EA	RIM CYLINDER	AS REQUIRED	626	SCH
1	EA	PERMANENT CORE	FSIC EVEREST 29T	626	SCH
1	EA	OFFSET DOOR PULL	8190-0	630	IVE
1	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	630	GLY
1	EA	SURF. AUTO OPERATOR	4640 SERIES (PUSH SIDE MOUNTED)	689	LCN
2	EA	ACTUATOR, TOUCH	8310-853T/8310-818T AS REQUIRED		LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
1	EA	DOOR SWEEP	BY ALUMINUM DOOR SUPPLIER		
1	EA	THRESHOLD	8655A (VERIFY JAMB DEPTH)	A	ZER
1	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		
1	EA	POWER SUPPLY	PS902 900-2RS		VON
1	EA	CARD READER	SPECIFIED ELSEWHERE		
1	EA	VIDEO INTERCOM	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.
OPERATIONAL DESCRIPTION:
IMMEDIATE EGRESS ALWAYS ALLOWED. DOOR CAN BE MANUALLY OR AUTOMATICALLY OPERATED. ACCESS CONTROL SYSTEM TO RETRACT AND HOLD EXIT DEVICE LATCHBOLT AND ENABLE EXTERIOR AUTOMATIC OPERATOR ACTUATOR. DOOR CAN BE MANUALLY PULLED OPEN OR AUTOMATICALLY OPERATED BY PUSHING ACTUATOR WHICH SIGNALS AUTOMATIC OPERATOR TO OPEN DOOR. INTERIOR ACTUATOR TO SIGNAL AUTOMATIC OPERATOR TO OPEN DOOR. LOCATE ACTUATORS AS DIRECTED BY ARCHITECT.
SECURE OPERATION:
ACCESS CONTROL SYSTEM TO RELEASE EXIT DEVICE LATCHBOLT AND TAKE CONTROL OF EXTERIOR ACTUATOR TO CONTROL ENTRY. IMMEDIATE EGRESS ALWAYS ALLOWED. AUTOMATIC OPERATION BY PUSHING INTERIOR ACTUATOR WHICH WILL RETRACT EXIT DEVICE LATCHBOLT THEN SIGNAL AUTOMATIC OPERATOR TO OPEN DOOR. ACCESS BY KEY, CARD READER OR BY VIDEO INTERCOM. CARD READER OR VIDEO INTERCOM WILL RETRACT EXIT DEVICE LATCHBOLT AND ALLOW ACCESS, AND TEMPORARILY ENABLE EXTERIOR ACTUATOR

TO ALLOW AUTOMATIC OPERATION. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 03 - (ALUMINUM SINGLE VESTIBULE WITH ELECTRIC RIM PANIC HARDWARE X CLOSER X CARD READER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-OP	626	VON
1	EA	RIM CYLINDER	AS REQUIRED	626	SCH
1	EA	PERMANENT CORE	FSIC EVEREST 29T	626	SCH
1	EA	OFFSET DOOR PULL	8190-0	630	IVE
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
1	EA	DOOR SWEEP	BY ALUMINUM DOOR SUPPLIER		
1	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		
1	EA	POWER SUPPLY	PS902 900-2RS		VON
1	EA	CARD READER	SPECIFIED ELSEWHERE		
1	EA	VIDEO INTERCOM	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL RETRACT EXIT DEVICE LATCHBOLT AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 04 - (SINGLE VESTIBULE WITH PUSH/PULL HARDWARE X CLOSER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW SERIES AS SPECIFIED	630	IVE
1	EA	DOOR PULL	8103EZ-0	630-316	IVE
1	EA	PUSH PLATE	8200	630	IVE
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HEADING # 05 - (SINGLE WITH PASSAGE SET)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	652	IVE

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PASSAGE SET	L9010 07A	626	SCH
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HEADING # 06 - (SINGLE WITH PASSAGE SET X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	652	IVE
1	EA	PASSAGE SET	L9010 07A	626	SCH
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
1	SET	GASKETING	485	AA	ZER
1	EA	AUTO DOOR BOTTOM (MORT)	360	AA	ZER

HEADING # 07 - (SINGLE WITH OFFICE LOCKSET X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050T 07A L583-363	626	SCH
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
1	SET	GASKETING	485	AA	ZER
1	EA	AUTO DOOR BOTTOM (MORT)	360	AA	ZER

HEADING # 08 - (SINGLE WITH PASSAGE SET X CLOSER X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	652	IVE
1	EA	PASSAGE SET	L9010 07A	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
1	SET	GASKETING	485	AA	ZER
1	EA	AUTO DOOR BOTTOM (MORT)	360	AA	ZER

NOTE: FIELD REVIEW EXISTING FRAME. FIELD MODIFY AND PREPARE EXISTING FRAME FOR NEW HARDWARE BEING INSTALLED. PROVIDE NECESSARY FILLERS, DUTCHMEN, REINFORCEMENTS, AND FASTENERS FOR MOUNTING NEW HARDWARE AND TO COVER EXISTING FRAME PREPS.

HEADING # 09 - (SINGLE - LEAD LINED - WITH PASSAGE SET X CLOSER X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	652	IVE
1	EA	PASSAGE SET	L9010 07A XL11-515	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
1	SET	GASKETING	485	AA	ZER
1	EA	AUTO DOOR BOTTOM (MORT)	360	AA	ZER

HEADING # 10 - (SINGLE WITH PRIVACY INDICATOR SET X CLOSER X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	L9040 07A L583-363 OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
1	SET	GASKETING	485	AA	ZER
1	EA	AUTO DOOR BOTTOM (MORT)	360	AA	ZER

HEADING # 11 - (SINGLE WITH CLASSROOM LOCKSET X CLOSER X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	652	IVE
1	EA	CLASSROOM LOCK	L9070T 07A	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
1	SET	GASKETING	485	AA	ZER
1	EA	AUTO DOOR BOTTOM (MORT)	360	AA	ZER

HEADING # 12 - (SINGLE WITH ENTRANCE LOCKSET W/ INSIDE INDICATOR X CLOSER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	652	IVE
1	EA	OFFICE W/SIM RETRACT W/ INSIDE INDICATOR	L9056T 07A L583-363 IS-LOC	626	SCH

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

NOTE: FIELD REVIEW EXISTING FRAME. FIELD MODIFY AND PREPARE EXISTING FRAME FOR NEW HARDWARE BEING INSTALLED. PROVIDE NECESSARY FILLERS, DUTCHMEN, REINFORCEMENTS, AND FASTENERS FOR MOUNTING NEW HARDWARE AND TO COVER EXISTING FRAME PREPS.

HEADING # 13 - (SINGLE WITH ENTRANCE LOCKSET W/ INSIDE INDICATOR X CLOSER X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	652	IVE
1	EA	OFFICE W/SIM RETRACT W/ INSIDE INDICATOR	L9056T 07A L583-363 IS-LOC	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
1	SET	GASKETING	485	AA	ZER
1	EA	AUTO DOOR BOTTOM (MORT)	360	AA	ZER

NOTE: FIELD REVIEW EXISTING FRAME. FIELD MODIFY AND PREPARE EXISTING FRAME FOR NEW HARDWARE BEING INSTALLED. PROVIDE NECESSARY FILLERS, DUTCHMEN, REINFORCEMENTS, AND FASTENERS FOR MOUNTING NEW HARDWARE AND TO COVER EXISTING FRAME PREPS.

HEADING # 14 - (SINGLE WITH STOREROOM LOCKSET W/ TACTILE WARNING X CLOSER X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	652	IVE
1	EA	STOREROOM LOCK	L9080T 807A 07A	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
1	SET	GASKETING	485	AA	ZER
1	EA	AUTO DOOR BOTTOM (MORT)	360	AA	ZER

HEADING # 15 - (SINGLE WITH FAIL SECURE ELECTRIFIED STOREROOM LOCKSET X CLOSER X CARD READER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	EU MORTISE LOCK	RX-L9092TEU 07A	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
1	EA	GASKETING	488S	BK	ZER
1	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		
1	EA	POWER SUPPLY	PS902	LGR	SCE
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL UNLOCK LOCKSET AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 16 - (SINGLE WITH FAIL SECURE ELECTRIFIED STOREROOM LOCKSET X CLOSER X CARD READER X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	EU MORTISE LOCK	RX-L9092TEU 07A	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
1	SET	GASKETING	485	AA	ZER
1	EA	AUTO DOOR BOTTOM (MORT)	360	AA	ZER
1	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		
1	EA	POWER SUPPLY	PS902	LGR	SCE
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL UNLOCK LOCKSET AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 17 - (SINGLE WITH FAIL SECURE ELECTRIFIED STOREROOM LOCKSET W/
DEADBOLT X INSIDE INDICATOR X CLOSER X CARD READER X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	EU MORTISE LOCK	RX-DM-L9492TEU 07A L583-363	626	SCH
1	EA	INSIDE INDICATOR	47804351 626	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	626	IVE
1	SET	GASKETING	485	AA	ZER
1	EA	AUTO DOOR BOTTOM (MORT)	360	AA	ZER
1	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		
1	EA	POWER SUPPLY	PS902	LGR	SCE
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER
WILL UNLOCK LOCKSET AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT
CONNECTED TO BUILDING'S SECURITY SYSTEM.

NOTE: DURING SPECIFIED TIMES OF DAY LOCKSET TO BE LEFT IN UNLOCKED POSITION TO
ALLOW FREE ACCESS. WHEN LOCK IS IN UNLOCKED POSITION DEADBOLT ON INSIDE CAN BE
USED TO LOCK OUTSIDE LEVER IN THE EVENT OF AN EMERGENCY AND WILL DISPLAY
"LOCKED".

HEADING # 18 - (AUTOMATIC SLIDING DOOR)

PROVIDE EACH SL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	SLIDING AUTOMATIC ENTRANCE,SEE SECTION 084229	DG2000-SS-SA-CR		SAT
2	EA	WAVE TO OPEN	MS41		BEA

NOTE: REFER TO SEPARATE SPECIFICATION SECTION 08 42 29.

HEADING # 19 - (EXISTING SINGLE DOORS)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1		ALL HARDWARE	EXISTING TO REMAIN		

END OF SECTION

Section 08 80 00
GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this Section consists of glass and glazing where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.
- B. Furnish and install the following:
 - 1. Laminated glass in interior wood and hollow metal doors and frames where scheduled
 - 2. Laminated glass at interior borrowed lites where scheduled
 - 4. Glazing and hardware for all aluminum pass-through type transaction windows
 - 5. All materials required to properly install glass furnished hereunder, including sealant, tapes, setting blocks, and spacers.
- C. Work of this section includes installation of glazing beads furnished under related sections.
- D. Furnish the following items for installation under related sections:
 - 1. Tempered glass in sliding aluminum entrance door systems specified in Section 08 42 29 – SLIDING AUTOMATIC ENTRANCES

1.2 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Subcontractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.3 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 06 10 00 - ROUGH CARPENTRY: Installation of steel door frames.
- C. Section 06 20 00 - FINISH CARPENTRY: Installation of doors.

- D. Section 06 40 00 – ARCHITECTURAL WOODWORK: Millwork and casework to receive glazing as part of this Section.
- E. Section 07 92 00 - JOINT SEALANTS: Requirements for sealants and backing materials.
- F. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Steel doors, door and borrowed lite frames, and related glazing stops, for both fire-resistance rated (labeled) and non-rated (labeled) conditions.
- G. Section 08 14 16 - FLUSH WOOD DOORS: Wood doors, and related glazing stops.
- H. Section 08 42 29 – SLIDING AUTOMATIC ENTRANCES: Sliding aluminum entrance systems..
- I. Section 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS: General requirements for glass referenced to this Section.
- J. Section 10 28 13 - TOILET ACCESSORIES: Framed mirrors.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. AAMA 804.1 - Ductile Back-Bedding Compound.
 - 2. Shapes, and Tubes.
 - 3. ASTM C 162 – Standard Terminology of Glass and Glass Products.
 - 4. ASTM C 864 – Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
 - 5. ASTM C 1036 - Flat Glass.
 - 6. ASTM C 1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
 - 7. ASTM C 1172 – Standard Specification for Laminated Architectural Flat Glass.
 - 8. ASTM C 1193 – Standard Guide for Use of Joint Sealants.
 - 9. ASTM C 1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
 - 10. ASTM E 283 - Rate of Air Leakage through Exterior Entrance and storefront, Curtains Walls and Doors.
 - 11. ASTM E 330 Structural Performance of Exterior Entrance and storefront, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 - 12. ASTM E 546 - Test Method For Frost Point of Sealed Insulating Glass Units.
 - 13. ASTM E 576 - Test Method for Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.
 - 14. ASTM E 773 - Test Method for Seal Durability of Sealed Insulating Glass Units.
 - 15. ASTM E 774 - Sealed Insulating Glass Units.

16. ASTM E 1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.
 17. ASTM E2188 - Standard Test Method for Insulating Glass Unit Performance.
 18. ASTM E2189 - Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
 19. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
 20. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
 21. Federal Safety Standards for Architectural Glazing Materials 16CFR1201.
 22. IGCC: Certified Products Directory, and Certification Guidelines.
 23. NFPA Publication 80 - Fire Doors and Windows.
 24. SGCC: Certified Products Directory, and Certification Guidelines.
- B. The following reference materials are hereby made a part of this Section by reference thereto:
1. GANA - Glazing Manual (2004 edition).
 2. GANA - Glazing Manual (50th Anniversary edition).
 3. SIGMA - Vertical Glazing Guidelines, Number A3000-87.
 4. Consumer Product Safety Commission-Safety Standard for Architectural Glazing Materials.

1.5 SEQUENCING

- A. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.6 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing:
1. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
 2. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.

3. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.7 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Product Data:
 - a. Product data sheets on glazing products: Provide chemical, functional, and environmental characteristics, size limitations, special application requirements. Identify available colors.
 - b. Sample Warranty: Provide copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
 2. Shop Drawings: Show sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
 - a. Plans and elevations 1/4 inch scale of each type of glazing assembly, and mirror assembly; indicate dimensions, and reference details. Verify dimensions with field measurements.
 3. Verification Samples:
 - a. 12 by 12 inch pieces of each specified type and thickness of glass, bearing labels indicating locations where each type of glass will be used.
 - b. Glazing tape: 12 inch length of specified type and size.
 4. Certificates: Manufacturer's written certification stating that the materials installed, meet or exceed the requirements specified under this Section.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 1. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

1.8 QUALITY ASSURANCE

- A. General: Perform glazing work in accordance with GANA - Glazing Manual, FGMA Glazing Manual, SIGMA and LSGA standards for glazing and installations methods.
 1. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Insulating Glass Performance Certification:
 1. Provide certification that insulated glass unites have been tested to, and comply with ASTM E2188 and ASTM E2190.
 2. Provide test results for Fog Testing under ASTM E2189.

C. Glass Labeling:

1. General: Manufacturer's Label shall be, acid-etched, sandblasted, ceramic-fired, laser-etched, embossed, or other similar type which, once applied, cannot be removed without being destroyed.
2. Safety glass: Label tempered and laminated safety glass with permanent manufacturer's label on each light with the mark visible after installation.
 - a. Furnish SGCC certification for safety glass in compliance with CPSC 16 CFR 1201 Cat 1 or Cat 11, or ANSI Z-97.1.
3. Fire-rated glass: Label each individual glazing unit with appropriate UL, Warnock Hersey, or other approval labeled markings with the listing mark visible after installation.

D. Qualifications:

1. Fabricators: Glazier specializing in applying the work of this Section with a minimum of 5 years of experience.
2. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.9 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
2. Deliver materials in labeled, protective packages, when and as required.

B. Storage and Handling Requirements:

1. Store and handle in strict compliance with manufacturer's instructions and recommendations of GANA Glazing Manual. Use clean gloves and tools when handling materials, avoid contamination. Use rolling blocks and suction cups to move glass units not in shipping crates.
 - a. Carefully store materials to avoid overloading any building component or structure.
 - b. Do not unpack material until it is to be set, unless un-packing is required for inspection by the Architect.
2. Store mirrors and coated glass in a dry place with acid-free paper between glass sheets.
3. Protect factory finished materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

1.10 SITE CONDITIONS

- A. Do not install glazing when ambient temperature is less than 50 degrees Fahrenheit.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.11 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Manufacturer Warranty/Guarantee: All shall include replacement of defective glass and mirrors, and delivery of replacement glass products furnished f.o.b. from point of manufacturer to project site.
 - 1. Mirrors: Manufacturer's 5 year written guarantee covering against defects in materials and workmanship of reflective coatings on mirrors and replacement of the same.
 - a. Provide coverage in Guarantee for manufacturing defects, including failure of reflective coatings as evidenced by peeling, cracking, discoloration, deterioration in metallic coating, or other visual indications of failure.
 - 2. Laminated glass: Manufacturer's 5 year written guarantee covering against defects in materials and workmanship of laminated glass and replacement of the same. Warranty shall be effective from date of original factory shipment to site.
 - a. Provide coverage in Guarantee for manufacturing defects, including failure of laminated glass units as evidenced by edge separation, delamination, or discoloration of inner layer.
 - 3. Insulating Glass: Manufacturer's 10 year written guarantee covering insulating glass against defects in materials and workmanship, including failure of seals effective on date of original factory shipment to site.
 - a. Provide coverage in Guarantee for manufacturing defects, including failure of hermetic seal of air space (except by glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating or other visual indications of seal failure or performance.

PART 2 - PRODUCTS

2.1 GLASS - GENERAL

- A. General requirements for glass: Of domestic and foreign manufacture, conforming to the referenced standards and with the additional requirements specified herein; factory labeled on each pane stating the strength, type, thickness and quality; with all labels remaining on glass until final cleaning.
 - 1. Glass thickness shown and heat treatment specified are minimum requirements. Provide glass thickness and heat treatment as required to meet specified performance criteria, State and local codes and ordinances.
 - 2. Provide black spacers for all insulated glass units.
 - 3. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
 - 4. Single-source fabrication assembly: All fabricated glass shall be processed and supplied by a single source manufacturer.
- B. Insulated Glass Units (IGU's):
 - 1. General:

- a. Conform to Class CBA of Insulating Glass Certification Council (IGCC).
 - b. Certify and test insulated glass units in compliance with ASTM E2188 and ASTM E2189.
 - c. Provide butyl primary seals and silicone secondary seals.
- 2. Provide all insulated glass with hermetically sealed spacer bars as approved by the Architect.
 - a. Spacers shall have welded, soldered or bent inter-pane spacer corners, or welded or soldered joints. Keyed corners will not be acceptable.
- C. Float Glass: Comply with ASTM C 1036, Class 1 clear, quality q3 glazing select.
- D. Heat Strengthened Glass: Comply with ASTM C 1048 HS, heat strengthened, Class 1 clear, quality q3 glazing select.
- E. Tempered Glass: Comply with ASTM C 1048 FT, fully tempered, Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1.
 - 1. All tempered glazing units to be installed with "draw" marks in the same orientation
- F. GLASS TYPES AS SPECIFIED UNDER SECTION 08 44 13 – glazed aluminum curtain walls
 - 1. Locations: Interior and exterior aluminum curtain wall, interior and exterior aluminum entrance doors

2.2 GLASS TYPES

- A. Glass Type "LG-1": Nominal 1/4 inch (6mm) thick laminated safety glass.
 - 1. Components:
 - a. Glass Ply 1: 1/8 inch (3mm) clear fully-tempered glass
 - b. Interlayer: 0.030 inch PVB (Polyvinyl Butyral)
 - c. Glass Ply 2: 1/8 inch (3mm) clear fully-tempered glass
 - 2. Locations: At typical interior hollow metal and wood non-rated doors and frames, sliding aluminum pass-through windows; refer to drawings and schedules
- B. Glass Type "LG-2": Nominal 9/16 inch (14mm) thick laminated safety glass.
 - 1. Components:
 - a. Glass Ply 1: 1/4 inch (6mm) clear fully-tempered glass
 - b. Interlayer: 0.060 inch PVB (Polyvinyl Butyral)
 - c. Glass Ply 2: 1/4 inch (6mm) clear fully-tempered glass
 - 2. Locations: At interior hollow metal and wood non-rated doors and frames at Day Boarding; refer to drawings and schedules
- C. Glass Type "LX-1": Nominal 7/16 inch (11mm) thick laminated radiation shielding safety glass
 - 1. 1. Components:
 - a. Glass Ply 1: 1/4 inch (6mm) clear LX-57B lead barium radiation shielding glass

- b. Interlayer: 0.030 inch PVB (Polyvinyl Butyral)
 - c. Glass Ply 2: 1/8 inch (3mm) clear fully-tempered glass
 - 2. Locations: At interior wood door at X-Ray room
- D. Glass Type "TG-1": Nominal 1/7 inch (6mm) thick clear, low-iron, anti-reflective, fully-tempered safety glass
 - 1. Components:
 - a. Base Glass: ASTM C1036, Type 1, Class 1 (Clear), Quality Q3, low-iron float glass
 - b. Heat Treatment: Fully Tempered to ASTM C1048, Kind FT.
 - c. Coating: Anti-Reflective coating to ASTM C1376, applied to both surfaces; minimum visible light transmittance 97%, maximum reflectance < 1%
 - d. Edge Work: Flat polished edge
 - e. Fabrication: Provide monolithic lite unless otherwise indicated
 - f. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1) Nippon Sheet Glass Co., Ltd.: Pilkington OptiView Range
 - 2) Guardian Glass: Guardian Clarity Neutral
 - 3) TRU VUE, Inc.: Museum Glass
 - 2. Locations: At sliding aluminum entrance doors at Induction, Dental and Surgery rooms

2.3 ALUMINUM PASS-THROUGH HARDWARE

- A. Aluminum Track System: Equal to C.R. Laurence Co., Inc. "Fawn" complete 6063-T5 extruded aluminum track assembly including (but not limited to): frame, double channel upper track, nylon roller press, vinyl guides, shoe, and double lower track, or approved equal.
 - 1. Lock: Cylindrical keyed lock

2.4 FABRICATION

- A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. Fabricate glass as required to openings with edge clearances and bite on glass as recommended by the manufacturer with clean-cut edges where concealed, and smooth-ground, polished and seamed edges where exposed to view. Do not cut, seam, nip or abrade glass after heat-tempering.
 - 1. For non-tempered to be cut at site, provide glass larger than required so as to obtain clean cut edges without seaming or nipping.
- C. Fabricate glass with the following edge treatments.
 - 1. Exposed edges: Polished-finished radiused (penciled).
 - 2. Concealed edges: Cut edges with minimum edge work.
 - 3. Butt-joint edges: Flat round and finished with edges eased.

2.5 ACCESSORIES

- A. Glazing tape: Preformed butyl-polyisobutylene rubber with 100 percent solids contained in extruded tape roll form and complying with AAMA 804.1; coiled on release paper; of sizes required for proper glazing. equal to one of the following:
 - 1. Protective treatments 3030 or 606.
 - 2. Tremco Preshimmed 440.
 - 3. Woodmont Chem-Tape 40.
- B. Setting blocks: Neoprene, 80-90 shore A durometer hardness, certified to be "silicone compatible"; sized as follows:
 - 1. Length: 0.1 inch per square foot of glass, but not less than 4 inches.
 - 2. Width: equal to glazing rabbet space minus 1/16 inch.
 - 3. Height to suit glazing method and pane weight and area.
- C. Spacers: Neoprene, 60-80 shore A durometer hardness, black, sized as required.
- D. Glazing sealant:
 - 1. General glazing sealant: One-part medium modulus, neutral curing, synthetic rubber sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, grade NS, Class 25 for uses NT, G and A, FS TT-S-001543A, Type, Class A. Color as selected by Architect.
 - a. Dow Corning Corporation, Midland MI.; product, "Silicone Glazing Sealant".
 - b. General Electric Company (GE Silicones) Waterford NY.; product, "SilGlaze II SCS2800".
 - c. Tremco, Beachwood OH.; product, "Proglaze.
- E. Bond-breakers and backing materials: Type recommended by manufacturer of sealants and gaskets.
- F. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

2.6 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 - 1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contract requiring such scaffolding.
 - 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).

3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Trade Contractor.

2.7 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Inspect receiving surfaces and ensure that they are dry and free from dust, or other foreign materials before glazing. Clean all surfaces with cloth saturated with mineral spirits of high-flash naphtha as recommended by glazing tape manufacturer, before glazing.
- B. Field Measurements: Verify that field measurements are as indicated on approved Shop Drawings.
 1. Check all openings, prior to glazing, to make certain that the opening is square, plumb and secure in order that uniform face and edge clearances are maintained.
 2. Determine the actual sizes required by measuring the receiving openings. Size glass and mirrors to permit required clearance and bite around full perimeter of glass, as set forth in the referenced FGMA standards, or as recommended by the glass manufacturer. Do not nip edges, to remove flares or to reduce oversize dimensions, under any circumstance.
- C. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION - DRY GLAZING

- A. Utilize dry glazing methods for field installation of glass in interior doors and frames.
 1. Install in vision panels in fire-rated doors and frames to requirements of NFPA 80.
 2. Install so that appropriate UL, Warnock Hersey, FireLite or other approval labeled markings remain permanently visible.
- B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (2 mm) above sight line.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
- D. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane.
- E. Place glazing tape on free perimeter of glazing in manner as described above.

- F. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- G. Knife trim protruding tape.
- H. Fill nail holes in wood framed openings to match door color and finish.

3.3 PROTECTION

- A. Protect glass from breakage immediately upon installation. Use streamers or ribbons suitably attached to framing and held free of the glass. Do not apply warning markings directly to the glass.
- B. Cover glass to protect it from activities that might abrade the glass surface.

3.4 CLEANING

- A. Clean glass surfaces promptly after installation, exercising care to avoid damage to the same. Remove excess glazing tape, labels, dirt, and other contaminants.

End of Section

Section 08 87 00
ARCHITECTURAL WINDOW FILMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this Section consists of architectural window films where shown on the Drawings, as specified herein, for a complete and proper installation. Work includes, but is not limited to the following.
- B. Furnish and install the following:
 - 1. Architectural decorative window films at existing hollow metal borrowed lite in Surgery D322M.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.

1.3 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASHRAE - American Society for Heating, Refrigeration, and Air Conditioning Engineers; Handbook of Fundamentals.
 - 2. ASTM E 84 - Standard Method of Test for Surface Burning Characteristics of Building Materials.
 - 3. ASTM E 308 - Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System.
 - 4. ASTM E 903 - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.
- B. NFRC 100/200 (Formerly ASTM E903) - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.
- C. General References The following reference materials are hereby made a part of this Section by reference thereto:
 - 1. All applicable federal, state and municipal codes, laws and regulations for architectural window films.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

- B. Sequencing:
 - 1. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, fabrication methods, finishes, performance data, and installation instructions for each item furnished hereunder.
- B. Product Data: Manufacturer's current technical literature on each product to be used, including:
 - 1. Manufacturer's Data Sheets.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- C. Selection Samples:
 - 1. Color and pattern samples: Architect to select color and pattern. Up to three color and patterns may be selected
- D. Verification Samples: For each film specified, two samples representing actual film color and pattern.
- E. Shop Drawings:
 - a. 1/4 inch scale elevations of each location where window film will be applied as identified in drawings
 - 1) Indicate all types and locations of films.
 - b. Large scale design details.
 - 1) Provide details of perimeter conditions.
- F. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 - 1. Operation and Maintenance Data: For all film components furnished under this Section 08 87 00.
 - 2. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

1.6 QUALITY ASSURANCE

- A. General:
 - 1. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

- B. Qualifications:
 - C. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.
 - 1. Provide documentation that the adhesive used on the specified films is a Pressure Sensitive Adhesive (PSA).
 - D. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
 - 1. Provide documentation that the installer is authorized by the Manufacturer to perform Work specified in this section.
 - 2. Provide a commercial building reference list of 5 properties where the installer has applied window film. This list will include the following information:
 - a. Name of building.
 - b. The name and telephone number of a management contact.
 - c. Type of glass.
 - d. Type of film and/or film attachment system.
 - e. Amount of film and/or film attachment system installed.
 - f. Date of completion.
 - E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 - 3. Refinish mock-up area to produce acceptable work.
- 1.7 PRE-INSTALLATION CONFERENCE
- A. Installer of the Work of this Section is required to attend pre-installation conference specified under Section 04 20 00 - UNIT MASONRY.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - B. Follow Manufacturer's instructions for storage and handling.
 - C. Store products in manufacturer's unopened packaging until ready for installation.
 - D. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

1.9 SITE CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.10 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. At project closeout, provide to Owner or Owners Representative an executed current copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.
- C. In order to validate warranty, installation must be performed by an Authorized dealer and according to Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on 3M Prestige PR60 Glass Finish Film.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. 3M Commercial Solutions, 3M Center Building, St. Paul, MN.
 - 2. Approved equal.

2.2 DESCRIPTION

- A. Gradient film for installation on glass surfaces.
 - 1. Performance/Design Criteria
 - a. Flammability: Surface burning characteristics when tested in accordance ASTM E84, demonstrating film applied to glass rate Class A for interior use:
 - b. Flame Spread Index: no greater than 25.
 - c. Smoke Developed Index: no greater than 55.
- B. Gradient Window Film
 - 1. Transparency Control Window Films: 3M Fasara gradation Illumina Seamless-PR window film as manufactured by 3M Company (SH2SSIM-PR) - Commercial Solutions, 3M Center Bldg. 223; St. Paul, MN 55144-1000; Toll Free Tel: 888-650-3497.
 - 2. Material Properties:
 - a. Composition: Illumina Seamless-S2 single gradation of pattern printed polyester film containing at least 220 layers and incorporating pressure sensitive adhesive on one side and an acrylic abrasion resistant coating

- on the other. Nanotechnology represents a breakthrough in technology due to the enhanced heat, UV and IR rejection, without the presence of any metals. The film shall not contain dyes.
- b. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
 - c. Variation in Total Transmission across the Width: Less than 2 percent over the average at any portion along the width.
 - d. Thickness: Nominal 3.3 mils (0.1 mm) with no evidence of coating voids.
 - e. Identification: Labeled as to Manufacturer as listed in this Section.
3. Optical Performance:
- a. Ultraviolet Transmittance: 0 percent.
 - b. Visible Light Transmittance: 61 percent.
 - c. Visible Light Reflectance - Interior – Interior: 22 percent.
 - d. Solar Heat Transmittance: 62 percent.
 - e. Solar Heat Reflectance: 16 percent.
 - f. Shading Coefficient at 90 Degrees (Normal Incidence): 0.79
 - g. Warranty Period: 3 Years

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate the installation of the architectural window films and related items to be furnished hereunder with the work of the other trades responsible for providing receiving and interfacing materials, and ensure that all receiving and supporting surfaces have been completed and ready to receive the work of this Section.
- B. Perform the installation work in strict accordance with the approved shop drawings, and the manufacturers' installation instructions, and the herein-referenced standards. Erect the various systems and items plumb and true, in proper alignment and relation to established lines and grades.

3.2 EXAMINATION

- A. Verification of Conditions: Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section. Notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.
 - 1. Verify that field measurements are as indicated on shop drawings.
 - 2. Beginning of installation means acceptance of project conditions.
- B. Film Examination:
 - 1. If preparation of glass surfaces is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
 - a. Glass surfaces receiving new film should first be examined to verify that they are free from defects and imperfections, which will affect the final

appearance.

2. Do not proceed with installation until glass surfaces have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result under the project conditions.

3.3 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.4 INSTALLATION

- A. Film Installation, General:
 1. Install in accordance with manufacturer's instructions.
 2. Cut film edges neatly and square at a uniform distance of 1/8 inch (3 mm) to 1/16 inch (1.5 mm) of window sealant. Use new blade tips after 3 to 4 cuts.
 3. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, on window glass and adhesive to facilitate proper positioning of film.
 4. Apply film to glass and lightly spray film with slip solution.
 5. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
 6. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.
- B. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing CONDITIONS.
- C. CLEANING AND PROTECTION
- C. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
 1. The manufacturer shall advise the Contractor of protective treatment and other precautions required by him through the remainder of construction to ensure that the work of this Section will be without damage or deterioration at the time of Substantial Completion of the Contract.
 2. Remove left over material and debris from Work area. Use necessary means to protect film before, during, and after installation.
 3. Touch-up, repair or replace damaged products before Substantial Completion.
 4. After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

End of Section

Section 09 00 05
ACOUSTICAL CEILINGS FILED SUB-BID CONTRACT REQUIREMENTS
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 0 and Division 1 Specification Sections, apply to this Section.

1.2 TIME, MANNER AND REQUIREMENTS FOR SUBMITTING FILED-SUB CONTRACT BIDS:

- A. The work of this section is work of a Filed Sub-Bid Contractor and includes the following requirements:
 - 1. Specification requirements for the Sub-Bid Contract "ACOUSTICAL CEILINGS" include all of the following listed Specification Sections in their entirety:
 - a. Section 09 51 00 – Acoustical Ceilings.
- B. Filed sub-bid contract bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the City of Worcester Purchasing Division, City Hall, 455 Main Street, Worcester, MA 01608 at the time and place stipulated in the "Invitation to Bid/Notice to Contractors." Along with the time of the bid opening, the following shall appear on the upper left hand of the envelope:

Name of Filed-Sub-Bidder: Print Name of Filed-Sub Contract Bidder
Project: WTHS TUFTS VET TECH CLINIC RENOVATION
Filed-Sub Contract Bid for Section: 09 00 05 – ACOUSTICAL CEILINGS

- C. Each Filed-Sub contract bid submitted for work under this Section shall be on forms furnished by the City of Worcester as required by Section 44F of Chapter 149 of the General Laws, as amended. Filed-Sub contract bid forms may be obtained at the Purchasing Division in person, or by written request.
- D. Filed-Sub contract bids filed with the City of Worcester shall be accompanied by a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the City of Worcester in the amount of five (5) percent of the bid. A Filed-Sub contract bid accompanied by any other form of bid deposit than those specified will be rejected.
- E. Additional Requirements:
 - 1. Filed-Sub contract bidder's attention is directed to Massachusetts G.L. Chapter 149 §44H, as amended, which provides in part as follows:
 - 2. Each Filed-Sub-contract bidder shall list in Paragraph E of the "Form for Filed-Sub Contract Bids" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that sub-subtrade requires such listing, provided that, in the absence of a contrary provision in the Specifications, any sub-bidder may, without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the Awarding Authority that he does

customarily perform such class of work with persons on his own payroll and is qualified to do so. This Section of the Specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.

Class of Work	Reference Specification	Paragraphs

- F. The work to be completed by the Filed-Sub Contractor for the work of this Section is shown on the following listed Drawings:

- The Work of this Trade Contract is shown on the following Drawings:
AD3.1, AD3.2, AD3.3, A1.0, A2.1, A2.2, A3.0, A3.1, A3.2, A4.1, A4.2, A5.0, A5.1, A6.1, A6.2, A6.11, A6.12, A6.13, A6.14, A8.0, A8.1, A8.2, A8.3, A8.4, A8.5, A8.6, A8.7, A8.8, A9.1, A9.2, A9.3, A10.1, A10.2, A11.1, A11.2, A11.3, A12.1, A12.2, S1.1, S1.2, S3.1, S3.2, S4.1, S4.2
- Related items which may require coordination or impact work of this trade are shown on the following Drawings:
FP1.1, FP3.1, P1.1, P3.1, P3.2, P3.3, DH3.1, DH4.1, H3.1, H3.2, H4.1, H4.2, H5.1, H5.2, H5.3, H5.4, E0.1, E0.2, ED1.1, ED1.2, ED1.3, EH1.1, EH1.2, EH1.3, EL1.1, EL2.1, EL2.2, EL2.3, EL2.4, EL2.5, EP1.1, EP2.1, EP3.1, EP3.2, EP4.1, EP4.2, EP4.3, EP4.4, EP4.5, EP4.6, FA0.1, FA1.1, FA2.1, FA3.1, FA3.2, SC0.1, SC1.1, SC1.2, SC2.1, TC0.1, TC1.1, TC1.2
- The complete List of Drawings for the Project is provided in Section 00 01 15.
- Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Filed-Sub Contractor's responsibility to determine full extent of work of this Section as required by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed-Sub Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.4 SEQUENCING

- A. Coordinate work of this Filed-Sub Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed-Sub Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Acoustical Ceiling Filed-Sub Contractor shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work and all other Work requiring such equipment as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 - 1. Scaffolding and staging required pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed-Sub Contractor.
 - 2. Acoustical Ceiling Filed-Sub Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed-Sub Contractor.
 - 4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each work day to prohibit access to the scaffolding by unauthorized individuals.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed-Sub Contractor shall be furnished, installed, operated and maintained in safe conditions by this Filed-Sub Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

End of Section

Section 09 00 06
RESILIENT FLOORING SUB-BID CONTRACT REQUIREMENTS
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 0 and Division 1 Specification Sections, apply to this Section.

1.2 TIME, MANNER AND REQUIREMENTS FOR SUBMITTING FILED SUB-BID CONTRACT BIDS:

- A. The work of this section is work of a Publicly Bid Filed sub-bid Contractor and includes the following requirements.
1. Specification requirements for the Filed sub-bid Contract "Resilient Flooring" include all the following listed Specification Sections, in their entirety:
 - a. SECTION 09 65 13 – RESILIENT BASE & ACCESSORIES
 - b. SECTION 09 65 43 – LINOLEUM FLOORING
 - c. SECTION 09 67 23 – RESINOUS FLOORING
- B. Filed sub-bid contract bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the City of Worcester Purchasing Division, City Hall, 455 Main Street, Worcester, MA 01608 at the time and place stipulated in the "Invitation to Bid/Notice to Contractors." Along with the time of the bid opening, the following shall appear on the upper left hand of the envelope:

Name of Filed Sub-Bidder: Print Name of Filed Sub-Bidder

Project: WTHS TUFTS VET TECH CLINIC RENOVATION

Filed Sub-bid for Section: 09 00 06 – RESILIENT FLOORING

- C. Each filed Sub-bid contract bid submitted for work under this Section shall be on forms furnished by the City of Worcester as required by Section 44F of Chapter 149 of the General Laws, as amended. Filed Sub-bid contract bid forms may be obtained at the Purchasing Division in person, or by written request.
- D. Filed Sub-bid contract bids filed with the City of Worcester shall be accompanied by a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the City of Worcester in the amount of five (5) percent of the bid. A filed Sub-bid accompanied by any other form of bid deposit than those specified will be rejected.
- E. Additional Requirements:
1. Filed Sub-bidder's attention is directed to Massachusetts G.L. Chapter 149 §44H, as amended, which provides in part as follows:
 2. Each filed Sub-bidder shall list in Paragraph E of the "Form for Sub-Bid" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that sub-trade requires such listing, provided that, in the absence of a contrary

provision in the Specifications, any sub-bidder may, without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the Awarding Authority that he does customarily perform such class of work with persons on his own payroll and is qualified to do so. This Section of the Specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.

Class of Work	Reference Specification	Paragraphs

F. The work to be completed by the Filed Sub-Contractor for the work of this Section is shown on the following listed Drawings:

1. The Work of this Trade Contract is shown on the following Drawings:
AD3.1, AD3.2, AD3.3, A1.0, A2.1, A2.2, A3.0, A3.1, A3.2, A4.1, A4.2, A5.0, A5.1, A6.1, A6.2, A6.11, A6.12, A6.13, A6.14, A8.0, A8.1, A8.2, A8.3, A8.4, A8.5, A8.6, A8.7, A8.8, A9.1, A9.2, A9.3, A10.1, A10.2, A11.1, A11.2, A11.3, A12.1, A12.2, S1.1, S1.2, S3.1, S3.2, S4.1, S4.2
2. Related items which may require coordination or impact work of this trade are shown on the following Drawings:
FP1.1, FP3.1, P1.1, P3.1, P3.2, P3.3, DH3.1, DH4.1, H3.1, H3.2, H4.1, H4.2, H5.1, H5.2, H5.3, H5.4, E0.1, E0.2, ED1.1, ED1.2, ED1.3, EH1.1, EH1.2, EH1.3, EL1.1, EL2.1, EL2.2, EL2.3, EL2.4, EL2.5, EP1.1, EP2.1, EP3.1, EP3.2, EP4.1, EP4.2, EP4.3, EP4.4, EP4.5, EP4.6, FA0.1, FA1.1, FA2.1, FA3.1, FA3.2, SC0.1, SC1.1, SC1.2, SC2.1, TC0.1, TC1.1, TC1.2
3. The complete List of Drawings for the Project is provided in Section 00 01 15.
4. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Filed Sub-Contractor's responsibility to determine full extent of work of this Section by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.

1.3 SUMMARY

- A. This Section includes Resilient Flooring Trade Contract Requirements and includes general requirements for preparation, installation and temporary protection of resilient flooring provided under this Trade Contract.
1. Provide independent testing laboratory services to perform relative humidity, moisture vapor emission, and pH tests on in situ concrete slabs, which shall be in addition to testing as may be performed by Owner.
 2. Prepare substrates to receive resilient tile flooring to ensure specified tolerance level for finish surface of floor tile. Preparation work includes patching, smoothing and leveling substrate, including:
 - a. Grinding down high spots of substrate.
 - b. Providing Portland cement-based latex underlayment (filler).

1.4 RELATED REQUIREMENTS

- A. Section 03 33 00 – CAST-IN-PLACE CONCRETE: Concrete floor slab substrate.
- B. Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING: General requirements for preparation, installation and temporary protection for flooring work which is NOT included as part of this Trade Contract.
- C. Section 09 65 13 – RESILIENT BASE AND ACCESSORIES.
- D. Section 09 65 43 - LINOLEUM FLOORING.

1.5 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards shall be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM D 4259 - Standard Practice for Abrading Concrete.
 - 2. ASTM E 329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
 - 3. ASTM E 1907 - Standard Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings
 - 4. ASTM F 710 - Preparing Concrete Floors to Receive Resilient Flooring.
 - 5. ASTM F 1482 - Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.
 - 6. ASTM F 1869 – Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - 7. ASTM F 2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes
 - 8. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.6 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Sub-Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.7 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. General: Coordinate flooring work with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
 - 2. Coordinate work of this Filed-Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
 - 3. Coordinate the work of this Section with the respective trades responsible for installing interfacing work.
- B. Pre-Installation Meetings: At least 30 calendar days prior to commencing any flooring work, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
 - 1. Required attendees:
 - a. Owner's Project Manager.
 - b. Architect.
 - c. Construction Manager.
 - d. Project Superintendents representing each floor system installer.
 - e. Manufacturer's technical representative(s) for flooring products as designated by Architect or Contractor.
 - f. Representatives of related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
 - 1) Section 09 65 43 - Linoleum Flooring.
 - 2. Agenda:
 - a. Scheduling of preparation and flooring operations.
 - b. Procedures for testing of relative humidity and moisture content of in situ substrates.
 - c. Water vapor emission control methods.
 - d. Review of staging and material storage locations.
 - e. Coordination of work by other trades.
 - f. Protection of completed Work.
 - g. Establish humidity and temperature limitations for performing the work, to which Architect and Contractor must agree.
 - h. Discuss process for inspection and acceptance of completed Work of this Section.
- C. Sequencing:
 - 1. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.

2. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.
3. Sequence work to ensure resilient flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
4. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.
5. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
6. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

1.8 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Test and Evaluation Reports: Include the following:
 - a. Report the Test Deployment Parameters at start of testing and finishing of testing:
 - 1) Start and finish dates and times of testing.
 - 2) Ambient temperature,
 - 3) Ambient relative humidity and dew point temperature.
 - 4) Minimum and maximum ambient temperature and relative humidity reached during testing.
 - b. Report the "Factor" used to calculate the actual test area of the Calcium Chloride test site.
 - c. Report the concrete slab thickness (in inches).
 - d. Report all test results in chart form listing the following:
 - 1) Test locations (also mark test locations on floor plan)
 - 2) Type(s) of Existing Floor Coverings
 - 3) Visual Distress Level of existing Floor Coverings
 - 4) Surface Temperature of Concrete
 - 5) pH Paper/ Pencil Reading (ASTM F 710)
 - 6) Visual Appearance of Concrete
 - 7) Concrete Slab Age
 - 8) Relative Humidity in Concrete, % (ASTM F 2170):
 - a) Depth of hole from top of Slab, in.
 - b) RH in concrete, %
 - c) Temp. in concrete, °F
 - 9) Surface Moisture Meter Test (ASTM E 1907):

- a) 1. Electrical Impedance Test Values or
 - b) 2. Electrical Resistance Test Values
 - 10) x. Moisture Vapor Emission (MVER) - CaC12 Test (ASTM F 1869):
 - a) Weight Gain in grams
 - b) Exposure Time/hrs
 - c) MVER Lbs/1000 Sq. Ft./24 hours
 - e. Report all unacceptable substrate and field conditions observed during testing.
- B. Submit 1 copy of test data to the installers of all flooring materials or floor surface coating materials scheduled to be installed.

1.9 QUALITY ASSURANCE

- A. General: perform relative humidity, moisture vapor emission (MVER) and acidity/alkalinity (pH) Testing for concrete slabs and floors.
 - 1. Resilient Flooring Filed-Subcontractor shall employ and pay for services of an independent testing laboratory to perform relative humidity, moisture vapor emission, and pH tests on concrete slabs as follows. The test shall be witnessed by the General Contractor, Resilient Flooring Filed-Subcontractor and Owner's Project Representative.
 - a. Relative Humidity, Moisture Vapor Emission and pH Testing on all concrete slabs over-which a finished floor provided under this Filed-Sub-Bid is to be installed.
 - 2. Testing Requirements: As specified under Part 3 of this Section.
 - a. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products.
 - 1) Perform additional testing after procedures have been performed by the General Contractor to reduce moisture content to ratings acceptable to the various flooring and floor-coating manufacturers. General Contractor's procedures to reduce moisture content may consist of project dehumidification and temporary heating, environmental controls, or moisture mitigation treatment to concrete.
 - 3. Testing Requirements: As specified under Part 3 of this Section.
 - a. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Additional testing shall comply with requirements and in quantities as initial tested, and be included as Work of this Trade Contract.
 - 1) Perform additional testing after procedures have been performed by the General Contractor to reduce moisture content to ratings acceptable to the various flooring and floor-coating manufacturers. General Contractor's procedures to reduce moisture content may consist of project dehumidification and temporary heating, environmental controls, or moisture mitigation treatment to concrete.

1.10 SEQUENCING

- A. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 GENERAL FLOORING ACCESSORIES

- A. Trowel-applied leveling compounds for patching, smoothing and leveling subfloors and underlayments: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
 - 1. Ardex Americas, Aliquippa, PA. products "Feather Flash" and "Ardex SD-P".
 - 2. Quikrete Companies., Atlanta, GA., product "Fast-Set Underlayment 1248".
 - 3. Silpro Masonry Systems Inc., Ayer MA., product "Profinish".
- B. Adhered flooring systems general requirements for adhesives (except as otherwise specified in individual Specification Sections):
 - 1. General Flooring Adhesives: High moisture resistant and alkali resistant adhesive: Synthetic Polymer, non-flammable in wet state, with NFPA, Class A rated, VOC compliant, capable of withstanding the following in continuous service:
 - a. Up to 90% relative humidity when measured in accordance with ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in-situ Probes.
 - b. Up to 8 lbs./1000 sq. ft./ 24 hours MVER when measured in accordance with ASTM F1869 - Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - c. VOC content: Less than 50 g/L.
 - 2. Acceptable manufacturers, or approved equal:
 - a. Advanced Adhesive Technology, Inc, Dalton GA.
 - b. DAP Incorporated, Dayton OH.
 - c. W.W. Henry Company, Aliquippa PA.
 - d. Roberts Consolidated Industries, Inc., City of Industry, CA.
 - e. Or adhesive recommended by flooring manufacturer for performance and compliance with warranty requirements.

2.2 TESTING EQUIPMENT

- A. For relative humidity testing: Digital Meter and Calibrated Humidity and Temperature probe kit in Compliance with ASTM F 2170.
 - a. Minimum 2 point probe calibration.
- B. For calcium chloride testing: Anhydrous calcium chloride testing in accordance with Rubber Manufacturer's Association (RMA) Test requirements and in compliance with ASTM F 1869.
- C. For pH testing: In compliance with ASTM F710.
 - 1. pH test paper.
 - 2. Distilled or de ionized water.

2.3 SCAFFOLDS AND STAGING

- A. General: Resilient Flooring Trade Contractor shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work and all other Work requiring such equipment as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 - 1. Scaffolding and staging required pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contractor.
 - 2. Resilient Flooring Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Trade Contractor.
 - 4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each work day to prohibit access to the scaffolding by unauthorized individuals.

2.4 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that spaces to receive flooring finishes are suitable for installation. Do not proceed with work until unsatisfactory conditions are corrected. Comply with manufacturer's recommendations including the following:
 - 1. Substrates shall be dry and clean.

2. Substrates shall be free of depressions, raised areas, or other defects which would telegraph through installed flooring.
 3. Verify concrete substrates have a flat tolerance of 3/16" in 10 linear feet, or more restrictive tolerances as specified under individual resilient flooring Specification Sections included as part of this Trade Contract.
 4. Temperature of resilient flooring and substrate shall be within specified tolerances.
 5. Moisture condition and adhesive bond tests shall be performed as specified herein.
- B. For applications on concrete:
1. Verify concrete substrate has been cured and is sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture test
 2. Verify curing, hardening, or breaking compounds have not been used. If there are any, do not proceed until compounds have been removed as specified.
 3. For applications on concrete slab on grade or below grade, verify vapor barrier below slab was installed. If no vapor barrier was installed, do not proceed with work unless written acceptance of such conditions is received and submitted.
 4. Perform testing of in situ concrete, relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings as specified herein. Do not proceed with work until results of moisture condition tests are acceptable.

3.2 SURFACE PREPARATION FOR TESTING

- A. General: Substrates shall be dry and clean. Remove all dirt, debris, sealers, coatings, finishes, film-forming curing compounds, and other substances which may affect the rate of moisture dissipation. Remove all dust by vacuum or other methods. Do not use chemicals of any kind to clean concrete.
1. Non-chemical methods for removal, such as abrasive grinding or bead-blasting, including methods described in ASTM D 4259 may be used on existing slabs with deleterious residues to achieve an appropriate state for testing.
- B. To test for pH at the surface of a concrete slab, use care not to over abrade the surface of the concrete which can result in overstated pH readings.

3.3 TESTING IN SITU CONCRETE SUBSTRATES

- A. Scope:
1. Provide in situ concrete relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings. Includes concrete placed as part of this Work which occurs below grade, above grade (suspended slabs), and slabs on grade.
 - a. Existing building suspended slabs may be excluded from this requirement.
- B. Scheduling:

1. Testing shall take place after allowing concrete to dry for a minimum of 90 days. Testing to be scheduled no less than one, nor more than three weeks prior to scheduled flooring installation.
 - a. DO NOT conduct testing unless the slab environment is identical to that in which the finished flooring is to be installed.
 2. In the event new flooring is to be installed over existing resilient flooring, remove the portion of the existing flooring and adhesive directly under the area where testing shall be conducted. Patch flooring to match existing construction after completion of testing.
- C. Test result submittals:
1. Report all test results in chart form listing test dates, time, depth of test well, in situ temperature, relative humidity, moisture vapor and pH levels.
 2. List test locations on chart and show same on marked up Floor Plan Drawings.
 3. Submit results in duplicate. Deliver copies directly to Architect, Owner's Project Representative and General Contractor.
- D. Testing Procedures, quantification of Relative Humidity
1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F), and 50 percent (plus or minus 10 percent) relative humidity. When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be included with the test report.
 2. The number of in situ relative humidity test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
 3. Drill test holes utilizing a roto hammer drill. Hole diameter shall not exceed outside diameter of the insertable test sleeve by more than 0.04 inch (1mm). Drilling operation must be dry. Do not use water for cooling or lubrication; do not wet-core test hole. Determine the thickness of the concrete slab from Construction Documents. Depths of test holes shall be as follows:
 - a. For elevated slabs (not poured in pans): Drill test holes to a depth equal to 20 percent of the concrete thickness.
 - b. For slabs on grade and elevated slabs in pans: Drill test holes to a depth equal to 40 percent of the concrete thickness.
 4. Vacuum all concrete dust from test hole.
 5. Insert a hole liner, or sleeve, to the full depth of test hole, assuring that the liner is capped or plugged at the end protruding from the concrete surface.
 6. Permit the test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
 7. Remove the sleeve plug and place a probe into the sleeve assuring that it reaches the bottom of the test hole.
 8. Allow the probe to sit in the test sleeve for 30 minutes before taking readings.
 9. Read and record temperature and relative humidity at the test site.

- E. Testing Procedures, quantification of concrete moisture vapor emission through Calcium Chloride Testing:
1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F) and 50 percent relative humidity (plus or minus 10 percent). When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be included with the test report.
 2. The number of vapor emission test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
 3. Tests sites are to be cleaned of all adhesive residue, curing compounds, paints, sealers, floor coverings, and similar materials. 24 hours prior to the placement of test kits.
 4. Weigh test dish on site prior to start of test. Scale must report weight to 0.1 grams. Record weight and start time.
 5. Expose Calcium Chloride and set dish on concrete surface.
 6. Install test containment dome and allow test to proceed for 60 to 72 hours.
 7. Retrieve test dish by carefully cutting through containment dome. Close and reseal test dish.
 8. Weigh test dish on site recording weight and stop time.
 9. Calculate and report results as pounds of emission per 1,000 square feet per 24 hours."
- F. Testing Procedures, quantification of Acidity/Alkalinity (pH) Level:
1. At or near the relative humidity test site and each vapor emission (calcium chloride) test site, perform pH test.
 - a. At each testing site, lay down a loose 2 foot by 2 foot sheet of non perforated sheet backed by plywood. Leave in place for 48 hours.
 - b. Remove sheet and place several drops of distilled or de ionized water onto the concrete surface to form a puddle approximately 1 inches in diameter.
 - c. Allow the water to set for approximately 60 seconds.
 - d. Dip the pH paper into the water and remove immediately, compare color to chart provided by paper supplier to determine pH reading
 2. Record and report results.
- G. Testing Procedures:
1. Initial testing: Provide 3 tests for the first 1,000 square feet.
 2. Add one test for each additional 1,000 square feet.
 3. Concrete surface area to be tested shall be completely clean as specified herein under Preparation.
 4. Perform moisture tests in strict accordance with the kit manufacturer's Instructions. Moisture tests shall remain undisturbed for 60 to 72 hours.

5. Immediately after moisture test has been removed from test area, conduct pH test in area previously covered by plastic dome of moisture test kit.
6. After completion of tests submit 2 copies of test data to the Architect. Submit a copy of the test data to all installers of flooring materials and resinous flooring materials scheduled to be installed.
7. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Perform such additional testing, at no additional cost to the Owner, after procedures have been performed to reduce moisture content to ratings acceptable to the various flooring and coating manufacturers.

3.4 FLOORING PREPARATION – GENERAL REQUIREMENTS

- A. Close spaces to pedestrian and worker traffic during the installation of the flooring.
- B. General: Comply with ASTM F 710 and manufacturer's recommendations for surface preparation. Remove substances incompatible with resilient flooring adhesive by method acceptable to manufacturer.
 1. Overlay all existing concrete slab surfaces with trowel-applied leveling compounds acceptable to manufacturer. Remove projections and repair other defects to tolerances acceptable to manufacturer.
 2. Remove, by light sanding and grinding, all protruding edges, high spots.
 3. Ensure substrate is flat to a plus or minus 1/8 inch in 10 feet tolerance. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
 4. Ensure that substrate is free from paint, varnish, wax, oil, or other foreign matter.
 5. For concrete substrates:
 - a. Concrete floors with steel troweled (slick) finish shall be properly roughened up (sanded) to ensure suitable adhesion.
 - b. Concrete floors with curing, hardening, and breaking compounds shall be abraded with mechanical methods only to remove compounds. Use blastrac or similar equipment.
- C. Removal of existing coatings and adhesives:
 1. Painted and sealed flooring substrates: Remove all existing coatings on flooring substrates. Certain paints may contain lead. Conform to federal, state and local laws regarding appropriate methods for identifying lead-based paint and removing such paint, and notify Owner if lead-based paint has been identified.
 - a. Remove existing visible lead-based paint in compliance with applicable regulations and requirements of governing agencies having jurisdiction
 - b. Isolate work areas from other workers of this project, provide air sampling results and worker exposure samples required by referenced regulations. Contractor is responsible for worker safety and environmental exposure of contaminants during the performance of this Work.
 - c. Remove all paint chips and debris using HFEPA vacuums. Dispose of caustic waste, paint chips in compliance with Resource Conservation

and Recovery Act (RCRA) and all other EPA, state and local authority requirements as might be applicable.

2. In situ adhesive on flooring substrates: Use of commercial adhesive removers may adversely affect the bonding of a new flooring covering. Comply with The Resilient Floor Covering Institute (RFCI) publication "*Recommended Work Practices for Removal of Resilient Flooring Coverings*" and flooring product manufacturer's written instructions and technical advisories for removal of existing adhesives, so substrate is acceptable for new flooring installation and warranty.
 3. In situ asphalt-based adhesive on flooring substrates: Contact flooring product manufacturer's technical representative to obtain instructions for removal of existing asphalt-base adhesives so substrate is acceptable for new flooring installation and warranty.
- D. Protection of In-situ Conditions: During the operation of work of this Trade Contract, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing surfaces which are soiled or otherwise damaged by Work of this Trade Contract, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.
- E. Use HEPA Vacuum to clean substrate, and ensure that substrate is dry, clean and smooth prior to application of flooring. Perform vacuuming immediately prior to installation.
- F. Apply primers as recommended by adhesive manufacturer's written instructions.
- G. Condition flooring materials, accessories and adhesives to room temperatures for a period of 48 hours minimum, and as additionally required under individual Specification Sections.

3.5 FLOORING INSTALLATION GENERAL

- A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.
1. Apply primers as recommended by adhesive manufacturer's written instructions.

3.6 ADHESIVE BOND TESTING

- A. Use the specified flooring and recommended adhesive, install approximately 36 by 36 inch sized flooring as specified under individual flooring specification sections. Install test samples approximately 50 feet apart throughout the area, but not less than 1 test per 1000 square feet. Areas next to walls or other light traffic areas should be selected for the bond test. Tape down the perimeter of the flooring to prevent drying of the adhesive at the edges. After a minimum period of 72 hours the flooring should be pulled from the subfloor. If an unusual amount of force is required, the bond could be considered sufficient. Floors demonstrating unsuitable bond to substrate require modifications to flooring installation and may require application of moisture mitigation products. Review all conditions with Architect/Engineer.

3.7 PROTECTION

- A. Provide protection of completed flooring areas from construction traffic until Substantial Completion of the General Contract. Cover all floor surfaces with heavyweight kraft paper and overlay with red-rosin paper, taping the edges to maintain position of the protection paper. Reapply papers to maintain floor protection.

End of Section

Section 09 00 09
PAINTING SUB-BID CONTRACT REQUIREMENTS
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 0 and Division 1 Specification Sections, apply to this Section.

1.2 TIME, MANNER AND REQUIREMENTS FOR SUBMITTING FILED-SUB CONTRACT BIDS:

- A. The work of this section is work of a Publicly Bid Filed-Sub Contractor and includes the following requirements:
1. Specification requirements for the Filed-Sub Contract "PAINTING" include all of the following listed Specification Sections: in their entirety:
 - a. Section 09 91 00 – PAINTING.
 - b. Section 09 91 13 – EXTERIOR PAINTING SCHEDULE.
 - c. Section 09 91 23 – INTERIOR PAINTING SCHEDULE.
- B. Filed sub-bid contract bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the City of Worcester Purchasing Division, City Hall, 455 Main Street, Worcester, MA 01608 at the time and place stipulated in the "Invitation to Bid/Notice to Contractors." Along with the time of the bid opening, the following shall appear on the upper left hand of the envelope:

Name of Filed-Sub-Bidder: Print Name of Filed-Sub Contract Bidder

Project: WTHS TUFTS VET TECH CLINIC RENOVATION

Filed-Sub Contract Bid for Section: 09 00 09 – PAINTING

- C. Each Filed-Sub contract bid submitted for work under this Section shall be on forms furnished by the City of Worcester as required by Section 44F of Chapter 149 of the General Laws, as amended. Filed-Sub contract bid forms may be obtained at the Purchasing Division, or by written request.
- D. Filed-Sub contract bids filed with the City of Worcester shall be accompanied by a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the City of Worcester in the amount of five (5) percent of the bid. A Filed-Sub contract bid accompanied by any other form of bid deposit than those specified will be rejected.
- E. Additional Requirements:
1. Filed-Sub contract bidder's attention is directed to Massachusetts G.L. Chapter 149 §44H, as amended, which provides in part as follows:
 2. Each Filed-Sub-contract bidder shall list in Paragraph E of the "Form for Filed-Sub Contract Bids" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that sub-subtrade requires such listing, provided that, in the

absence of a contrary provision in the Specifications, any sub-bidder may, without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the Awarding Authority that he does customarily perform such class of work with persons on his own payroll and is qualified to do so. This Section of the Specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.

Class of Work	Reference Specification	Paragraphs

- F. The work to be completed by the Filed-Sub Contractor for the work of this Section is shown on the following listed Drawings:
- The Work of this Trade Contract is shown on the following Drawings:
AD3.1, AD3.2, AD3.3, A1.0, A2.1, A2.2, A3.0, A3.1, A3.2, A4.1, A4.2, A5.0, A5.1, A6.1, A6.2, A6.11, A6.12, A6.13, A6.14, A8.0, A8.1, A8.2, A8.3, A8.4, A8.5, A8.6, A8.7, A8.8, A9.1, A9.2, A9.3, A10.1, A10.2, A11.1, A11.2, A11.3, A12.1, A12.2, S1.1, S1.2, S3.1, S3.2, S4.1, S4.2
 - Related items which may require coordination or impact work of this trade are shown on the following Drawings:
FP1.1, FP3.1, P1.1, P3.1, P3.2, P3.3, DH3.1, DH4.1, H3.1, H3.2, H4.1, H4.2, H5.1, H5.2, H5.3, H5.4, E0.1, E0.2, ED1.1, ED1.2, ED1.3, EH1.1, EH1.2, EH1.3, EL1.1, EL2.1, EL2.2, EL2.3, EL2.4, EL2.5, EP1.1, EP2.1, EP3.1, EP3.2, EP4.1, EP4.2, EP4.3, EP4.4, EP4.5, EP4.6, FA0.1, FA1.1, FA2.1, FA3.1, FA3.2, SC0.1, SC1.1, SC1.2, SC2.1, TC0.1, TC1.1, TC1.2
 - The complete List of Drawings for the Project is provided in Section 00 01 15.
 - Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Filed-Sub Contractor's responsibility to determine full extent of work of this Section as required by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed-Sub Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.4 QUALITY ASSURANCE

- A. Company specializing in work described in the above listed individual specification sections with minimum 5 years documented experience.

1.5 SEQUENCING

- A. Coordinate work of this Filed-Sub Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed-Sub Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Painting Filed-Sub Contractor shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work and all other Work requiring such equipment as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 - 1. Scaffolding and staging required pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed-Sub Contractor.
 - 2. Painting Filed-Sub Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed-Sub Contractor.
 - 4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each work day to prohibit access to the scaffolding by unauthorized individuals.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed-Sub Contractor shall be furnished, installed,

operated and maintained in safe conditions by this Filed-Sub Contractor, as
referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

End of Section

Section 09 05 06

COMMON WORK RESULTS FOR FLOORING
(FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 06)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Filed Sub-Bid Requirements: As provided under Section 09 00 06 – RESILIENT FLOORING FILED SUB-BID REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Bid Contract includes all individual specification sections listed in Section 09 00 06.

1.2 SUMMARY

- A. This Section includes general requirements for flooring preparation, installation and temporary protection.
 - 1. Prepare substrates to receive flooring as required to ensure specified tolerance level for finish surface of all work required by this Filed subcontract. Preparation work includes patching, smoothing and leveling substrate, including:
 - a. Grinding down high spots of substrate.
 - b. Providing portland cement-based latex filler.
 - 2. Provide independent testing laboratory services to perform relative humidity, moisture vapor emission, and pH tests on in situ concrete slabs, which shall be in addition to testing as may be performed by Owner.

1.3 RELATED REQUIREMENTS

- A. Section 09 00 06 – RESILIENT FLOORING FILED SUB-BID CONTRACT REQUIREMENTS: Filed Sub-Bid Contract requirements for work of this Section.
- B. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES: Coved base.
- C. Section 09 65 43 - LINOLEUM FLOORING: Linoleum flooring.
- D. Section 09 67 23 – RESINOUS FLOORING: Poured epoxy flooring

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
1. ASTM F-710 - Preparing Concrete Floors to Receive Resilient Flooring.
 2. ASTM F-1869 – Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 3. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. General: Coordinate flooring work with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequencing:
1. Field Measurements:
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
 2. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

1.6 RELATIVE HUMIDITY, MOISTURE VAPOR EMISSION AND ACIDITY/ALKALINITY (PH) TESTING

- A. Concrete slabs and floors:
1. Resilient Flooring Filled Sub-Bid Contractor shall employ and pay for services of an independent testing laboratory to perform relative humidity, moisture vapor emission, and pH tests on concrete slabs as follows. The test shall be witnessed by the Construction Manager, and Owner's Project Manager.

- a. Relative Humidity, Moisture Vapor Emission and pH Testing on all concrete slabs over which a finished floor is to be installed. This includes, the following floor finishes that are part of the work of this Filed Subcontract
 - 1) Resilient sheet flooring, including linoleum flooring.
 - 2) Rubber flooring, including rubber tile, rubber sports flooring, and stair treads/risers.
2. Requirements: As specified under Part 3 of this Section.
 - a. Submit 1 copy of test data to the installers of all flooring materials or coating materials scheduled to be installed.
 - b. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Perform such additional testing, at no additional cost to the Owner, after procedures have been performed to reduce moisture content to ratings acceptable to the various flooring and coating manufacturers.

PART 2 - PRODUCTS

2.1 PATCHING AND FILLING COMPOUNDS

- A. Trowel-applied leveling compounds for patching, smoothing and leveling subfloors and underlayments: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
 1. Ardex, Inc., products "Feather Flash" and "Ardex SD-P".
 2. Quikrete Companies, product "Fast-Set Underlayment 1248".
 3. Silpro Masonry Systems Inc., product "Profinish".
- B. Accessories:
 1. Primers: Unless otherwise recommended by cementitious underlayment and patching mortar manufacturer for substrate material, condition, and porosity encountered:
 - a. Ardex: "P-51".
 - b. Pro Spec: "Level Set Primer".
 - c. Silpro: "C 21 All Acrylic".
 2. Cleaning agent: Commercial Muriatic acid.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that spaces to receive flooring finishes are suitable for installation. Do not proceed with work until unsatisfactory conditions are corrected. Comply with manufacturer's recommendations including the following:
 - 1. Substrates shall be dry and clean.
 - 2. Substrates shall be free of depressions, raised areas, or other defects which would telegraph through installed flooring.
 - 3. Verify concrete substrates have a flat tolerance of 3/16 inch in ten linear feet.
 - 4. Temperature of resilient flooring and substrate shall be within specified tolerances.
 - 5. Moisture condition and adhesive bond tests shall be performed as specified herein.
- B. For applications on concrete, verify curing, hardening, or breaking compounds have not been used. If there are any, do not proceed until compounds have been removed as specified.
- C. For applications on concrete slab on grade or below grade, verify vapor barrier below slab was installed. If no vapor barrier was installed, do not proceed with work unless written acceptance of such conditions is received and submitted.
- D. Perform testing of in situ concrete, relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings as specified herein. Do not proceed with work until results of moisture condition tests are acceptable.

3.2 PREPARATION

- A. General: Comply with flooring manufacturer's requirements for preparation of substrate to receive resilient flooring.
- B. Vacuum clean substrate, and ensure that substrate is dry, clean and smooth prior to application of flooring.
- C. Remove, by light sanding and grinding, all protruding edges, high spots.
- D. Ensure substrate is flat to a plus or minus 1/8 inch in 10 feet tolerance. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- E. Ensure that substrate is free from paint, varnish, wax, oil or other foreign matter.

- F. Apply primers as recommended by adhesive manufacturer's written instructions.
- G. Condition flooring materials, accessories and adhesives to room temperatures for a period of 48 hours minimum.
- H. Mechanical surface preparation
 - 1. Shot blast all surfaces to receive resinous flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum CSP of 3 as described by the International Concrete Repair Institute.
 - 2. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
 - 3. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
 - 4. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer's recommendations. Refer to manufacturer's joint guidelines.
 - 5. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufacturer's recommendations.
- I.

3.3 TESTING IN SITU CONCRETE SUBSTRATES

- A. Scope:
 - 1. Provide in situ concrete relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings. Includes concrete placed as part of this Work which occurs below grade, above grade (suspended slabs), and slabs on grade.
 - a. Existing building suspended slabs may be excluded from this requirement.
- B. Scheduling:
 - 1. Testing shall take place after allowing concrete to dry for a minimum of 90 days. Testing to be scheduled no less than one, nor more than three weeks prior to scheduled flooring installation.

- a. DO NOT conduct testing unless the slab environment is identical to that in which the finished flooring is to be installed.
 2. In the event new flooring is to be installed over existing resilient flooring, remove the portion of the existing flooring and adhesive directly under the area where testing will be conducted. Patch flooring to match existing construction after completion of testing.
- C. Test result submittals:
 1. Report all test results in chart form listing test dates, time, depth of test well, in situ temperature, relative humidity, moisture vapor and pH levels.
 2. List test locations on chart and show same on marked up Floor Plan Drawings.
 3. Submit results in duplicate. Deliver copies directly to Architect, Owner's Project Representative and General Contractor.
- D. Testing equipment: shall be equal to the following:
 1. For relative humidity testing (ASTM F2170):
 - a. Digital Meter and Calibrated Humidity and Temperature probe kit as manufactured by Vaisala Inc. 10D Gill Street, Woburn, MA, 01801.
 - 1) Minimum 2-point probe calibration.
 2. For calcium chloride testing (ASTM F1869):
 - a. Anhydrous calcium chloride testing
 - b. Test kits: Vaprecision, Inc. 2941 West MacArthur Boulevard, Suite 135. Santa Ana, CA 92704.
 3. For pH testing (ASTM F710):
 - a. pH test paper by Micro Essential Laboratory, Inc., P.O. Box 100824 4224 Avenue "H", Brooklyn, NY 11210.
 - b. Distilled or de ionized water.
- E. Testing Procedures Quantification of Relative Humidity
 1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F), and 50 percent (plus or minus 10 percent) relative humidity. When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions

during the test period. A transcript of this information must be Included with the test report.

2. The number of in situ relative humidity test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
3. Drill test holes utilizing a rotary hammer drill. Hole diameter shall not exceed outside diameter of test sleeve by more than 0.04 inch. Drilling operation must be dry. Determine the thickness of the concrete slab from Construction Documents. Depths of test holes shall be as follows:
 - a. For elevated slabs (not poured in pans): Drill test holes to a depth equal to 20 percent of the concrete thickness.
 - b. For slabs on grade and elevated slabs in pans: Drill test holes to a depth equal to 40 percent of the concrete thickness.
4. Vacuum all concrete dust from test hole.
5. Insert a hole liner, or sleeve, to the full depth of test hole, assuring that the liner is capped or plugged at the end protruding from the concrete surface.
6. Permit the test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
7. Remove the sleeve plug and place a probe into the sleeve assuring that it reaches the bottom of the test hole.
8. Allow the probe to sit in the test sleeve for 30 minutes before taking readings.
9. Read and record temperature and relative humidity at the test site.

F. Testing Procedures - Quantification of Concrete Moisture Vapor Emission through Calcium Chloride Testing.

1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F) and 50 percent relative humidity (plus or minus 10 percent). When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be included with the test report.
2. The number of vapor emission test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 In the first 1.000 square feet and I per each additional 1,000 square feet.

3. Tests sites are to be cleaned of all adhesive residue, curing compounds, paints, sealers, floor coverings, and similar materials. 24 hours prior to the placement of test kits.
4. Weigh test dish on site prior to start of test. Scale must report weight to 0.1 grams. Record weight and start time.
5. Expose Calcium Chloride and set dish on concrete surface.
6. Install test containment dome and allow test to proceed for 60 to 72 hours.
7. Retrieve test dish by carefully cutting through containment dome. Close and reseal test dish.
8. Weigh test dish on site recording weight and stop time.
9. Calculate and report results as pounds of emission per 1,000 square feet per 24 hours."

G. Testing Procedures Quantification of Acidity/Alkalinity (pH) Level:

1. At or near the relative humidity test site and each vapor emission (calcium chloride) test site, perform pH test.
 - a. At each testing site, lay down a loose 2 foot by 2 foot sheet of non-perforated sheet backed by plywood. Leave in place for 48 hours.
 - b. Remove sheet and place several drops of distilled or de ionized water onto the concrete surface to form a puddle approximately 1 inch in diameter.
 - c. Allow the water to set for approximately 60 seconds.
 - d. Dip the pH paper into the water and remove immediately, compare color to chart provided by paper supplier to determine pH reading
2. Record and report results.

H. Testing Procedures:

1. Initial testing: Provide 3 tests for the first 1,000 square feet.
2. Add one test for each additional 1,000 square feet.
3. Concrete surface area to be tested shall be completely clean. Remove all adhesives, residue, debris and sealing compounds. Remove all dust by vacuum or other methods. Do not use chemicals of any kind to clean concrete.
4. Perform moisture tests in strict accordance with the kit manufacturer's Instructions. Moisture tests shall remain undisturbed for 60 to 72 hours.

5. Immediately after moisture test has been removed from test area, conduct pH test in area previously covered by plastic dome of moisture test kit.
6. After completion of tests submit 2 copies of test data to the Architect. Submit a copy of the test data to all installers of flooring materials and resinous flooring materials scheduled to be installed.
7. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Perform such additional testing, at no additional cost to the Owner, after procedures have been performed to reduce moisture content to ratings acceptable to the various flooring and coating manufacturers.

3.4 FLOOR PREPARATION – GENERAL REQUIREMENTS

- A. General: Comply with ASTM F 710-92 and manufacturer's recommendations for surface preparation. Remove substances incompatible with resilient flooring adhesive by method acceptable to manufacturer.
 1. Concrete floors with steel troweled (slick) finish shall be properly roughened up (sanded) to ensure suitable adhesion.
 2. Concrete floors with curing, hardening, and breaking compounds shall be abraded with mechanical methods only to remove compounds. Use shot blast machine.
 3. Provide 100% coverage of substrate with specified floor patching material.
- B. Fill voids, cracks, and depressions with trowel-applied leveling compounds acceptable to manufacturer. Remove projections and repair other defects to tolerances acceptable to manufacturer.
- C. Vacuum subfloors immediately prior to installation to remove loose particles.

3.5 ADHESIVE BOND TESTING

- A. Use the specified flooring and recommended adhesive, install approximately 3 by 3 foot sized flooring as specified under individual flooring specification sections. Install test samples approximately 50 feet apart throughout the area. Areas next to walls or other light traffic areas should be selected for the bond test. Tape down the perimeter of the flooring to prevent drying of the adhesive at the edges. After a minimum period of 72 hours the flooring should be pulled from the subfloor. If an unusual amount of force is required, the bond could be considered sufficient. Floors demonstrating unsuitable bond to substrate require modifications to flooring installation and may require application of moisture mitigation products. Review all conditions with Architect.

3.6 PROTECTION

- A. Provide protection of completed flooring areas from construction traffic until Substantial Completion. Cover all floor surfaces with heavyweight kraft paper and overlay with red-rosin paper, taping the edges to maintain position of the protection paper. Reapply papers as required to maintain floor protection.

End of Section

Section 09 21 17
SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install shaft wall systems including framing, liner and board finish components.
 - 1. Gypsum Board taping and finishing are specified under Section 09 29 00 – GYPSUM BOARD.
- B. Install access panels occurring in shaft walls, furnished by Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 05 40 00 - COLD-FORMED METAL FRAMING: Load bearing framing.
- C. Section 06 10 00 - ROUGH CARPENTRY:
 - 1. Supplemental wood blocking.
 - 2. Installation of metal door frames in shaft wall systems.
- D. Section 07 92 00 - JOINT SEALANTS: Requirements for sealants and backing materials.
- E. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: Shop primed access panels, occurring in partitions and walls.
- F. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Non-load bearing partition and ceiling framing and furring.
- G. Section 09 29 00 - GYPSUM BOARD: Gypsum board finishes, applied over work of this Section 09 21 17, including: joint treatment, joint compound finishing and related trim components.
- H. Section 09 51 00 - ACOUSTICAL CEILINGS: Suspended acoustical tile ceiling including suspension system and associated edge moldings.
- I. Section 09 81 00 – ACOUSTICAL INSULATION: Acoustical batt insulation.
- J. Section 09 91 00 - PAINTING: Applied finish coatings.

1.3 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C 475 - Joint Treatment Materials for Gypsum Wallboard Construction.

2. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
3. ASTM C 919 - Use of Sealants in Acoustical Applications.
4. ASTM C 1047 - Accessories for Gypsum wall board and veneer base.
5. ASTM C 1396 - Gypsum Wallboard.
6. ASTM E 90 - Method of Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
7. ASTM E 119 - Fire Tests of Building Construction and Materials.
8. GA 201 - Gypsum Board for Walls and Ceilings.
9. GA 214 - Recommended Specifications for Levels of Gypsum Board Finish.
10. GA 216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
11. All applicable federal, state and municipal codes, laws and regulations for fire rated assemblies.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
 2. Work of this Section shall be closely coordinated with the work of Section 09 29 00 - GYPSUM BOARD, to assure the steady progress of the Contract.
- B. Sequencing: Do not install shaft wall until all pipes, ducts, conduits, and other such items which are to be enclosed thereby, have been permanently installed, inspected and approved.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 2. Shop Drawings:
 - a. Details of any special conditions associated with fireproofing.
 - b. Mark-up a set of blackline interior elevations indicate corrections to grid layout and provide dimensioning showing locations of all proposed control joints and expansion joints.
 - 1) Provide interior elevation drawings for interior elevations which are not included as part of the Contract Drawing set.
 - c. Indicate designated hourly ratings.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

2. Deliver materials in original packages, containers or bundles bearing brand name, identification of manufacturer or supplier.
 - B. Storage and Handling Requirements:
 1. Store materials inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
 - a. Neatly stack board materials flat to prevent sagging.
 2. Handle board materials so to prevent damage to edges, ends and surfaces.
 3. Protect metal trim accessories and corner beads from being bent or damaged.
 - C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including plaster materials in packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.
- 1.7 SITE CONDITIONS
- A. In accordance with GA 216, maintain minimum ambient temperature of 50 degrees Fahrenheit 48 hours before, during taping and compounding, and until completely dry thereafter.
- 1.8 WARRANTY
- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
 - B. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:
 1. Metal components and related items:
 - a. Clarkwestern Dietrich Building Systems, LLC, Schiller Park, IL.
 - b. Marino\Ware, Division of Ware Industries, South Plainfield, NJ.
 - c. Cemco Steel Framing and Metal Lath, City of Industry, CA.
 - d. Telling Industries, Mentor, OH.
 - e. United States Gypsum Company (USG), Chicago, IL.
 2. Gypsum liner panels and board materials:
 - a. United States Gypsum Company (USG), Chicago, IL.
 - b. National Gypsum Company, Charlotte, NC.
 - c. Georgia-Pacific Gypsum, LLC, Atlanta, GA.
 - d. Lafarge Corporation, Hendron, VA.

- B. The design and details as shown on the drawings and the model numbers specified herein are to establish the standards of design and quality and not to limit competition.

2.2 DESCRIPTION

- A. Regulatory Requirements:
 - 1. Fire resistance ratings: Provide materials and assemblies of the rating required, tested per ASTM E 119, which are identical to those indicated by reference to Gypsum Association file numbers in "Fire Resistance Design Manual" or to design designation in the Underwriters Laboratories "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction and to the Owners' insurance underwriters
 - 2. Seismic Compliance: Nonstructural components that are permanently attached to structures and their support attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance to local jurisdiction.
- B. Sustainability Requirements:
 - 1. Gypsum Board Recycled Content: Use maximum available percentage of recycled materials. Gypsum board products incorporated into the work shall contain not less than 50 percent of recycled materials.

2.3 MATERIALS

- A. Studs for shaft wall assemblies: or, 20 gage (0.0329 inch [0.84 mm] minimum thickness), galvanized and complying with ASTM C 645, 2-1/2 inch size, or as indicated otherwise in the drawings.
 - 1. Framing members shall have a G-40 (hot-dipped galvanized) minimum protective coating conforming to ASTM A653 and ASTM A1003 (table 1). Equivalent coatings (G40e) will not be considered equal.
 - 2. Acceptable products include the following:
 - a. Clarkwestern Dietrich Building Systems, LLC, West Chester, OH, product, "C-T Stud".
 - b. Marino\Ware, Division of Ware Industries, South Plainfield, NJ, product: "CT-Stud".
 - c. Cemco Steel Framing and Metal Lath, City of Industry, CA, product; "C-H Studs".
 - d. Telling Industries, Mentor, OH, product; "C-T Stud".
 - e. United States Gypsum Company (USG), Chicago, IL product, "C-H Studs".
- B. Runners for studs in shaft wall assemblies: J-track, galvanized and complying with ASTM C 645, with 2-1/4 inch leg, in size, gage and manufacturer to match shaft wall studs.
- C. Struts for jamb framing of door openings in shaft wall assemblies: J-type strut, galvanized and complying with ASTM C 645, 20 gage (0.0329 inch [0.84 mm] minimum thickness), with minimum 3 inch return.
- D. Shaftwall liner: UL fire resistance rated, ASTM C 442 - Type X board with beveled edges, 1 inch thick, 24 inches wide, of lengths to minimize end joints.

1. Acceptable products include the following, or approved equal:
 - a. United States Gypsum Company (USG) Sheetrock Brand product; "Mold-Tough Liner Panels".
 - b. National Gypsum Company, Gold Bond Brand product; "Fire-Shield Shaftliner XP, with Sporgard".
 - c. Georgia-Pacific Gypsum, LLC, product; "DensGlass Shaftliner".
 - d. Lafarge Corporation, product "Mold Defense Shaftliner Type X".
 - E. Gypsum board and finishing: Specified under Section 09 29 00 – GYPSUM BOARD.
- 2.4 ACCESSORIES
- A. Finishing trim, joint tapes, compound and accessories: Specified under Section 09 29 00 – GYPSUM BOARD.
 - B. Fasteners:
 1. Shaft wall framing:
 - a. Expansion-type fasteners for securing vertical concrete and masonry surfaces.
 - b. Concrete stub nails for securing runners to concrete.
 - c. Nº.7 by 7/16 inch Pan head self-drilling screw to attach metal framing components.
 2. Board fasteners: In compliance with ASTM C954 or ASTM C1002, of head type, thread, point and finish as recommended by the shaft wall system manufacturer.
- 2.5 SOURCE QUALITY CONTROL
- A. Obtain shaft wall products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of shaft wall system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that all items which are to be enclosed by Work of this Section, have been permanently installed, inspected and approved.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 INSTALLATION - GENERAL

- A. Erect shaft wall systems in strict accordance with the manufacturers' UL listed test construction for the required fire rating and in strict accordance with manufacturer's instructions, ASTM C 754 for Metal Framing, together with the additional requirements specified herein and as indicated on the Drawings.
- B. Install supplementary framing in shaft-wall assemblies around openings, for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.

3.3 INSTALLATION OF SHAFT WALL

- A. Install J runners or E studs at floor and ceiling structural elements with suitable fasteners located 2 inches from each end and intermediate fasteners spaced no greater than 24 inches.
 - 1. Install runners and studs prior to fireproofing.
 - 2. Do not splice studs, all studs shall extend from the floor to the underside of the structure above in one single length.
- B. Install studs in direct contact with all door and window frame jambs, abutting partitions, partition corners and existing construction elements; screw fasten with one screw per flange.
 - 1. Where studs are installed directly to exterior masonry walls, install 15 pound asphalt felt between stud and wall.
- C. Install studs 3/8 inch to not more than 1/2 inch less than opening height and install between liner panels with liner inserted in the groove. Install full-length steel "E" studs over shaft wall liner at T-intersections, corners, columns and both sides of closure panels. Frame openings cut within a liner panel with "E" studs around perimeter. For openings, frame with vertical "E" studs at edges, horizontal J-strut at head and sill, and reinforcing as recommended by the shaft wall manufacturer. Suitably frame all openings to maintain structural support for wall.
- D. Furnish and install additional cross bracing and other framing elements, to assure a completely rigid assembly on metal stud partitions and furred areas, whether or not such bracing has been indicated on the Drawings, and for proper receipt of items which will be attached to partition surfaces.
 - 1. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices and similar items.
- E. Cut liner board panels 1 inch less than opening height and erect vertically between J-runners. Where shaft walls exceed 14 feet in height, position liner panel end joints within upper and lower third points of wall. Stagger joints top and bottom in adjacent panels.
 - 1. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.
- F. Erect fire rated gypsum panel base layer horizontally on one side of studs with end joints staggered. Fasten base layer to studs with 1 inch, Type S-12 screws. Caulk perimeter of base layer panels.
- G. Apply fire rated gypsum panels face layer vertically over base layer with joints staggered and attach with 1-5/8 inch Type S-12 screws staggered from those in base, spaced 12 inches on center and driven into studs.
- H. Finish boards, trim and joint compound finishing as specified under Section 09 29 100 – GYPSUM BOARD.

3.4 APPLICATION OF ACOUSTICAL SEALANT

- A. General: Install sealant and backing in accordance with the recommendations of ASTM C-919 and sealant manufacturer's recommendations.

1. Perform preparation in accordance with C-790. Thoroughly clean all joints, removing all loose mortar, oil, grease, dust, frost, and other foreign materials that will prevent proper adhesion of primers and sealant materials.
 2. If so recommended and furnished by the specific sealant manufacturer, apply primer to all joint surfaces, taking care not to stain adjacent surfaces.
- B. Seal all partition perimeters prior to taping or compounding. Where perimeters are edged with metal trim, apply sealant and backing material between trim and dissimilar material.
- C. Seal all penetrations in partition types designated for "acoustical" insulation. Penetrations to receive sealant include electrical boxes, plumbing, heating and air conditioning ducts, telephone, intercom hookups and similar items.
1. Install joint bead back-up in all joints in excess of 5/8-inch depth, and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.
 - a. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
 - b. Do not stretch back-up material into joints.
 - c. Install bond breaker wherever recommended by the sealant manufacturer to prevent bond of the sealant to surfaces where such bond might impair the Work.
 2. Apply sealant in continuous beads without open joints, voids or air pockets
 - a. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
 3. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.

3.5 APPLICATION OF JOINT TREATMENT

- A. Application of joint tape and compound finishing is specified under Section 09 29 00 – GYPSUM BOARD.

3.6 TOLERANCES

- A. Install shaft wall partitions with a maximum variation from true flatness of 1/8 inch per 10 feet, noncumulative.

3.7 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris, scraps, and deposits of compound and gypsum fill.
- B. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of gypsum fill, and other materials installed under this Section.

End of Section

Section 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this Section consists of non-load bearing metal framing for partitions, ceilings, and soffits, where shown on the Drawings, as specified herein, for a complete and proper installation. Work includes, but is not limited to the following.
 - 1. Coordinate work of this Section with Section 23 00 00 – HVAC for required stud spacing and locations of vertical ductwork within interior walls.
- B. Furnish and install:
 - 1. Metal furring and framing including cross bracing and knee bracing including designing framing for doors, finishes, openings, jambs and headers where indicated on the Drawings.
 - 2. Reinforcing plate blocking.
 - 3. Deflection track assemblies at tops of metal stud partitions.
 - a. Provide fire-rated assemblies at fire-rated, corridor, and smoke partitions.
 - b. Provide non fire-rated assemblies at all other partitions.
 - 4. Metal framing for decorative column covers.
 - 5. Provide special designed framing at the curtain framing support at the stage curtain.
 - 6. Z-furring metal stud framing standoff attachment clips at fireproofed steel and otherwise called for on the drawings.
 - 7. Furring, hangers, metal framing system at parking below building ceiling.
 - 8. Metal framing at interior side of exterior wall structural beams.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 05 40 00 – COLD-FORMED METAL FRAMING: Engineered framing systems to receive gypsum drywall finish.
- C. Section 06 10 00 - ROUGH CARPENTRY:
 - 1. Wood blocking.
 - 2. Installation of hollow metal and aluminum door frames in gypsum drywall work.
- D. Section 07 21 00 - THERMAL INSULATION: Thermal and acoustical batt insulation.
- E. Section 07 81 00 – APPLIED FIREPROOFING: Cementitious fireproofing at structural steel.
- F. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing steel door frames.

- G. Section 08 31 00 - ACCESS DOORS AND PANELS: Shop primed access panels, occurring in partitions and walls.
- H. Section 09 29 00 - GYPSUM BOARD: Gypsum board, applied over metal framing installed by this Section 09 22 16 including: gypsum board, and related trim components.
- I. Section 09 51 00 - ACOUSTICAL CEILINGS: Suspended acoustical tile ceiling, including metal suspension system.
- J. Division 21 - FIRE SUPPRESSION: Fire protection systems occurring within non-structural metal framed assemblies.
- K. Division 22 - PLUMBING: Plumbing systems occurring within non-structural metal framed assemblies.
- L. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Supply and return air registers.
- M. Division 26 - ELECTRICAL: Independent hangers for suspended lighting fixtures.

1.3 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process..
 - 2. ASTM C 645 - Non-Load Bearing Steel Studs, Runners, and Rigid Furring Channels for Screw Application of Gypsum Board.
 - 3. ASTM C 646 - Steel Drill Screws for the Application of Gypsum Sheet Material to Light Gage Steel Studs.
 - 4. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard.
 - 5. ASTM E 90 - Method of Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
 - 6. ASTM E 119 - Fire Tests of Building Construction and Materials.
 - 7. GA 203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum board.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work
 - 2. Work of this Section shall be closely coordinated with the work of Section 09 29 00 - GYPSUM BOARD to assure the steady progress of the Contract.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer.
- C. Qualifications:
 - 1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Storage and Handling Requirements:
 - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 - 2. Protect materials from damage due to moisture, surface contamination, corrosion and damage from construction operations and other causes.

1.8 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The design and details as shown on the drawings and the model numbers specified herein are to establish the standards of design and quality and not to limit competition.

2.2 DESCRIPTION

- A. Regulatory Requirements

1. Obtain certificate of compliance from authority having jurisdiction indicating approval of specified products.
 2. Fire resistance ratings: Where gypsum board systems with fire-resistance ratings are indicated, provide materials and assemblies of the rating required, tested per ASTM E 119, which are identical to those indicated by reference to Gypsum Association file numbers in "Fire Resistance Design Manual" or to design designation in the Underwriters Laboratories "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction and to the Owners' insurance underwriters.
 - a. Fire-Test-Response Characteristics: Provide components that comply with rating requirements specified for fire-rated assemblies under UL 2079 for non-load bearing wall systems.
 - 1) Deflection Clips and Firestop Track: Connections and/or top runner provided in fire-resistance-rated assemblies shall be certified by UL 2079 for cyclic movement requirements.
- B. Sustainability Requirements:
1. Recycled content of Steel: Use maximum available percentage of recycled steel. Steel framing products incorporated into the work shall contain not less than 30 percent of recycled steel.

2.3 FRAMING MATERIALS

- A. "Hat shaped" Furring channels: 7/8 x 2-3/4 inch, roll-formed, hat-shaped, furring channel 25 gage hot-dip galvanized steel conforming to ASTM C 645.
- B. Resilient furring channels: Roll-formed, hat-shaped, 1/2 x 2-5/8 inch, 26 gage hot-dip galvanized steel conforming to ASTM C 645, with pre-punched holes, equal to Dietrich Industries, Inc., Pittsburgh PA, Metal Channel "RC1".
- C. Studs: 'C-shaped' screw studs, hot-dip galvanized steel complying to ASTM C 645, 20 gage (0.0329 inch [0.84 mm] minimum thickness), of widths indicated on the Drawings, or thicker gages under the specified standards to meet fire resistance ratings.
- D. Runners for metal studs: 'U-shaped' hemmed, hot-dip galvanized steel track conforming to ASTM C645, of gage and width to match respective stud sizes, or heavier gage per design requirements, having 1-1/4 inch leg at all head, (ceiling) conditions and a 4 inch leg at all sill, (floor) conditions.
- E. Internal reinforcement for various stud conditions, and bracing: 10 gage, minimum, galvanized steel.
- F. Furnish cross bracing and knee bracing, to assure a completely rigid assembly on metal stud partitions and furred areas.
- G. Comply with minimum gage requirements for various gypsum wallboard types.

2.4 DEFLECTION TRACK ASSEMBLIES:

- A. Non Fire-Rated Assemblies
 1. Deflection Track: Manufacturer's standard top runner with extended flanges designed to prevent cracking of gypsum board applied to interior partitions

resulting from deflection of the structure above fabricated from steel sheet complying with ASTM A 653 or ASTM A 568. Thickness as indicated for studs, and width to accommodate depth of studs, and the following configuration.

- a. Top runner with extended deep flanges that either have V-shaped offsets that compress; slots 1 inch o.c. that allow fasteners attached to studs through the slots; or 16 gage sliding clip assemblies attached to top track and clipped to stud
- B. Fire-Rated Assemblies: Head of wall dynamic fire rated joint systems for head of wall assemblies in compliance with UL 2079 HW-D classified assemblies. Provide one of the following systems:
 1. Deflection track / clip system: The Steel Network, Inc., product "VertiClip", including step bushings. Clips and track 20 gage, and of width to accommodate depth of studs indicated.
 2. Deflection slip track System: Comply with requirements of ASTM C 645 except configuration, of thickness indicated for studs and width to accommodate depth of studs indicated with flanges offset to accommodate gypsum board thickness.
 - a. Fire Trak Corp., Kimball, MN products:
 - 1) "Shadowline" at balanced and unbalanced fire-rated assembly partitions.
 - 2) "Cavity Shadowline" at shaftwall and chase wall (double stud) partitions.
 3. Coordination: Verify with partition schedule on the Drawings to ensure proper depth of flange offsets at various partitions types.

2.5 CEILING AND SOFFIT SUSPENSION MATERIALS

- A. Hanger attachments: Galvanized steel hanger eyes, of size and capacity to safely sustain a live load of at least 150 pounds per hanger attachment.
- B. Hangers: Soft temper, pre-stretched galvanized carbon steel wire, conforming with ASTM A641, with a yield stress load of at least three times design load, but not less than 12 gage.
- C. Sound isolation hangers (OT/PT and Vocational Learning Center under Stage as indicated on the Drawings): Pre-compressed neoprene rubber and spring isolation hanger designed for high frequency sound waves and low frequency vibrations. Size hangers as recommended by manufacturer for anticipated ceiling load.
 1. Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Kinetics, Noise Control Inc., product, "IsoGrid Ceiling Hanger" as specified herein.
 2. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Kinetics, Noise Control Inc., Dublin, OH.
 - b. L.D. Peters and Sons, Inc., New Rochelle NY.
 - c. Mason Industries, Inc., Happaugue NY.

- D. Sound isolation hangers (Instructor and related Shop Classrooms under Gymnasium; Life Skills and ROTC spaces under Music Rooms and Auditorium): Pre-compressed neoprene rubber and spring isolation hanger; designed for high frequency sound waves and low frequency vibrations. Size hangers as recommended by manufacturer for anticipated ceiling load.
 - 1. Sound isolation hangers: Kinetics Noise Control, Inc. Dublin, Ohio, "Muta" series, or approved equal.
- E. Grid system for direct attachment of finish board: Comprised of double web main furring tees, 1 1/2 inches high by 1-3/8 inches flange face by 0.020 inch thick; double web cross tees, 1 1/2 inches high by 15/16 inch flange face by 0.020 inch thick; 0.020 inch thick wall channels, with 1-1/2 inches interior web height; and all splices, clips, and related items. Provide Underwriters Laboratories Label fire-rated assemblies for locations requiring fire-rated ceilings and soffits
 - 1. Chicago Metallic product "System 640 and System 650 Furring System".
 - 2. Armstrong World Industries product "Drywall Furring System".
 - 3. Donn (USG) Corporation, Chicago IL, product "USG Drywall Furring System" with DGLW tees.

2.6 ACCESSORIES

- A. Metal sheet plate blocking and bracing, where indicated: galvanized sheet 0.0312 inch thickness (20 gage).
- B. Fasteners:
 - 1. Expansion-type fasteners for securing vertical concrete and masonry surfaces.
 - 2. Concrete stub nails for securing runners to concrete.
 - 3. N^o.7 by 7/16 inch Pan head self-drilling screw to attach metal framing components.
- C. Reinforcing plates for blocking: 20 gage cold rolled sheet steel, provide minimum 6 inch width, or as otherwise indicated on the drawings.

PART 3 – EXECUTION

3.1 INSTALLATION, QUALITY STANDARDS

- A. General: Perform erection procedures for the various gypsum board system conditions, except as otherwise specified, as set forth in GA 201, GA 206, the written instructions of gypsum board manufacturer, together with the additional requirements specified herein and as indicated on the Drawings.
- B. Wherever fire-resistive rated assemblies are indicated on the Drawings, erect gypsum board systems in strict accordance with the manufacturers' UL listed test constructions for the required fire rating on each specific assembly.

3.2 INSTALLATION OF FURRING

- A. Install metal furring channel horizontally, with channels spaced not more than 16-inch on centers, and attaching the channels to the masonry or concrete substrates with expansion type fasteners spaced not more than 8 inches on centers. Shim

beneath channels as needed to ensure that a uniform receiving plane is maintained throughout.

3.3 INSTALLATION OF PARTITION FRAMING, GENERAL

- A. Install metal runners at floor and ceiling to structural elements with suitable fasteners located 2 inches from each end and intermediate fasteners spaced no greater than 24 inches.
- B. Install metal stud framing with open side facing in same direction, engaging floor and ceiling runners.
 - 1. Stud spacing:
 - a. Typical: 16 inches on-center.
 - b. For partitions supporting wall cabinets and other wall mounted equipment: 12 inches on-center.
 - c. For curved partitions space framing closer together than normal to prevent flat areas between framing members.
 - 2. When necessary to splice studs, nest stud with 8 inch overlap and screw studs together with screws on both flanges.
 - 3. Where studs are installed directly to exterior masonry walls, install asphalt felt between stud and wall.
- C. Install studs in direct contact with all door and window frame jambs, abutting partitions, partition corners and existing construction elements; screw fasten with screw through both flanges of studs and track, top and bottom.
- D. Securely anchor studs to jamb and head anchors of steel door and window frames. Over head of frames and openings in partitions, install a horizontal section of runner with a web flange bent at each end, horizontally and secure to strut studs with two screws in each bent web. Provide cripple studs over wall openings.
- E. Where horizontal studs are used for wall reinforcing or framing, cut pieces of stud and install horizontally between vertical studs. Cope horizontal studs to fit between flanges of vertical studs. Bend ends of horizontal studs or install clip angles in order to secure by screwing to vertical studs.
- F. Furnish and install additional cross bracing and knee bracing and other framing elements, to assure a completely rigid assembly on metal stud partitions and furred areas, whether or not such bracing has been indicated on the Drawings, and for proper receipt of items which will be attached to partition surfaces.

3.4 INSTALLATION OF DEFLECTION TRACK

- A. Isolate interior metal stud framing and shaft wall framing from building structure to prevent transfer of loading imposed by structural movement due to deflection.
 - 1. Install deflection track top runner in accordance with manufacturer's instructions and to attain lateral support and avoid axial loading.
 - 2. Install fire-rated deflection track top runner in accordance with manufacturer's instructions at top of fire-rated, corridor and smoke partitions.

3.5 INSTALLATION OF REINFORCING PLATE BLOCKING

- A. Install steel reinforcing plates in partitions and furred walls for the support of wall mounted objects as follows:
 - 1. Wherever such reinforcing plates are indicated on the drawings.
 - 2. In locations where wall bumpers are to be installed for the protection of wall surfaces from swinging doors. (See Section 08 71 00 - DOOR HARDWARE).
- B. Secure gage sheet metal reinforcing plates to steel studs with 1-1/4", Type "S" bugle head screws.

3.6 TOLERANCES

- A. Install partition and ceiling framing and furring with a maximum variation from true flatness of 1/8 inch per 10 feet, noncumulative.

End of Section

Section 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this Section consists of gypsum board (drywall) and trim finishes for partitions, ceilings, and soffits, where shown on the Drawings, as specified herein, and as required for a complete and proper installation.
- B. Furnish and install:
 - 1. Taped, compounded and sanded gypsum board finishes.
 - 2. Impact and abuse resistant gypsum board where indicated on Drawings and specified herein.
 - 3. Cement board at interior of roof curbs as indicated on Drawings and specified herein.
 - 4. Cementitious tile backer board at shower partitions, soffits and ceilings where indicated on Drawings and specified herein.
 - 5. 5/8" fiber-reinforced moisture resistant tile backer board where indicated on Drawings and specified herein.
 - 6. Acoustical Drywall Ceilings where indicated on the Drawings and specified herein.
 - 7. 5/8" exterior sheathing board where indicated on the Drawings and specified herein.
 - 8. All trim and accessory components related to gypsum board work.
 - 9. Acoustical joint sealant and backing at perimeter of gypsum board partitions.
 - 10. Transition molding at gypsum board where indicated on Drawings and specified herein.
 - 11. Cement board and exterior sheathing at ceiling assembly at parking below building.
 - 12. Miscellaneous Drywall and accessories as indicated in the drawings
 - 13. Aluminum Sheet at accordion folding door striker jambs.
 - 14. Embedded lead lined gypsum board.
- C. Install access panels occurring in gypsum board work furnished by Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 05 40 00 - COLD-FORMED METAL FRAMING: Load bearing framing.
- C. Section 06 10 00 - ROUGH CARPENTRY:
 - 1. Supplemental wood framing and blocking supporting gypsum board.

2. Installation of metal door frames in gypsum board work.

- D. Section 06 20 00 - FINISH CARPENTRY.
- E. Section 07 21 00 - THERMAL INSULATION.
- F. SECTION 07 27 00 – AIR BARRIERS.
- G. Section 07 84 00 – FIRESTOPPING: Fireproof firestopping, firesafing materials, smoke seals and related accessories, occurring in gypsum wall assemblies, including firestopping for rated walls at flutes in roof deck.
- H. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing steel door frames.
- I. Section 08 31 00 - ACCESS DOORS AND PANELS: Shop primed access panels, occurring in partitions and walls.
- J. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Non-load bearing partition and ceiling framing and furring.
- K. Section 09 30 13 – TILING: Ceramic tile finishes over backer board substrate installed by this Section 09 29 00.
- L. Section 09 51 00 - ACOUSTICAL CEILINGS: Suspended acoustical tile ceilings and transitions.
- M. Section 09 81 00 – ACOUSTICAL INSULATION: Acoustical batt insulation.
- N. Section 09 91 00 - PAINTING: Applied finish coatings.
- O. Section 10 40 00 - SAFETY SPECIALTIES.
- P. Division 21 - FIRE SUPPRESSION: Sprinkler heads in ceiling system.
- Q. Division 22 - PLUMBING: Plumbing penetrations in ceiling system.
- R. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Supply and return air registers.
- S. Division 26 - ELECTRICAL: Independent hangers for suspended lighting fixtures.

1.3 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A108.11 - Interior Installation of Cementitious Backer Units.
 - 2. ANSI A118.9 - Cementitious Backer Units.
 - 3. ASTM A 167 - Stainless and Heat-resisting Chromium-nickel Steel Plate, Sheet and Strip.
 - 4. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.
 - 5. ASTM C 475 - Joint Treatment Materials for Gypsum Wallboard Construction.

6. ASTM C 630 - Water Resistant Gypsum Backing Board.
7. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
8. ASTM C 919 - Use of Sealants in Acoustical Applications.
9. ASTM C 1002 - Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
10. ASTM C 1047 - Accessories for Gypsum wall board and veneer base.
11. ASTM C 1396 - Gypsum Wallboard.
12. ASTM E 90 - Method of Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
13. ASTM E 119 - Fire Tests of Building Construction and Materials.
14. GA 201 - Gypsum Board for Walls and Ceilings.
15. GA 214 - Recommended Specifications for Levels of Gypsum Board Finish.
16. GA 216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
17. GA 220 - Recommended Specifications for Gypsum Board Winter Related Job Problems.
18. UL - Fire Resistance Directory.
19. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
20. All applicable federal, state and municipal codes, laws and regulations for fire rated assemblies.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
2. Work of this Section shall be closely coordinated with the work of Section 05 40 00 - COLD-FORMED METAL FRAMING and Section 09 22 16 - NON-STRUCTURAL METAL FRAMING, to assure the steady progress of the Contract.

B. Sequencing:

1. Do not install gypsum board until all pipes, ducts, conduits, and other such items which are to be enclosed thereby, have been permanently installed, inspected and approved.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
2. Shop Drawings:
 - a. Details of any special conditions associated with fireproofing.

- b. Mark-up a set of blackline interior elevations indicate corrections to grid layout and provide dimensioning showing locations of all proposed control joints and expansion joints.
 - 1) Provide interior elevation drawings for interior elevations which are not included as part of the Contract Drawing set.
- c. Mark-up a set of plans depicting types of gypsum board products being used on the outmost layer

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum board.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Storage and Handling Requirements:
 - 1. Store materials inside, under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
 - a. Neatly stack board materials flat to prevent sagging.
 - 2. Handle board materials so to prevent damage to edges, ends and surfaces.
 - 3. Protect trim, accessories and corner beads from being bent or damaged.

1.8 SITE CONDITIONS

- A. Environmental Conditions: In accordance with GA 216, maintain minimum ambient temperature of 50 degrees Fahrenheit 48 hours before, during taping and compounding, and until completely dry thereafter.

1.9 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Gypsum board products:
 - a. United States Gypsum Company, Chicago IL. (USG).
 - b. National Gypsum Company, Gold Bond Products Division, Charlotte NC. (Gold Bond).
 - c. G-P Gypsum Corporation, Atlanta GA.
 - d. CertainTeed Gypsum, Malven, PA
 2. Cementitious tile backer board ("Cement board"):
 - a. Custom Building Products, Inc., Seal Beach, CA.
 - b. Fin Pan, Inc., Hamilton OH.
 - c. Unifix, Inc., division of National Gypsum Company, Charlotte, NC.
 - d. United States Gypsum Company, Chicago, IL.
 3. Reveal trim:
 - a. Fry Reglet Corporation, Norcross GA
 - b. Gordon Inc., Shreveport LA.
 - c. Pittcon Industries, Inc., Riverdale MD.
 4. Acoustic Gypsum/Panel products
 - a. Armstrong "Acoustibuilt" , Lancaster, Pa.
 - b. BASWA Acoustics "Phon Base" Cleveland, OH
 - c. Pyrok "StarSilent", Mamaroneck, NY
- B. The design and details as shown on the Drawings and the model numbers specified herein are to establish the standards of design and quality and not to limit competition.

2.2 DESCRIPTION

- A. Regulatory Requirements:
1. Fire resistance ratings: Where gypsum board systems with fire-resistance ratings are indicated, provide materials and assemblies of the rating required, tested per ASTM E 119, which are identical to those indicated by reference to Gypsum Association file numbers in "Fire Resistance Design Manual" or to design designation in the Underwriters Laboratories "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction and to the Owners' insurance underwriters.

2.3 BOARD MATERIALS

- A. Fire rated gypsum board: UL fire resistance rated, ASTM C 1396 'Type X' board, 5/8 inch thick, 48 inch width, of lengths to minimize end joints, with tapered edges.
1. Acceptable products include the following, or approved equal:
 - a. USG Sheetrock brand "EcoSmart Type ULIX"

- b. National Gypsum Company, Gold Bond brand product "Fireshield Gypsum Board".
 - c. G-P Gypsum Corporation product, "Toughrock Fireguard".
 - d. CertainTeed Type X
 2. Locations: Typical non-impact/abuse resistant walls and ceilings, above ceiling partitions and first layer of multi-layer assemblies.
- B. Abuse-Resistant Gypsum Board (ARGB): Moisture/mold resistant, UL type FRX-G fire resistance type, ASTM C-1278 board, complying with ASTM C1658 and ASTM C36.
 1. ASTM C1629 Test Result Characteristics, minimum Level ratings:
 - a. Abrasion: Level 2.
 - b. Indention: Level 2.
 - c. Soft Body Impact: Level 2.
 - d. Hard Body Impact: Level 1.
 2. Acceptable products include the following or approved equal:
 - a. USG Sheetrock brand product "Aqua-Tough AR Interior Panels".
 - b. National Gypsum Company, Gold Bond brand product "eXP Interior Extreme AR Gypsum Panel".
 - c. G-P Gypsum Corporation product, "Dense Armor Plus Abuse-Resistant Interior Panel".
 - d. CertainTeed ExtremeAbuse w M2 Tech
 3. Locations: Lobbies, Entrances, Vestibules, Cafeteria, Servery, Corridors, Common Rooms and Single/Multi-User Toilet Rooms.
- C. Cementitious tile backer board (tiled walls): 5/8-inch nominal thickness, glass fiber reinforced, with a minimum indentation strength of 1250 pounds per square inch and minimum flexural strength of 480 pounds per square inch and manufacturer's standard edge guard system.
 1. Acceptable products include the following, or approved equal:
 - a. United States Gypsum Company, product: "Durock Cement Board with Edgeguard".
 2. Locations: Non-rated walls/ceilings at Showers and at "wet walls" (walls with plumbing fixtures) of Multi-User Toilet Rooms, Showers/Toilets and Team Rooms scheduled to receive tile finish.
- D. Exterior Sheathing Board: 5/8" thick Type X gypsum sheathing board complying with ASTM C 1177 with fiberglass mat surface front and back with silicone-treated gypsum core conforming with the following requirements:

Properties	Test	Results
Surfacing:		Glass mat
Width:		4'-0" nominal
Length:		10'-0" (+/- 1/4 inch) maximum
Flexural Strength, lb/ft parallel (4'-0" weak	ASTM C 473	80 pounds

direction):		
Humidity Deflection, (inches):	ASTM C 473	1/4 inch, maximum
Linear Expansion with Change Moisture (in/in % RH):	ASTM C 518	6.25×10^{-6} , maximum
Thermal resistance "R" (in/ft ² °F/Btu):	ASTM C 518	0.45, minimum
Weight (per 1,000 sq ft):	ASTM C 1177	1,900 pounds minimum
Bending Radius	ASTM C 1177	6 feet, minimum
Mold growth:	ASTM D 3273	Score 10 with no mold detected
Racking Strength, lbs/ft, dry (ultimate):	ASTM E 72	>540 pounds per foot
Surface burning characteristics:	ASTM E 84	Flame spread: 10, maximum
Permeance (ng/Pa•s•m ²):	ASTM E 96 (dry cup method)	23 perms, maximum
Combustibility:	ASTM E 136	Noncombustible
Coefficient of Thermal Expansion (in/in/°F):	ASTM E 228 modified	8.5×10^{-6} , maximum
1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Georgia Pacific Corporation, Gypsum Division, Atlanta GA., product "DensGlass Fireguard Sheathing".
 - b. United States Gypsum Company, Chicago IL. (USG), product "Securock Ultralight Glass-Mat Firecode X Sheathing".
 - c. National Gypsum Company, Gold Bond Products Division, Charlotte NC. (Gold Bond), product "e²XP Sheathing".
 - d. CertainTeed GlasRoc Sheathing Type X

E. Lead Backed Gypsum Board

1. 5/8" thick, Type-X gypsum board with pure lead sheet complying with ASTM C 1396 and federal specification QQ-L-201 F, factory laminated to the back side of the gypsum panel. The lead shall extend 1" minimum beyond all edges to allow for overlapping of joints.
2. Lead sheet lining: 1/64-inch minimum
3. Accessories by lead backed gypsum board manufacturer:
 - a. Lead strips at corners
 - b. Lead discs at screw penetrations, minimum thickness equal to lead sheet lining.
 - c. Sheet lead for backing and shielding of cut-outs for electrical, plumbing, and all other penetrations.
4. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

- a. Mayco Industries, Inc., Birmingham, AL,
- b. The Ultray Group, Oakville, ON L6L 6M5, Ultraray Radiation Protection
- c. A&L Shielding, Rome, GA, 30161

2.4 ACCESSORIES

- A. Polyvinyl chloride (PVC) trim accessories, conforming to ASTM D 1784 and C 1047.
 - 1. J Bead: Edge trim with exposed 1/2 inch face cap, furnish trim model number corresponding to the board thickness where installed.
 - a. Plastic Components model number: 200X-50 (for 1/2 inch thick board) or 200S-58 (for 5/8 inch thick board).
 - b. Vinyl Corp. model number: JB50 (for 1/2 inch thick board) or JB58 (for 5/8 inch thick board).
 - c. AMICO. model number: AMJB50 (for 1/2" thick board) or AMJB58 (for 5/8" thick board).
 - 2. L Bead: casing edge trim, furnish trim model number corresponding to the board thickness where installed
 - a. Plastic Components model number: 221-50 (for 1/2 inch thick board) or 221-58 (for 5/8 inch thick board).
 - b. Vinyl Corp. model number: LB50 (for 1/2 inch thick board) or LB58 (for 5/8 inch thick board).
 - c. AMICO. model number: AMSB50 (for 1/2 inch thick board) or AMSB58 (for 5/8 inch thick board).
 - d. CertainTeed No-Coat L-Trim 1/2 inch or 5/8 inch
 - 3. L-Bead with removable leg: Casing edge trim for joints at ceilings doors and windows, with removable leg strip, furnish trim model number corresponding to the board thickness where installed
 - a. Plastic Components model number: 224-50 (for 1/2 inch thick board) or 224-58 (for 5/8 inch thick board).
 - b. Vinyl Corp. model number: CT-50(for 1/2 inch thick board) or CT-58 (for 5/8 inch thick board).
 - c. AMICO product "Zip Strip" model number: AMZIP50 (for 1/2 inch thick board) or AMZIP58 (for 5/8 inch thick board).
 - 4. Corner beads, 90 degree with 1-1/4 inch flanges:
 - a. Plastic Components model number: 209.
 - b. Vinyl Corp. model number: VLCB.
 - c. AMICO. model number: AMCB125.
 - d. CertainTeed No-Coat Outside 90
 - 5. Control joints: "V" type joint with nominal 3/16 inch reveal and removable temporary tape:
 - a. Gold bond model "EZ Strip Expansion Joint".
 - b. Plastic Components model number: 2027-16.
 - c. Vinyl Corp. model number: CJV16.
 - d. AMICO. model number: AMDCJV16.

6. Partition closures: Adjustable partition closure at transition between windows and partition walls, in sizes as indicated on the Drawings, as manufactured by Gordon Incorporated, Bossier City, LA., product: "Mullion Mate", or approved equal.
 1. Finish to match Architects sample.
 7. Heavy-duty corner trim (Gymnasium, Weight Room, and Toilet Room soffits above toilet partitions, where indicated on Drawings): Continuous outside corner trim made of extruded aluminum 6063, chemical conversion coating conforming to ASTM D 1730, Type B and MIL-C-5541A, equal to Fry Reglet Corporation.
 - a. At single layer of gypsum board: model number DMCT-375
 - b. More than single layer of gypsum board: model number DMCT-1250.
- B. Paper faced trim accessories for use with Abuse Resistant Gypsum Board:
1. Corner beads (at outside corners): Paper-faced galvanized steel sheet for finishing with joint compound conforming with ASTM C-1047, equal USG product "Sheetrock" Brand Paper-Faced Metal Corner Bead.
 - a. Provide curved-edge cornerbead with notched or flexible flanges at curved openings.
 - b. CertainTeed No-Coat Outside 90
 2. Casing beads: Paper-faced galvanized steel sheet for finishing with joint compound conforming with ASTM C-1047, equal to USG product "Sheetrock" Brand Paper-Faced Metal Beads and Trims.
 - a. LC-Bead (J-Bead): Use at exposed panel edges.
 - b. L-Bead: Use where indicated
 - c. U-Bead: Use where indicated.
 3. Control joints: Solid zinc "V-shaped control joint, having 3/32 inch thick perforated grounds, equal to USG Control Joint No. 093.
 4. Extended leg wall moldings for wall gaps exceeding standard wall molding length of 7/8" by 1/2" (max).
- C. Transition trim: 15/16 inch horizontal flanged, cold rolled steel chemically cleaned in manufacturer's standard white finish equal to Armstrong World Industries "15/16" Flush Transition Molding".
1. 'F' reveal: 3/4 inch wide recess by nominally 5/8 inch deep reveal channel equal to Fry Reglet Corporation, model number FDM-625-75.
 2. Refer to Section 09 51 00 – ACOUSTICAL CEILINGS for transition trim between ceiling and soffit,
- D. Tapes and compound:
1. Primer/surfacer (at ARGB only): High build spray applied primer/surfacer USG, product "Tuff-Hide" or approved equal. Primer/surfacer shall be provided by the same manufacturer as the abuse resistant gypsum board.
 2. Joint tape (at paper-faced gypsum): Nominal 2 inch wide, high strength, cross-fibered paper drywall tape.
 3. Joint tape (at fiberglass faced gypsum): Nominal 2 inch wide, self-adhering (adhesive backed), fiberglass mesh tape.

4. Joint tape (exterior sheathing): Self-adhesive, 2 inch wide fiberglass mesh tape compatible with sheathing.
 - a. Acceptable Manufacturers: Subject to compliance with the requirements specified herein manufacturers offering similar products include the following, or approved equal:
 - 1) Dura-Tape International, Union NJ, product "Dura-Tape Fiberglass Mesh Tape".
 - 2) Westpac Materials, Orange, CA, product "Self-Adhesive Fiberglass Mesh Tape".
 - 3) Grabber Construction Products, Alpine, UT, product "Grabber Mesh Tape GMT200 Series".
 5. Joint compound for setting fiberglass joint tape:
 - a. Acceptable products include the following or approved equal
 - 1) Certainteed, Valley Forge PA, product "ProRock Moisture and Mold Resistant 90".
 - 2) Georgia Pacific Gypsum LCC, Pittsburgh PA, product "Densarmor Cote"
 - 3) CTS Cement Manufacturing Corporation, Cypress CA., product "Rapid Set OnePass".
 - 4) United States Gypsum Company, Chicago IL, product "Durabond"
 6. Joint compound for setting paper joint tape: 'Speed-setting type compound', field mixed.
 - a. Acceptable products include the following or approved equal:
 - 1) USG product "Durabond" or "Easysand".
 - 2) Gold bond product "Stay Smooth 30".
 - 3) Georgia Pacific Gypsum LCC, product "ToughRock All-Purpose Dry Mix"
 7. Joint Compound for finishing: Field mixed joint compound or factory pre-mixed compound.
 - a. Field-mixed compounds:
 - 1) Acceptable products include the following or approved equal:
 - a) USG product "Durabond 90".
 - b) Gold bond product "Stay Smooth 90".
 - c) Georgia Pacific Gypsum LCC, product "ToughRock Setting Compound 90".
 - b. Factory pre-mixed compounds:
 - 1) Acceptable products include the following or approved equal:
 - a) USG product "Ready-Mixed Joint Compound".
 - b) Gold bond product "All Purpose Compound".
 - c) Georgia Pacific Gypsum LCC, product "ToughRock Ready Mix All-Purpose Compound"
- E. Fasteners (interior board systems):
1. Type S, bugle head screws complying with ASTM C 1002, for applying gypsum board to metal framing, ceiling grid system, and furring channels.
 - a. Not less than 1 inch long for single layer gypsum board.
 - b. Not less than 1-5/8 inch [41mm] long for double-layer gypsum board.

2. Type W, bugle head screws complying with ASTM C 1002, for applying gypsum board to wood plywood backing, and blocking
 - a. Not less than 1-1/4 inch [31mm] long for single layer gypsum board
 - b. Not less than 1-5/8 inch [41mm] long for double-layer gypsum board,
3. Type S-12, fine thread self-drilling screws complying with ASTM C 1002, for applying gypsum board to light gage metal framing.
 - a. Not less than 1 inch [25 mm] long for 1/2 inch thick single layer gypsum board.
 - b. Not less than 1-1/4 inch [31mm] long for 5/8 inch thick single layer gypsum board.
 - c. Not less than 1-5/8 inch [41mm] long for double-layer gypsum board,
- F. Fasteners (exterior sheathing): Type S-12 fine thread rust resistant 1 inch [25mm] long self-drilling screws, for applying single layer sheathing board to light gage metal framing.
- G. Ceiling buttons, perforated type, 1 inch diameter, for use at multiple layered gypsum board ceiling systems.
- H. Laminating adhesive: USG Durabond Joint Compound 90, USG Ready-mixed ALL Purpose Compound, or equal.
- I. Joint Sealers (interior acoustical sealant type): One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable. Acceptable products include the following, or approved equal.
 1. Tremco, Beachwood OH.; product, "Acoustical Sealant".
 2. United States Gypsum Company, Chicago IL.; product "USG Acoustical Sealant".
 3. Pecora Corporation, Harleysville PA.; product "AC-20 FTR".
- J. Joint Sealer (exterior sheathing): One-part low modulus, neutral curing, RTV, silicone rubber sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, NS, Class 50, Use NT, G, A and O with a minimum movement capability of +50 percent and -50 percent, equal to the following:
 1. Dow Corning, product, "795".
 2. Sika, product "Sikasil WS-296".
 3. Tremco, product "Spectrem 2".
- K. Liquid sealer for cuts, holes and ends of moisture resistant board; provide one of the following or acceptable equal.
 1. Shellac type sealer: mix 4 pounds of orange or bleached shellac dissolved in 1 gallon of denatured ethyl-alcohol.
 2. Varnish type sealer: Fast setting marine varnish.

2.5 SOURCE QUALITY CONTROL

- A. Obtain gypsum board products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that all items which are to be enclosed by Work of this Section, have been permanently installed, inspected and approved.
- B. Inspect framing and other substrates; verify that they are in proper condition to receive the work of this Section.
- C. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. During the operation of gypsum board work, protect all wood, metal, glass, flooring, and other finished materials against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

3.3 INSTALLATION - GENERAL

- A. General: Perform erection procedures for the various gypsum board system conditions, except as otherwise specified, as set forth in GA 201, GA 216, GA 220, the written instructions of gypsum board manufacturer, together with the additional requirements specified herein and as indicated on the Drawings.
- B. Where fire-resistive rated assemblies are indicated, erect gypsum board systems in strict accordance with the manufacturers' UL listed test constructions for the required fire rating on each specific assembly.
- C. Install specified control joints as indicated on Drawings and where run of partitions, or furred surfaces exceeds 30 feet. Show locations of all control joints on shop drawings. The design intent shall follow the principles in the following order:
 - 1. First, locate control joints above door frames and/or any other opening in the wall at the corners of the head and if not feasible then.
 - 2. Second, locate control joints at the edge of a full height wall tile section, and if not feasible then.
 - 3. Third, locate control joints at a location that divides the remaining wall in a purposeful way, not just at 30' interval wherever it lands ie. divided in one half, divided in 1/3, divided equally away from wall mounted items like marker boards, monitors, fire extinguishers, etc.
 - 4. Run vertical control joints continuously to top of partition, shaft wall or furred area, as applicable.
- D. All boards shall not contact the surface on the concrete floor slab and shall be prepared to the floor for the proper tolerances for the resilient or other base installation.
- E. Provide and install "Acoustic Drywall" and accessories in strict accordance with manufacturer's printed instructions:
 - 1. Provide proof of receipt of hands-on installation training by the manufacturer

2. Provide mock up of ceiling/ fascia application per Section 01 43 39 "Mock-ups"
3. Deliver and store material as directed by the manufacturer
4. Installation to commence when the specific site conditions are met per manufacturer's instructions

3.4 INSTALLATION OF GYPSUM BOARD

- A. Screw fasten only, gypsum board to framing and furring, with ends and edges occurring over firm bearing. At all door jambs screw fasten gypsum panels 8 inches on center to both box studs
 1. Erect single layer fire-resistance rated gypsum board vertically.
 2. Erect standard and moisture resistant layer board in most economical direction.
 3. Erect ceiling and soffit gypsum boards to meet UL requirements, where applicable, stagger end joints over supports. Secure gypsum board with fasteners inserted through ceiling buttons; anchor fasteners directly to framing or suspended support system.
- B. Wherever items penetrate the gypsum board surfaces, use extra care in cutting the gypsum board to ensure a uniformly-dimensioned joint between the penetrating item and the gypsum board, and fill joints with specified sealant material. Verify the expected deflection factor of the penetrating members, and cut the gypsum accordingly, to prevent damage thereto from the deflecting members.
- C. Treat cut edges and holes in moisture resistant gypsum board with approved liquid sealer.
 1. If shellac is used, apply in thin layers to dry quickly.

3.5 INSTALLATION OF ACOUSTIC GYPSUM BOARD

- A. Provide and install "Acoustic Drywall" and accessories in strict accordance with manufacturer's printed instructions:
- B. Provide proof of receipt of hands-on installation training by the manufacturer
- C. Provide mock up of ceiling/ fascia application per Section 01 43 39 "Mock-ups"
- D. Deliver and store material as directed by the manufacturer
- E. Installation to commence when the specific site conditions are met per manufacturer's instructions
- F. Adhere to specific details for intersection with walls
- G. Seal all gaps between wall molding to wall, sprinkler penetrations, smoke detectors etc.
- H. Finish ceiling and adjacent balcony fascia

3.6 INSTALLATION OF CEMENT BOARD

- A. Walls:
 1. Wall framing substrate: Do not install cement board directly over protrusions from stud plane such as heavy brackets or fastener heads.

2. Make necessary cut-outs. Install cement board horizontally leaving 1/8 to 3/16 space at all joints, including joints with dissimilar materials. Stagger board joints with those of adjacent rows.
3. Fasten cement board with 1-1/4 inch length type S bugle head screw. Fasten boards every 8 inches on center in field and along edges. At edge conditions, locate fasteners between 1/2 inch to 2 inches from board edge.
4. At all joints and corners, fill gap solidly with dry-set or latex-modified, portland cement mortar and imbed 2 inch mesh fiberglass tape and smooth material over joint and corner.

3.7 INSTALLATION OF LEAD BACKED GYPSUM BOARD

- A. General: Install lead lined gypsum board in accordance with trim manufacturer's recommendations and as follows:
 1. Install batten strips to the face of stud prior to gypsum board.
 2. Install in vertical configuration.
 3. Overlap lead lining with 1" overlap attached to each board.
 4. Overlap lead lining into door frames.
 5. Fasten screws to allow lead disc to cover the screw head and be flush with the finish face of the gypsum board.
 6. Double line behind each wall penetration with lead sheets equal to the thickness of the gypsum board lining. Allow sufficient overlap of lead to cutout to eliminate leakage.
 7. Gaps at any point in the lead lining assembly shall be covered with lead sheet of minimum thickness equal to gypsum board lining.
 8. All scraps shall be disposed of as lead containing materials in accordance with state and federal requirements,

3.8 APPLICATION OF ACOUSTICAL SEALANT

- A. General: Install sealant and backing in accordance with the recommendations of ASTM C-919 and sealant manufacturer's recommendations.
 1. Perform preparation in accordance with C-790. Thoroughly clean all joints, removing all loose mortar, oil, grease, dust, frost, and other foreign materials that will prevent proper adhesion of primers and sealant materials.
 2. If so recommended and furnished by the specific sealant manufacturer, apply primer to all joint surfaces, taking care not to stain adjacent surfaces.
- B. Seal all partition perimeters prior to taping or compounding. Where perimeters are edged with metal trim, apply sealant and backing material between trim and dissimilar material.
- C. Seal all penetrations in partition types designated for "acoustical" insulation. Penetrations to receive sealant include electrical boxes, plumbing, heating and air conditioning ducts, telephone, intercom hookups and similar items.
 1. Install joint bead back-up in all joints in excess of 5/8-inch depth, and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.

- a. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
 - b. Do not stretch back-up material into joints.
 - c. Install bond breaker wherever recommended by the sealant manufacturer to prevent bond of the sealant to surfaces where such bond might impair the Work.
2. Apply sealant in continuous beads without open joints, voids or air pockets
 - a. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
 3. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.

3.9 APPLICATION OF JOINT TREATMENT

- A. Install joint tape at all joints where gypsum boards abut and where boards form internal corners, whether or not such joints will be concealed from view.
- B. Apply compound to all joints, edges, corners, fastener head depressions and abrasions in the surfaces, whether or not such conditions will be concealed from view. Sand completely smooth all compound surfaces, which will be exposed to view, and leave ready to receive applied coatings or finish.
- C. Provide the minimum levels of gypsum board finishes as defined by the Gypsum Association recommended specifications GA-214 and GA-216, per the following:
 1. At areas hidden from view, except as otherwise specified: Level 1.
 2. At areas hidden from view, requiring a fire rating: Level 1.
 3. At concealed plenum spaces above ceilings attic spaces: Level 1.
 4. At non-occupied spaces (i.e. attics): Level 1.
 5. At surfaces scheduled to receive tile: Level 2.
 6. At surfaces scheduled to receive applied acoustical wall paneling: Level 2.
 7. At surfaces scheduled to receive "flat" (without any sheen), "pearlescent", and egg-shell low-gloss painted finishes: Level 4.
 8. Spray apply primer at all FRP and FRL wall protection finishes in accordance with manufacturer's instructions to produce a Level 5 finish.

3.10 TOLERANCES

- A. Maximum variation for gypsum board partitions and ceilings from true flatness: 1/8 inch per 10 feet, noncumulative.

3.11 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris, scraps, and deposits of compound and gypsum fill.
- B. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of gypsum fill, and other materials installed under this Section.

- C. All lead lined gypsum board waste shall be disposed of as lead containing materials in accordance with state and federal requirements,

End of Section

Section 09 30 13
CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this Section consists of tiling where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following:
- B. Furnish and install the following:
 - 1. Ceramic wall tile.
 - 2. Installation systems, adhesives, mortars and grouts.
 - 3. Fluid applied waterproofing membrane where indicated.
 - 4. Preparation of control joints to receive sealant in tiled work.
 - 5. Metal edge and transition strips.
- C. Install the following furnished under the designated Sections:
 - 1. Install access panels into tiled walls as specified under Section 08 31 00 - ACCESS DOORS AND PANELS.
- D. Perform drilling and cutting in tile surfaces, as required to accommodate penetrating items of other trades, from templates and instructions furnished by the respective trades.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 04 20 00 - UNIT MASONRY: Concrete masonry unit substrate.
- C. Section 07 92 00 - JOINT SEALANTS: Backer rod and sealant at control joints.
- D. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: access panels, occurring in partitions and walls.
- E. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal stud framing to receive cementitious backer board installed under this Section.
- F. Section 09 29 00 - GYPSUM BOARD: Backer panels to receive tile finish.
- G. Section 09 00 03 - TILE TRADE CONTRACT REQUIREMENTS: Trade Contract requirements for work of this Section.
- H. Section 10 14 00 - Signage
- I. Section 10 28 13 - TOILET ACCESSORIES: Furnishing toilet accessories and installation templates.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
1. ANSI A108.1A - Installation of Ceramic Tile in the Wet Set Method, with Portland Cement Mortar.
 2. ANSI A108.1B - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
 3. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
 4. ANSI A108.10 - Installation of Grout in Tilework.
 5. ANSI A118.1 - Dry-Set Portland Cement Mortar.
 6. ANSI A118.4 - Latex-Portland Cement Mortar.
 7. ANSI A118.6 - Ceramic Tile Grouts.
 8. ANSI A118.7 – Polymer Modified Cement Grouts
 9. ANSI A118.10 - Waterproofing.
 10. ANSI A137.1 - Specifications for Ceramic Tile.
 11. ANSI A10.20 - Safety Requirements for Ceramic Tile, Terrazzo and Marble Work.
 12. TCNA (formerly TCA) - Handbook for Ceramic Tile Installation, latest edition.
 13. ASTM C 144 - Aggregate for Masonry Mortar.
 14. ASTM C 150 - Portland Cement.
 15. ASTM A 185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 16. ASTM C 627 - Evaluating Ceramic Floor Tile Installation Systems.
 17. ASTM C 920 - Specifications for Elastomeric Joint Sealant.
 18. ASTM C 1026 - Measuring Resistance of Ceramic Tile to Freeze Thaw Cycles
 19. ASTM C 1027 - Determining Visible Abrasion Resistance of Glazed Ceramic Tile
 20. ASTM D 226 - Asphalt Saturate Felt used in Roofing and Waterproofing.
 21. ASTM D 2103 – Polyethylene Film
 22. ASTM E 119 – Fire Test of Building Construction and Materials.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. TCNA (formerly TCA) - Handbook for Ceramic Tile Installation, latest edition.
- C. Definitions: For the purposes of these specifications the following terms are defined:
1. Wet Areas: Rooms/spaces which has plumbing fixtures, sinks, toilets, or floor drains. Wet areas additionally include rooms/spaces which are exposed to weather.
 2. Dry Areas: Rooms/spaces which have no plumbing, sinks, toilets, or floor drains.

1.4 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - a. Include maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
 - 2. Shop Drawings: 1/4 inch scale elevations and plans of tile patterns.
 - 3. Selection Samples:
 - a. Manufacturer's sample boards for each type and color group of tile specified, and grout colors, for selections by the Architect.
 - 4. Verification Samples:
 - a. Mount tile and apply grout on one 12 by 12 inch cement backerboard, for each tile type and selected color, to indicate color and texture variations, tile flatness and joint size variations.
 - b. Trim shapes and base, in selected colors in types and shapes indicated for project conditions.
 - c. Stone threshold, 12 inch long samples in shaped profile.
 - 5. Source Quality Control Submittals:
 - a. Grade Certificates: Manufacturer's Master Grade Certificates submitted prior to shipment of tile to project.
- B. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
 - 1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra materials in, an amount equal to 3 percent of tile and trim of each color, finish and type installed.

1.5 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
 - 1. Conform to ANSI/TCNA A 137.1 and TCNA Handbook for Ceramic Tile Installation.
- B. Sole Source: Obtain installation products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum board.
- C. Qualifications:
 - 1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.6 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 45 00 - QUALITY CONTROL.

- B. Provide mock-up panels, minimum 25 square feet, illustrating color, texture and finish, and demonstrating the minimum standard for the Work.
 - 1. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
 - 2. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Deliver tile in manufacturer's sealed cartons, grade-sealed by the manufacturer in accordance with ANSI A 137.1, with grade-sealed unbroken, and clearly marked as to contents, color, and quantity.
 - 3. Deliver and store tile setting materials in original, sealed, containers showing manufacturer's identification, year of production, new weight, date of packaging, and location of packaging.
- B. Storage and Handling Requirements:
 - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 - 2. Store and protect containers above floor level, keep dry until ready for use.
 - 3. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.8 SITE CONDITIONS

- A. Environmental conditions:
 - 1. General: Maintain ambient temperatures between 50 (10° C) and 80 (26° C) degrees Fahrenheit in tiled areas, for 24 hours prior to installation, during installation and for 7 days after completion.
 - 2. When temperature of substrate exceeds 90 (32° C) degrees Fahrenheit, contact manufacturer for instructions.
- B. Do not install setting or grouting materials in a closed, unventilated environment. Ventilate propane or fossil fuel heaters to prevent damage to tile work from carbon-dioxide build up.

1.9 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Manufacturer Warranty: The manufacturer of installation systems, adhesives, grouts and mortars shall provide a comprehensive non pro-rated written five (5) year warranty against defective products which covers replacement materials and labor costs for demolition, tile accessories, and installation systems.
 - 1. Warranty to provide for tile lifting or separation from substrate, and setting bed/grout deterioration, when products have been installed with referenced TCNA setting systems using specified setting and grout materials.

2. Warranty excludes structural failure, movement or cracking of substrate materials, and workmanship performed not in accordance with manufacturer's instructions and industry standard guidelines.
- C. Special Warranty: Provide 2 year, non pro-rated warranty which shall include provisions for cracking, breakage or failure of tile due to defective workmanship
 1. Materials must be compatible and from one source, single source responsibility for waterproofing, installation, mortars and grouts. Job-site mixtures of sand portland cement and site dilution of additives shall not be permitted.

1.10 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, deliver to the Owner extra materials for future repairs and maintenance.
 1. Furnish 3 percent of each size, color, and surface finish of tile specified, but not less than 25 square feet of each type.
 2. Clearly label and package extra materials securely to prevent damage.
 3. Furnish 3 unopened containers of each type of grout used.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Glazed ceramic wall tile:
 - a. American Olean Tile Company, Lansdale, PA.
 - b. Dal-Tile Corporation, Dallas, TX.
 - c. Sikes Corp., Florida Tile Division, Lakeland, FL.
 2. Mortars, adhesives & Grouts:
 - a. Bostik Corp. (Hydroment), Middleton MA.
 - b. C-Cure Chemical Company, Inc., Houston, TX
 - c. Custom Building Products, Inc., Seal Beach, CA.
 - d. Laticrete International, Inc., Bethany, CT
 - e. Mapei Corporation, Elk Grove, IL.
 - f. TEK Special Construction Brands, Inc. (division of HB Fuller), Arlington Heights, IL.
 3. Edging materials:
 - a. Schlüter Systems L.P., Plattsburgh NY.
 - b. Ceramic Tool Company Inc., Waukesha WI.
 - c. Custom Building Products, Inc., Seal Beach, CA.

2.2 TILE

- A. Glazed ceramic wall tile (CT-1) : Standard grade glazed ceramic tile, conforming to ANSI A137.1, nominal 6 by 6 by 5/16 inch thick, ceramic body, square-edges as manufactured by Dal-Tile Corporation or approved equal in colors selected from the full range of Group 2 wall tile including Dal-Tile, "Color Wheel Classic Collection" series matte finish in combinations and patterns as indicated on Drawings.
 - 1. Up to two (2) colors in Color Group 2.
 - 2. Trim and special shapes: Provide all bases, stops, returns, trimmers, and other shapes indicated or required to produce a completely finished installation.
 - a. Except as may be otherwise indicated, provide color and finish matching adjacent tile.
- B. Glazed ceramic wall tile (CT-2): Basis of Design-Standard grade glazed ceramic tile, conforming to ANSI A137.1, nominal 6 by 6 by 5/16 inch thick, ceramic body, square-edges as manufactured by Dal-Tile Corporation or approved equal in colors selected from the full range of Group 3 wall tile including Dal-Tile, "Color Wheel Linear Collection" series semi-gloss finish in combinations and patterns as indicated on Drawings.
 - 1. Up to two (2) colors in Color Group 3.
 - 2. Trim and special shapes: Provide all bases, stops, returns, trimmers, and other shapes indicated or required to produce a completely finished installation.
 - a. Except as may be otherwise indicated, provide color and finish matching adjacent tile.
- C. Glazed ceramic wall tile (CT-3): Basis of Design-Standard grade glazed ceramic tile, conforming to ANSI A137.1, nominal 3 by 6 by 5/16 inch thick, ceramic body, square-edges as manufactured by Dal-Tile Corporation or approved equal in colors selected from the full range of Group 3 wall tile including Dal-Tile, "Color Wheel Linear Collection" series semi-gloss finish in combinations and patterns as indicated on Drawings.
 - 1. Up to two (2) colors in Color Group 3.
 - 2. Trim and special shapes: Provide all bases, stops, returns, trimmers, and other shapes indicated or required to produce a completely finished installation.
 - a. Except as may be otherwise indicated, provide color and finish matching adjacent tile.
- D. Glazed ceramic wall tile for patching existing walls (CT-4, CT-5): Basis of Design-Standard grade glazed ceramic tile, conforming to ANSI A137.1, nominal 6 by 6 by 5/16 inch thick, ceramic body, square-edges as manufactured by Dal-Tile Corporation or approved equal in colors matching the existing tile from Dal-Tile, "Color Wheel Classic" and "Color Match" Collections.
 - 1. Up to two (2) colors in any color group.
 - a. Except as may be otherwise indicated, provide color and finish matching adjacent tile.
- E. Setting Materials

Thin-set polymer-modified Portland cement dry-set mortar, complying with the bond strength requirements of ANSI A118.4.

1. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Mapei product: Ultraflex LFT
 - b. Laticrete product number 254 Platinum, with antimicrobial additive.
 - c. Custom Building Products " Porcelain Tile Mortar"

2.3 GROUTING MATERIALS

- A. Grout for walls having joints less than 1/8 inch width: Acrylic modified Portland cement (unsanded) grout conforming to ANSI 118.6.
 1. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

Mapei product: Ultracolor Plus FA for use with Keracolor wall grouts

 - a. Laticrete product "Laticrete 1600 Series (unsanded) with admix 1776 antimicrobial.
 - b. Custom Building Products PolyBlend unsanded grouts.
- B. Color Match grout for use with CT-2 and CT-3: Acrylic modified Portland cement sanded grout conforming to ANSI 118.6.
 1. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Mapei product: "Flexcolor Design",
 - b. Color : Custom color to be selected by architect

2.4 ACCESSORIES

- A. Edge strips at walls and corner trim: Equal to Schlüter Systems L.P., product series "Jolly", in height as required for tile thickness, fabricated from extruded aluminum with satin nickel anodized finish and integrated joint spacer.
- B. 135 degree corner trim: Equal to Schlüter Systems L.P., product series "Deco DE", in width as required for tile thickness, fabricated from stainless steel.
- C. Grout Sealer: Manufacturer's silicone product for sealing grout joints and that does not change color or appearance of grout.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc.; CeramaSeal Grout & Tile Sealer.
 - b. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout.
 - c. TEC; a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone Grout Sealer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Verify that all concrete substrates are at least 28 calendar days old, completely cured and free of negative hydrostatic conditions or moisture problems.
- B. Beginning of installation means acceptance of substrate and site conditions.

3.2 PREPARATION

- A. During the operation of work of this Section, protect surrounding in situ materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all surfaces which are soiled or otherwise damaged by Work of this Section, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.
- B. Ensure that all anchors, plugs, electrical and mechanical work to be in or underneath tile have been installed.
- C. Vacuum clean substrate surfaces.

3.3 INSTALLATION - GENERAL REQUIREMENTS

- A. Installation Standards: The American National Standard Specifications for the Installation of Ceramic Tile, 1992 edition (ANSI A108), is hereby made a part of this specification. All work of this Section shall be installed in accordance with the requirements contained in referenced ANSI A108 standards, and as additionally specified below, and in accordance with the manufacturer's specifications of those products used.
- B. Installation Methods: Schedule of substrate conditions, generic type of tile used, with appropriate setting and grouting methods are listed at end of this Section.
 - 1. Use trowel shapes and sizes as recommended by setting materials manufacturer.
 - 2. Back-butter tiles as required to provide coverage indicated.
 - 3. Back-butter tiles as required to provide coverage indicated, except for tiles exceeding 144 square inches which require a complete back application of mortar.
- C. Tile Patterns and types: Tile patterns are shown on the Drawings, if more information is required, obtain the necessary information from the Architect. Do not interrupt tile pattern around openings.
- D. Tile Layout and installation
 - 1. Layout tile on room axis, leaving equal sized border units of not less than one-half tile width.
 - 2. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly.

3. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, full without voids, cracks, excess mortar, or excess grout.

3.4 INSTALLATION OF CONTROL JOINTS

- A. General: Provide control joints where indicated on the Drawings, and as directed by the Architect. Where not indicated, provide joints per the following requirements in specific locations approved by Architect:
 1. Interior tilework: 24 to 36 feet in each direction, except where exposed to direct sunlight or moisture.
 2. Interior tilework exposed to direct sunlight or moisture: 12 to 16 feet in each direction.
 3. Where tile abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, and where changes occur in substrate materials.
 4. At perimeter walls in rooms and spaces larger than 12 feet on one side.
 5. As continuation of expansion joints, control joints, and seismic joints in the building structure which occur in tile areas.
- B. Locations: Verify exact locations of joints with Architect prior to commencing tile installation.
- C. Control joints:
 1. Form control joints neat, straight, and uniformly wide equal to width of normal tile joint. Cut tile neatly and to accurate radius at exposed junction with pipes.
 2. Extend control joints full thickness of tile, setting bed and reinforcing.
- D. Keep open joints free of grout and debris until filled with sealant. Install non-contaminating temporary joint filler to maintain joints in clean condition until installation of joint backing and sealant under Section 07 92 00 - JOINT SEALANTS.

3.7 TOILET ROOM TILE INSTALLATION – TCNA NUMBER W244C WITH THINSET

- A. General: Install in accordance with ANSI A108.5, TCNA installation method number W244C, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
 1. Setting materials: Latex modified Portland cement (ANSI A118.4).
 2. Grout materials: Acrylic modified Portland cement (unsanded) grout (ANSI A118.6).
- B. Install latex modified Portland cement bed to a thickness recommended by manufacturer.
- C. Grouting:
 1. Allow tile to fully set prior to grouting; do not grout in less than 24 hours after installation of tile.
 2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

3.8 INSTALLATION – METAL EDGE AND TRANSITION STRIPS

- A. General: Install in accordance with ANSI A108.5, TCNA installation method number F113, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
 - 1. Ensure that top surface of metal edge and transition strips align with surface plane of tile.
- B. Grouting: Install in accordance with installation requirements of abutting tile.
- C. Press perforated anchoring leg of trim into troweled dry set mortar bedding. Trowel additional mortar over perforated anchoring leg of trim to ensure full coverage and support of tile edges.
- D. Solidly embed tiles in manner that tiled surface is flush with top of trim profile. Tile may exceed trim height by 1/32 inch [1 mm] to 1/16 inch [1.5 mm], but tile may not be installed lower than height of trim. Maintain a 1/8 inch [3 mm] minimum uniform joint width between edge of tile and metal trim to be filled by grout.

3.9 INSTALLATION - GROUT

- A. Remove spacers, ropes, glue, and similar foreign matter prior to grouting.
- B. Force the maximum amount of the approved grout into joints in accordance with pertinent recommendations contained in ANSI A108.10.
- C. Fill in joints of cushion-edge tile to depth of the cushion; fill joints of square-edge tile flush with the surface.
- D. Fill all gaps and skips. Do not permit mortar or mounting mesh to show through grouted joints.
- E. Provide hard finished grout which is uniform in color, smooth and without voids, pin holes, or low spots.
- F. Remove all excess grout immediately after installation thereof, wash and rinse tile free from grout film, and tool grout to a uniform density throughout.
- G. Seal all wall and floor grout.

3.10 REPAIR

- A. Replace cracked chipped, broken, and otherwise defective tiles.
- B. Remove work not complying with requirements of the Contract Documents or the referenced standards, and promptly replace with work which does comply.

3.11 CLEANING

- A. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of mortar, grout, and other materials installed under this Section, and wash completed tile work.
 - 1. Do not use acid or acid cleaners to clean tile.
 - 2. When tile is thoroughly clean and dry, polish glazed tile with clean dry cloths.

3.12 PROTECTION

- A. Do not permit traffic over finished floor surface until grout and tile materials are fully set, and not less than 72 hours. Protect floor surfaces with heavy red-rosin paper or kraft paper. Remove and dispose of floor protection as directed by the Construction Manager.

End of Section

Section 09 51 00
ACOUSTICAL CEILINGS

(FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 05)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Trade Contract Requirements: As provided under Section 09 00 05 – ACOUSTICAL CEILINGS FILED SUB-BID CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 09 00 05.

1.2 SUMMARY

- A. Work Included: The scope of work, without limiting the generality thereof, consists of furnishing all labor, materials, plant, transportation, equipment, accessories, appurtenances, and services necessary and/or incidental to the proper completion of all acoustical ceiling work shown on the Drawings, described in the Specifications, or as reasonably inferred from either, in the opinion of the Designer, as being required, and includes:
 - 1. Acoustical ceiling systems including suspension systems.
- B. The work of this Section consists of acoustical and suspended ceilings where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.
- C. Furnish and install the following:
 - 1. Suspended acoustical tile, including suspension systems and associated edge moldings.
 - 2. Furnish and install joint sealant at ceiling edge angles where abutting walls.
 - 3. Furnish and install decorative suspended ceiling systems.
 - 4. Furnish and install all supplemental steel, hangers and supports as required to suspend acoustical ceiling clouds.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from Construction Manager's or Trade Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.4 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 07 92 00 - JOINT SEALANTS: Requirements for sealants and backing materials.
- C. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: Shop primed access panels, occurring in partitions and walls.
- D. Section 09 22 16 – NON-STRUCTURAL METAL FRAMING: Metal ceiling and soffit framing for gypsum board, including hanger attachments, wire hangers, and screwable metal tee grid system.
- E. Section 09 29 00 - GYPSUM BOARD: Suspended drywall construction ceilings and soffits.
- F. Division 21 - FIRE SUPPRESSION: Sprinkler heads in ceiling system.
- G. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Air diffusion devices in ceiling.
- H. Division 26 - ELECTRICAL:
 - 1. Fire alarm and smoke detection equipment mounted in ceiling system.
 - 2. Light fixtures and independent hangers for suspended fixtures.

1.5 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM A 641 - Zinc- Coated (Galvanized) Carbon Steel Wire
 - 2. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method "UL Classified".
 - 3. ASTM C 523 - Light reflectance of Acoustical Material by the Integrating Sphere Reflectometer.
 - 4. ASTM C 635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - 5. ASTM C 636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - 6. ASTM E 84 - Surface Burning Characteristics of Building Material "UL Classified"
 - 7. ASTM E 119 - Fire Tests of Building Construction and Materials "UL Classified".
 - 8. ASTM E 413 - Classification for Rating Sound Insulation.
 - 9. ASTM E 580 - Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.

10. ASTM E 1264 - Classification of Acoustical Ceiling Products.
11. ASTM E 1414 - Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum. "UL Classified".
12. UL Fire Resistance Directory and Building Material Directory.
13. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

B. General References The following reference materials are hereby made a part of this Section by reference thereto:

1. CISCA (Ceilings and Interior Systems Contractors Association) - Acoustical Ceilings: Use and Practice.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
2. Be responsible for establishing locations and levels for all work of this Section, except such parts as may be delivered to others and set by them. In such cases assist them in properly locating said parts.

B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees: Architect, General Contractor, Installer's Project Superintendent, manufacturer's technical representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:

- a. Section 09 22 16 – NON-STRUCTURAL METAL FRAMING
- b. Section 09 29 00 - GYPSUM BOARD
- c. Division 21 - FIRE SUPPRESSION.
- d. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING.
- e. Division 26 - ELECTRICAL

2. Agenda:

- a. Scheduling of suspended ceiling operations.
- b. Review of staging and material storage locations.
- c. Coordination of work by other trades.
- d. Installation procedures for ancillary equipment.
- e. Protection of completed Work.
- f. Establish weather and working temperature conditions to which Architect and Contractor must agree.
- g. Discuss process for manufacturer's inspection and acceptance of completed Work of this Section.

- C. Sequencing:
 - 1. Field Measurements:
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
 - 2. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, to allow work which will be concealed by the ceilings to be completed prior to commencing installing the ceilings in such locations.
- D. Scheduling:
 - 1. Install acoustical units after interior wet work is dry.
 - 2. Schedule work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated and overhead work is completed, tested and approved.

1.7 SEQUENCING

- A. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.8 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 - 2. Shop Drawings:
 - a. Plans of each room in scale to match Contract Drawings; indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to the system.
 - b. All drawings bearing dimensions of actual measurements taken at the project.
 - c. Large scale installation details of special conditions.
 - d. Manufacturer to provide shop drawings of panels and specific locations and layouts for ACT-8 and ACT-14
 - 3. Verification Samples:

- a. 4 by 4 inch samples of acoustical units, illustrating material and finish.
 - b. 12 inch long samples of suspension system components including main runners, cross runner and edge trim.
 - B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 - 1. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and guarantees as specified elsewhere herein this Section.
 - C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
 - 1. Provide to the Owner, extra ceiling panel and suspension components, 5 percent of each type installed.
- 1.9 QUALITY ASSURANCE
 - A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
 - B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of acoustical ceiling panels.
- 1.10 DELIVERY, STORAGE AND HANDLING
 - A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Do not deliver acoustical ceiling panels to the project until all concrete, masonry, plaster and other wet work has been completed and dry.
 - 3. Deliver acoustical ceiling panels in original, unopened packages and store protected in a fully enclosed space.
 - B. Storage and Handling Requirements:
 - 1. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
 - C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.
- 1.11 SITE CONDITIONS
 - A. General Contractor shall maintain uniform temperature of minimum of 60 degrees Fahrenheit and humidity of 20 to 40 percent prior to, during, and after installation.

1.12 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Manufacturer Warranty:
 - 1. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Construction Manager may have by law or other provisions of the Contract Documents.

1.13 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra ceiling tiles and suspension framing for future repairs and maintenance, from the same manufacturer as those installed, in the following amounts.
 - 1. Acoustical ceiling tiles: 5 percent of each type and color, installed.
 - 2. Suspension framing: 50 linear feet of each type and color utilized on the project.
 - 3. Perimeter edge trim: 50 linear feet of each type and color utilized on the project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Acoustical ceiling panel:
 - a. Armstrong World Industries, Inc., Lancaster, PA.
 - b. USG Interiors Inc., Chicago, IL.
 - c. Certaineed Corporation, Valley Forge, PA.
 - d. Hunter Douglas Architectural Products Inc., Norcross, GA.
 - e. Gordon, Inc., Interior Specialties Division, Bossier City, LA.
 - f. Rockfon, LLC, Chicago, IL.
 - 2. Suspension system:
 - a. Armstrong World Industries, Inc., Lancaster, PA
 - b. USG Interiors Inc., (Donn®) Chicago, IL.
 - c. Chicago Metallic Corp., Chicago, IL
 - d. Hunter Douglas Architectural Products Inc., Norcross, GA.

2.2 DESCRIPTION

- A. General Description: Manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance as indicated.
 - 1. Obtain certificate of compliance from authority having jurisdiction indicating approval of specified products.
- B. Sustainability Requirements:
 - 1. Recycled content of acoustical ceiling panels: Use maximum available percentage of materials by weight. Products incorporated into the work shall contain not less than 50 percent of recycled content.
 - 2. Recycled content of steel used in grid framing: Use maximum available percentage of recycled steel. Steel framing products incorporated into the work shall contain not less than 25 percent of recycled steel.

2.3 PERFORMANCE/DESIGN CRITERIA

- A. Fire Resistance: Where fire-resistance ratings are indicated or required by authorities having jurisdiction, provide materials and construction which are identical to assemblies whose fire-resistance ratings have been tested in compliance with ASTM E 119 by independent agencies acceptable to the Architect and authorities having jurisdiction.
- B. Surface Burning Characteristics: Provide UL Classified material whose surface burning characteristics, when tested in compliance with ASTM E 84 are Class A.
- C. Where the following ratings are specified, provide materials and construction which are identical to those tested by Underwriters Laboratories or equivalent independent testing agencies acceptable to the Architect.
 - 1. Noise Reduction Coefficient (NRC): Ratings have been tested in compliance with ASTM C423.
 - 2. Ceiling Attenuation Class (CAC): Ratings have been tested in accordance with ASTM E1414.
 - 3. Light Reflectance (LR): Ratings has been tested in compliance with ASTM C523.

2.4 ACOUSTICAL CEILING PANELS

- A. Type ACT-1 ceiling panel (Typical):
 - 1. Panel size: 24 by 24 inch by 7/8 inch thick.
 - 2. Panel edge: Beveled Tegalur
 - 3. Description: ASTM E-1264 Type A, Form 2.2, Pattern E, , Class A
 - 4. Color: White.
 - 5. Minimum light reflectance range: LR 0.87.
 - 6. Acoustical characteristics:
 - a. NRC: 0.80
 - b. CAC: 35.
 - 7. Acceptable products:

- a. Armstrong: "Ultima High NRC" Number 1941
 - b. CertainTeed product: "Symphony M" Number 1222B
 - c. USG product "Mars High-NRC/High CAC" Number 87200
- B. Type ACT-2 ceiling specialty cloud (Teaching hub):
 - 1. Surface Texture: Smooth Texture
 - 2. Composition: Fiberglass
 - 3. Color: Vanilla Ash (WVA),
 - 4. Size: 24 by 24 inch by 7/8 inch thick
 - 5. Edge Profile: 1/4" reveal
 - 6. Description: ASTM E-1264 Type B. Form B2, Pattern G; Fire Class A
 - 7. Noise Reduction Coefficient (NRC): .90
 - 8. Articulation Class (AC): 190
 - 9. Acceptable Products:
 - a. Basis of Design: Armstrong World Industries, Inc. Product: LYRA PB, ITEM 8494PBWVA
 - b. Approved equal

CEILING GRIDS

- C. Ceiling grid for ACT-1: 15/16 inch exposed tee grid ceiling panel. Acceptable products include the following, or approved equal:
 - a. Armstrong; 15/16" Prelude Exposed Tee System.
 - b. Chicago Metallic; 200 Snap-Grid System.
 - c. USG, Donn; DX Series.
 - d. Celotex, 15/16" Release
 - 1. System.Color: White
- D. Ceiling grid for ACT-2: 15/16 inch exposed grid, aluminum capped, G90 hot-dipped galvanized steel tee suspension system (or all aluminum tee system), in color matching ceiling tile. Acceptable products include the following, or approved equal:
 - a. Armstrong; Prelude XL Tee System (Basis of Design)
 - b. Chicago Metallic; 1830 Series.
 - c. USG, Donn; ZXLA Series.
 - 1. Basis of Design Color: Armstrong Hay (SHY)

2.5 CEILING GRID PERIMETER EDGE TRIM SYSTEM

- A. Perimeter edge trim system at areas ACT-2. Edge trim shall be nominal 6 inch height as indicated on drawings, designed to accommodate straight edges as well as converse curved and convex curved edges as may be indicated on Drawings. Attachment to grid system is provided by a specially designed attachment clip, which snaps into the locks against hems of trim and is screw-attached to the bulb of the intersection suspension system member. Color shall be as selected by the Architect from the manufacturer's full range of standard and premium colors.

Independent sections of trim are joined together using the splice plate. Acceptable products are:

- a. Armstrong: Axiom Perimeter Trim and Transitions (Basis of Design)
 - b. Chicago Metallic: Infinity suspension trim.
 - c. USG: Compasso Elite series.
1. Basis of Design Color: Rainstorm (SRS)
 2. Size and profile: Refer to Drawings.
 3. Locations: As indicated on Drawings.

2.6 ACCESSORIES

- A. Edge moldings: Standard edge trim: Grid system manufacturer's standard L-shape edge trim compatible with exposed grid system and color matched.
 1. Armstrong: Model 7800.
 2. Chicago Metallic: Model 1430.01.
 3. USG: Model M7.
- B. Hanger attachments: Of the most appropriate types for the specific receiving surfaces.
- C. Specialty Ceiling Hanger Clips: Direct load carrying clips for specialty ceiling "cloud" suspension below ACT ceiling with 15/16" grid.
- D. Hangers: ASTM A641 Soft temper, pre-stretched galvanized carbon steel wire, with a yield stress of at least 3 times design load, but not less than 12 gage.
- E. Wall Angle Column Ring: Extruded aluminum alloy 6063 T5, with chemical conversion coating and clear anodized finish. Equal to Fry Reglet Corporation, Norcross, GA., Product: "Wall Angle Column Ring".
- F. Joint Sealer: One component acrylic latex caulking compound, conforming to FS 19-TP-21M and ASTM C 834 Type P, Grade NF, paintable within 24 hours after application, with a minimum movement capability of ± 12.5 percent, equal to one of the following:
 1. BASF (Sonneborn), product, "Sonolac".
 2. Tremco, product, "Tremflex 834".
 3. Bostik, product, "Chem-Calk 600".
 4. Pecora, product "AC-20+".
- G. Sealant:
 1. Acoustical ceiling edge angle to irregular wall surfaces, Type AP.

2.7 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall

be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contract requiring such scaffolding.

2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Trade Contractor.

2.8 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 1. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 PREPARATION

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing surfaces which are soiled or otherwise damaged by Work of this Section, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.
- B. Surface Preparation:
 1. Carefully examine all receiving surfaces, to which attachments will be made hereunder, and determine the most practical way of making such attachments. Request Architect's approval of any attachment method which differs from that indicated on the approved shop drawings before proceeding with installation.
 2. Permit acoustical ceiling tile to reach room temperature and a stabilized moisture content prior to installation.

3.3 INSTALLATION

- A. Locate system on room axis, leaving equal sized border units. Minimum width and length of border units shall be 6 inches, unless otherwise approved by the Architect.

- B. Install all components of the suspended grid systems in accordance with the manufacturer's instructions, the approved shop drawings, conforming to ASTM C-636 requirements. Ensure a deflection not to exceed 1/360 span of 48-inch simple span.
- C. Install specified edge moldings wherever ceilings intersect a wall or partition surface, and around all items having any dimension of 4 inches or more which penetrate the ceilings, including circular penetrations. Set moldings absolutely level, using as long lengths as practicable, and secure with fasteners recommended by manufacturer for the type of substrate.
 - 1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before installing moldings.
 - 2. Screw-attach moldings to substrate at intervals not over 16 inches on center, and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.
- D. Install hanger attachments to overhead construction in accordance with the approved shop drawings, spacing the attachments not more than 48 inches on centers over location of each main tee member.
 - 1. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers to span the extra distance.
 - 2. Install hanger wire to attachments with triple twists.
- E. Install main tees parallel to the long dimension of each area, spacing the tees 48 inches on centers. Secure the bottom of hanger wires through slots in the main tee members and tie with triple twists. Level the main tees as the work progresses.
- F. Uniformly space the cross tees at 24 inches on centers and secure the cross tees into the main tees as recommended by the system manufacturer.
- G. Provide sealant at gaps between new acoustical ceiling edge angles and all irregular walls.
- H. Fit acoustical ceiling tile units in place, free from damaged edges or other defects detrimental to appearance and function. Install acoustical ceiling tile level, in uniform plane, and free from twist, warp or dents.
 - 1. Field cut tegular type tile with a tegular reveal at all edge conditions.
 - 2. Where required by governmental agencies having jurisdiction, install retention clips, provide two clips per ceiling panel installed on opposite sides of panel.

3.4 TOLERANCES

- A. Maximum variation from flat and level surface: 1/8 inch in 10 feet.
- B. Maximum variation from plumb of grid members caused by eccentric loads: 2 degrees.

3.5 CLEANING

- A. Properly clean surfaces of panels and open grids free from dirt and handling marks. Wherever surfaces cannot be cleaned by normal methods or have defects, remove and replace with new components.

- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- C. Clean work under provisions of Section 01 73 00 – EXECUTION.

3.6 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

Section 09 65 13
RESILIENT BASE AND ACCESSORIES

(FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 06)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Filed Sub-Bid Contract Requirements: As provided under Section 09 00 06 – RESINOUS FLOORING FILED SUB-BID CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Contract includes all individual specification sections listed in Section 09 00 06.

1.2 SUMMARY

- A. Preparation of substrate.
- B. Furnish and install the following:
 - 1. Vinyl resilient base.
 - 2. Resilient molding accessories, transition strips.
 - 3. Installation materials and adhesives.
 - 4. and as indicated on the drawings

1.3 RELATED REQUIREMENTS

- A. Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS: application of protection paper to finished resilient flooring.
- B. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- C. Section 09 00 06 - RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS: Trade Contract requirements for work of this Section.
- D. Section 09 65 43 - LINOLEUM FLOORING: Linoleum sheet flooring.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
 - 2. F1861 - Standard Specification for Resilient Wall Base.
 - 3. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 REGULATORY REQUIREMENTS

- A. Provide materials and assemblies conforming to applicable building codes and regulatory agencies for flame/fuel/smoke rating requirements of base trim in accordance with ASTM E 84.

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions.
- B. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions.
 - 2. Selection samples: Manufacturers' sample chain of colors available for selection by Architect.
 - 3. Verification samples: Each type resilient base and color selected, 24 inches long.

1.7 QUALITY ASSURANCE

- A. Avoid color and pattern differential; provide base from one production run in any single room or contiguous areas.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver resilient base materials in original, unopened packages and store protected for three days prior to installation in area of installation to achieve temperature stability.
- B. Store materials in a clean dry, enclosed space off the ground and protected from the weather. Protect adhesives from freezing.

1.9 ENVIRONMENTAL CONDITIONS

- A. Maintain uniform temperature of minimum of 65 degrees Fahrenheit and humidity of 20 to 40 percent 48 hours prior to, during, and 48 hours after installation. Store resilient flooring materials and accessories in the spaces where they will be installed for at least 48 hours before beginning installation. Thereafter, maintain a minimum temperature of 55 degrees Fahrenheit in the areas where the work is completed.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work.
- B. Sequence work to ensure resilient flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.

- C. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

1.11 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Provide manufacturer's standard wear warranties for all resilient base materials installed under this Section.

1.12 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra base materials for future repairs and maintenance, from the same manufacturing runs as those installed, in the following amounts.
 - 1. Resilient base: 100 linear feet of each type and color installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Roppe Corporation, Fostoria OH. "Basis of Design"
 - 2. Johnsonite, Middlefield OH.
 - 3. Burke-Mercer Products Company, San Jose CA.
 - 4. Vinyl Products Inc., Floor Products Division, Sheboygan WI.
 - 5. Tarkett, Inc., Parsippany NJ.

2.2 RESILIENT BASE

- A. Vinyl Base: Homogenous vinyl, 4 inches 0.125 gage thickness complying with ASTM F-1861, Type TV (Thermoplastic Vinyl), in colors as selected by the Architect from manufacturer's available standards. Provide premolded end stops, external and internal corners, of same material, size, and color as base.
 - 1. Provide coved base at resilient flooring.
 - 2. Provide straight (non-coved) base at carpeted and walk-off entrance mat areas.
- B. Base accessories: Premolded end stops of same material, size and color as base. Job-form all external and internal corners from base material, pre-molded corner pieces will not be acceptable.
- C. Refer to Room Finish Schedules for locations of types.

2.3 ACCESSORIES

- A. Adhesives
 - 1. General: Water resistant, low VOC, acceptable to the resilient flooring manufacturer, for substrate conditions.

2. Acceptable products include the following, or approved equal:
 - a. Advanced Adhesive Technology, Inc, Dalton GA, product: "No. 432 Modified Acrylic Cove Base Adhesive".
 - b. DAP Incorporated, Dayton OH, product: "Cove Base Construction Adhesive".
 - c. Roberts Consolidated Industries, Inc., City of Industry, CA, product: "Premium Solvent-Free Cove Base Adhesive".
- B. Cleaning material: Domestic neutral floor detergent having a pH 7 or pH 8, as recommended by the flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 INSTALLATION - GENERAL

- A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.
- B. Spread only enough adhesive to permit installation of materials before initial set.

3.3 INSTALLATION OF ACCESSORIES

- A. Resilient base: Install base on solid backing, bond to vertical substrate with continuous contact at horizontal and vertical surfaces. Apply wall base to walls, columns, casework and other permanent fixtures in areas where base is required.
 1. Install in lengths as long as practical.
 2. Scribe to fit to door frames and other interruptions.
 3. Form all external and internal corners in accordance with manufacturer's written instructions. Cope inside corners and fit neatly.

3.4 CLEANING

- A. Post-installation Cleaning: As installation progresses, continually remove excess adhesive from floor, base and wall surfaces without damage.

End of Section

Section 09 65 43
LINOLEUM FLOORING
(FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 06)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Filed Sub-Bid Contract Requirements: As provided under Section 09 00 06 – RESINOUS FLOORING FILED SUB-BID CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Contract includes all individual specification sections listed in Section 09 00 06.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Modular linoleum tiles.
 - 2. Vinyl transition strips wherever edges of linoleum flooring materials abut dissimilar flooring, where no thresholds occur.
 - 3. Floor preparation.
 - 4. Accessories (including adhesives and primers)
 - 5. And as indicated on the drawings

1.3 RELATED REQUIREMENTS

- A. Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS: Application of protection paper to finished resilient flooring.
- B. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- C. Section 09 00 06 – RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS: Trade Contract requirements for work of this Section.
- D. Section 09 05 06 - COMMON WORK RESULTS FOR FLOORING: General preparation and testing requirements of flooring substrate.
- E. Section 09 29 00 - GYPSUM BOARD: Gypsum board substrate to receive resilient base.
- F. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES: Coved resilient base in conjunction with resilient flooring.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials
2. ASTM E 492 – Standard Test Method for Laboratory Measurement of Impact Sound Transmission through Floor-Ceiling Assemblies Using the Tapping Machine
3. ASTM E 648 – Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
4. ASTM E 662 – Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
5. ASTM E 989 – Standard Classification for Determination of Impact Insulation Class (IIC)
6. ASTM E 1745 – Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
7. ASTM F 141 – Standard Terminology Relating to Resilient Floor Coverings
8. ASTM F 710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
9. ASTM F 1482 – Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring
10. ASTM F 1861 – Standard Specification for Resilient Wall Base
11. ASTM F 1869 – Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
12. ASTM F 2034 – Standard Specification for Linoleum Sheet Floor Covering
13. ASTM F 2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
14. ASTM F-2195 –Linoleum Floor Tile
15. ASTM F 2419 – Standard Practice for Installation of Thick Poured Gypsum Concrete Underlayments and Preparation of the Surface to Receive Resilient Flooring
16. ASTM F 2471 – Standard Practice for Installation of Thick Poured Lightweight Cellular Concrete Underlayments and Preparation of the Surface to Receive Resilient Flooring
17. ASTM F 2659 – Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and other Floor Slabs and Screeds Using a Non- Destructive Electronic Moisture Meter
18. ASTM F 2678 – Standard Practice for Preparing Panel Underlayments, Thick Poured Gypsum Concrete Underlayments, Thick Poured Lightweight Cellular Concrete Underlayments, and Concrete Subfloors with Underlayment Patching Compounds to Receive Resilient Flooring
19. ASTM F 3191 – Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring
20. NFPA 253 – Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
21. NFPA 258 – Test Method for Specific Optical Density of Smoke Generated by Solid Materials
22. NFPA 253 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

23. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 09 00 06 – RESILIENT FLOORING FILED SUB-BID REQUIREMENTS.
- B. Sequencing:
 1. Sequence work to ensure resilient flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
 2. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each specified product.
 - a. Furnish manufacturer's product literature on flooring adhesive, highlight adhesive properties, including VOC's and maximum moisture pressure limits for substrates.
 2. Shop drawings: Plans, in scale to match Contract Drawings, of each flooring area scheduled for Work of this Section.
 - a. Indicate layout of tile units and direction of tile patterns.
 - b. Identify selected colors and patterns.
 - c. Show location of welded seams and joints with abutting materials.
 - d. Drawings shall bear dimensions of actual measurements taken at the project.
 - e. Show locations and types of reducer and edge strips.
 - f. Where more than one adhesive type is specified or otherwise required by flooring manufacturer, identify on shop drawings areas for each adhesive type.
 3. Samples for selection: Manufacturers' sample chain of colors and patterns available for selection by Architect.
 4. Verification Samples:
 - a. Sheet flooring: 12 by 12 inch illustrating color, and pattern for each color and type of flooring selected.
 - b. Full sized flooring tile, illustrating color, and pattern for each color and type of tile selected.
 - c. Resilient base: Each type and color selected, 24 inches long.
 - d. Edging: 12 inches long demonstrating profile, thickness, size and color.

1.7 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Provide installed mock-up of flooring, minimum 100 square feet, illustrating color, texture and finish for each flooring type specified herein, and demonstrating the minimum standard for the Work.
- C. Locate mock-ups where directed and include all surfaces and materials scheduled to receive a field applied finish.
- D. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
- E. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Deliver resilient flooring materials in original, unopened packages and store protected for three days prior to installation in area of installation to achieve temperature stability.
- B. Storage and Handling Requirements:
 - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets. Store materials in a clean dry, enclosed space off the ground and protected from the weather
 - 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
 - 3. Protect adhesives from freezing.
- C. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - PRODUCT REQUIREMENTS.
 - 1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable and recyclable.

1.9 ENVIRONMENTAL CONDITIONS

- A. Maintain uniform temperature of minimum of 65 degrees Fahrenheit and humidity of 20 to 40 percent 72 hours prior to, during, and after installation. Store resilient flooring materials and accessories in the spaces where they will be installed for at least 72 hours before beginning installation. Thereafter, maintain a minimum temperature of 55 degrees Fahrenheit in the areas where the work is completed.

1.10 SEQUENCING AND SCHEDULING

- A. Sequence work to ensure resilient flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated and work overhead is completed.

- B. Install flooring and base after interior wet work is dry.

1.11 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Submit manufacturer's standard wear warranties for all flooring materials installed under this Section.

1.12 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra flooring and base materials for future repairs and maintenance, from the same manufacturing runs as those installed, in the following amounts:
 - 1. Flooring: 5 percent of each material in each color, and pattern installed.

PART 2 - PRODUCTS

2.1 LINOLEUM TILE FLOORING (LT-1, LT-2)

- A. Linoleum Tile Flooring: linoleum; all natural resilient, self-sanitizing, bactericidal inhibiting effect flooring material. Products which may be incorporated in the work include the following:
 - 1. Forbo Industries Inc., Hazleton PA, product: "Marmoleum Modular".(Basis of design)
 - 2. Tarket North America, Solon OH, product: "LinoFloor xf2".
 - 3. Gerflor USA, Bolingbrook IL, product: Gerflor Linoleum
- B. Flooring Construction: Homogeneous floor covering made from natural ingredients including linseed oil, rosin binders, wood flour, limestone and dry pigments which are mixed and then calendared onto a polyester backing to ensure optimum dimensional stability. Topshield2™ high performance finish with double UV cured double layer technology. Total construction shall conform with FS LLL-F-1238A, and contain no asbestos.
- C. Linoleum tile flooring Physical Characteristics
 - 1. Size: 39.37 in x 9.84 in
 - 2. Nominal Thickness: .1 inch
 - 3. Backing: Polyester
 - 4. Color: (2) Colors selected by architect from manufacturers full line.
 - 5. Installation: Ashlar
 - 6. Meets or exceeds all technical requirements as set forth in ASTM F 2195 Standard Specification for Linoleum Tile Flooring Type I
 - 7. Static load limit: 1,500 pounds per square inch when tested in accordance with ASTM F 970-00, Standard Test Method for Static Load Limit.
 - 8. Slip resistance: Meets or exceeds the industry recommendation of >0.5 for flat surfaces when tested in accordance with ASTM D 2047, Standard Test Method for Static Coefficient of Friction.
 - 9. Fire Testing: Class 1 when tested in accordance with ASTM E 648/NFPA 253, Standard Test Method for Critical Radiant Flux. Meets 450 or less when

tested in accordance with ASTM E 662/ NFPA 258, Standard Test Method for Smoke Density

- D. Pattern and color shall extend throughout total thickness of wear surface. Color and patterns are as indicated on Drawings, where not indicated, as selected by Architect from manufacturer's full available range.
- E. Patterns to be field cut. Refer to the Drawings for layout of patterns.

2.2 ACCESSORIES

- A. Trowel-applied leveling compounds for patching, smoothing and leveling subfloors and underlayments: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
 - 1. Ardex, Inc., products "Feather Flash" and "Ardex SD-P".
 - 2. Quikrete Companies, product "Fast-Set Underlayment 1248".
 - 3. Silpro Masonry Systems Inc., product "Profinish".
 - 4. Henry: product 482 Lino-Pro.
- B. Adhesive for tile linoleum flooring:
Basis of Design: Forbo: "Sustain 100" adhesive, selected based on manufacturer guidelines for specific substrate and RH and PH tests.
- C. Warranty: Limited 5-year warranty
- D. Transition/reducing strips, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bull nose edge, with color to match or contrast with the flooring, or as selected by the Architect.
- E. Floor Cleaning material: Domestic floor detergent, as recommended by the flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Insure that concrete substrate is acceptable to the flooring manufacturer and adhesive supplier. Conform to requirements of Section 09 00 06 – RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS.
- C. Preinstallation Testing, Evaluation and Assessment: Moisture testing of concrete substrate, refer to Section 09 00 06 – RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS.
- D. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. General: Comply with requirements specified under Section 09 00 06 – RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS, the flooring manufacturer's

requirements for preparation of substrate to receive resilient flooring, and as additionally specified herein.

- B. Pre-installation off-gassing ventilation: Ventilate flooring products prior to installation. Open packaging, or remove from packaging, and ventilate flooring in a secure, dry, well-ventilated space free from contaminant sources and residues. Provide a temperature range of 60 degrees F minimum to 90 degree F maximum continuously for not less than 72 hours.
 - 1. Do not ventilate within limits of Work unless otherwise approved by Architect.
- C. Overlay all existing concrete slab surfaces with trowel-applied leveling compounds acceptable to manufacturer. Remove projections and repair other defects to tolerances acceptable to manufacturer.

3.3 INSTALLATION - GENERAL

- A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.
 - 1. Apply primers as recommended by adhesive manufacturer's written instructions.
- B. Spread only enough adhesive to permit installation of materials before initial set.
- C. Mix tile to ensure that concentration of surface patterns is uniform throughout. Use tile from cartons in same sequence as manufactured and packaged, if so numbered.
- D. Maintain reference markers, holes and openings that are in place or have been marked for future cutting; repeat markers on flooring as marked on substrate. Use non-permanent marking devices which may be cleaning washed off when no longer required.
- E. Install resilient flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring. Do not install resilient flooring over concrete slabs until they have been cured and are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture test.
- F. Neatly fit resilient materials to all intersecting surfaces, and make joints as inconspicuous as possible.
- G. Terminate flooring at centerline of door in closed position where adjacent floor finish is of different material or color.
- H. Apply resilient materials to have uniform contact with receiving surfaces throughout, with tight joints, and with all finish surfaces smooth, in true plane, free from buckles, waves, and other imperfections.
- I. Extend resilient flooring to wall lines beneath all movable equipment and movable casework. Fit resilient flooring onto breaks and recesses, against non-resilient bases, around pipes and other protrusions, under saddles, and to and around other fixed surfaces, making neat cuts in the flooring and minimizing joints.
- J. Install reducer strips as required to terminate flooring. Transition strips with carpet are provided under Section 09 68 13.

- K. Provide adhesion testing of the flooring in accordance with the manufacturer's printed literature.

3.4 INSTALLATION - FLOOR TILE

- A. Lay flooring in a square grid pattern, with joints and seams parallel to building lines. Lay tile flooring in pattern as indicated on the drawings or if not indicated as such, lay pattern-grain in singular direction. Lay tile with joints straight and continuous in both directions and with border tile not less than 1/2 the width of the tile.
- B. Neatly fit resilient materials to all intersecting surfaces, and make joints as inconspicuous as possible.
- C. Terminate flooring at centerline of door in closed position where adjacent floor finish is of different material or color. Where flooring pattern continues through door openings, continue established pattern with no interruption.
- D. Apply resilient materials to have uniform contact with receiving surfaces throughout, with tight joints, and with all finish surfaces smooth, in true plane, free from buckles, waves, and other imperfections.
- E. Extend resilient flooring to wall lines beneath all movable equipment and movable casework. Fit resilient flooring onto breaks and recesses, against non-resilient bases, around pipes and other protrusions, under saddles, and to and around other fixed surfaces, making neat cuts in the flooring and minimizing joints.

3.5 INSTALLATION - SHEET LINOLEUM FLOORING

- A. Install linoleum using conventional full-spread method. Application shall be performed by factory trained mechanics franchised by the manufacturer in accordance with the manufacturer's instructions, and using tools and techniques recommended by the flooring manufacturer. Do not reverse roll sheets.
- B. Cut sheet material into required lengths and sizes. Layout and cut to achieve minimum number of seams and for pattern match between abutting edges, Reverse every other sheet.
- C. Lay cut sheets flat and allow to come to room temperature prior to installation. Seams in corridors shall run perpendicular to corridor.
- D. Lay flooring so as to ensure full uniform contact with adhesive and substrate and to produce finished surfaces which are smooth, even and in true planes, free of buckles, waves, and other imperfections.
 - 1. Wet install flooring with adhesive. Adhesive spread rate shall be as recommended by manufacturer, at approximately 125 to 175 square feet per gallon.
- E. Install the sheets and roll the floor surface to work wrinkles and air pockets out past the outer edges.
- F. Seams:
 - 1. Sheet products shall be installed net fit seams. Install seams with no gaps or fullness, cut material at an angle so as to slightly undercut flooring, roll seam with a steel roller making sure flooring material is set in wet adhesive.

- G. Flash cove installation:
 - 1. Where indicated install cove sticks and extend flooring up the wall in a flash cove method to height indicated on Drawings.

3.6 INSTALLATION OF ACCESSORIES

- A. Place resilient transition strips tightly butted to flooring and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring which would otherwise be exposed.
- B. Resilient edge and transition strips:
 - 1. Install edge strips at all edges of flooring which would otherwise be exposed.
 - 2. Place resilient edge strips tightly butted to flooring and secure with adhesive recommended by the edge strip manufacturer.

3.7 CLEANING

- A. General: Comply with requirements of Section 01 73 00 – EXECUTION for periodic and final cleaning, and as additionally specified herein.
 - 1. Control accumulation of waste materials and trash. Daily clean work areas by sweeping and disposing of debris, and scraps.
- B. As installation progresses, continually remove excess adhesive from floor, base and wall surfaces without damage.
 - 1. Prohibit traffic on finished floor areas until flooring adhesive has fully set.
 - 2. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.
- C. Sweep floors to remove all loose dirt and debris.
- D. Clean sheet linoleum floors:
 - 1. Scrub floors using a one disc scrubbing machine with green nylon pad and water to which a neutral cleaning agent (less than pH9) has been added.
 - 2. Rinse thoroughly and let dry
 - 3. Apply manufacturer's recommended spray cleaning fluid containing 5 percent natural wax and no polymers. Dust wipe or dry mop.

3.8 PROTECTION

- A. General: Protect finished work under provisions Section 09 00 06 – RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS.
- B. Prohibit traffic on finished floor areas until flooring adhesive has fully set.
- C. Prohibit washing, scrubbing or other similar 'wet' operations to occur on finished floor areas for a minimum period of 5 calendar days after installation.
- D. Provide protection of completed flooring areas from construction traffic until Substantial Completion. After cleaning and polishing, cover all resilient floor surfaces with non-staining heavyweight kraft paper and overlay with red-rosin paper, taping the edges to maintain position of the protection paper. Reapply

papers as required to maintain floor protection. Remove and dispose of floor protection as directed by Construction Manager.

End of Section

Section 09 67 23
RESINOUS FLOORING

(FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 06)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Filed Sub-Bid Contract Requirements: As provided under Section 09 00 06 – RESINOUS FLOORING FILED SUB-BID CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Contract includes all individual specification sections listed in Section 09 00 06.

1.2 SUMMARY

- A. Prepare surfaces to receive resinous flooring.
- B. Apply multilayered resinous waterproof flooring system with an integral waterproof base turned up at walls, bases, pipe sleeves and equipment pads.
 - 1. Provide subsequent flooring system touch-up and repairs as required to provide a complete seamless molded waterproof system.
- C. All floors and bases labeled as “epoxy” on the room finish schedule shall be coated per the requirements of this Section.
- D. And as indicated on the drawings

1.3 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete substrate, curbs and equipment pads.
- C. Section 04 20 00 - UNIT MASONRY: Masonry partitions and walls.
- D. Section 07 92 00 - JOINT SEALANTS: Requirements for sealants and backing materials.
- E. Section 09 05 06 - COMMON WORK RESULTS FOR FLOORING: General preparation and testing requirements of flooring substrate.
- F. Division 22 - PLUMBING: "floor-flange" type floor drains.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.

Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
2. All applicable federal, state and municipal codes, laws and regulations for flammability and smoke generation of interior finishes.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, material compositions, and application instructions for all products to be applied hereunder
 - a. Include certification of data indicating Volatile Organic Compound (VOC) content of all floor system components.
 2. Manufacturer's instructions: Manufacturer's installation instructions indicating special procedures, integral base, and perimeter conditions.
 - a. The manufacturer's recommended methods of installation, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation methods used on the Work.
 3. Certification: Material certificates signed by manufacturer certifying that the waterproof mechanical equipment room flooring complies with requirements specified herein.
 4. Selection samples:
 - a. Sample card indicating Manufacturer's full range of colors available for selection by Architect.
 5. Verification samples:
 - a. Samples of each level of slip resistance, aggregate, and pattern available in the specified products from the proposed manufacturer.
 - b. 12 x 12 inch samples of finished surface illustrating material color, texture and finish.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Manufacturer's warranties: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.

1.6 QUALIFICATIONS

- A. Applicator: Company specializing in performance of the work of this Section with 5 years minimum documented experience and trained by manufacturer in installing resinous flooring types similar to that required for this Project, and who is acceptable to manufacturer of primary materials.

1.7 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Provide mock-up panels, minimum 25 square feet, including floor and wall base applications, illustrating color, texture and finish, and demonstrating the minimum standard for the Work.

1. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
2. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.

1.8 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain resinous flooring materials, including primers, resins, and finish coats, from a single manufacturer.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site in sealed and labeled containers; container labeling shall include manufacturer's name, type of paint, color mix designation, expected coverage, surface preparation instructions, instructions for mixing and reducing, drying time, and clean-up recommendations.
- B. Store materials, conforming with applicable codes and fire regulations, in designated spaces. Keep storage area secure when direct access is not required or when not performing work under this Section. Take precautionary measures to prevent fire hazards and spontaneous combustion, maintain a dry-chemical type fire extinguisher in all areas where materials of this Section are being stored or used.
- C. Store materials in a well ventilated area at minimum ambient temperature of 45 degrees Fahrenheit and a maximum of 90 degrees Fahrenheit.
- D. Do not use the sanitary system for mixing or disposal of refuse material. Carry water to mixing rooms and dump waste material in a suitable refuse receptacle. Remove oily rags and waste each day.

1.10 PROJECT CONDITIONS

- A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 50 degrees Fahrenheit for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
- B. Apply flooring materials within temperature and humidity range specified by coating manufacturer.
- C. Provide sufficient lighting to maintain 80 foot-candles measured mid-height at substrate surface.

1.11 SEQUENCING AND SCHEDULING

- A. Immediately notify the Architect in writing of conditions which may require a change in the specifications of this Section before proceeding with the work. Failure to do so, in a timely fashion, so as not to interfere with the schedule of work of this Contract, shall be construed as acceptance of the coatings specified. Perform all corrective measures, at no cost to the Owner, for any defects in the work, resulting from the use of such materials.
- B. Do not order materials until all required schedules have been properly submitted, reviewed by the Contractor and Approved by Architect.

1.12 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Sherwin-Williams HPF, 95 Goodwin Street, East Hartford, CT 06108, Phone: (860) 528-9838
 - 2. Crossfield Products Corp. (Dex-o-Tex), Roselle Park, NJ.
 - 3. FloRock Polymer Flooring, Chicago, IL.

2.2 RESINOUS FLOORING

- A. Basis of Design: Sherwin-Williams HPF, ACCELERA HC self-leveling, decorative chip broadcast, cementitious urethane/blended polymer seamless flooring system
 - 1. System Materials:
 - a. Topping: Sherwin-Williams HPF, Poly-Crete SL resin, hardener and SL aggregate.
 - b. The broadcast aggregate shall be Sherwin-Williams HPF ¼", 1/8", or 1/16" Chips
 - c. 2nd Broadcast Coat: Sherwin-Williams HPF, ACCELERA resin and hardener.
 - d. Topcoats: Sherwin-Williams HPF ACCELERA EXT resin and hardener.
 - 2. Patch Materials
 - a. Shallow Fill and Patching: Use Sherwin-Williams HPF Poly-Crete MD (up to 1/8 inch).
 - b. Deep Fill and Sloping Material (over ¼ inch): Use Sherwin-Williams HPF, Poly-Crete WR.

2.3 PRODUCT REQUIREMENTS

A. Topping	Poly-Crete SL
1. Percent Reactive	100 %
2. VOC	0 g/L
3. Bond Strength to Concrete ASTM D 4541	400 psi, substrates fails
4. Compressive Strength, ASTM C579	9,000 psi
5. Tensile Strength, ASTM D 638	2,175 psi

6.	Flexural Strength, ASTM D 790	5,076 psi
7.	Impact Resistance @ 125 mils, MIL D-3134,	160 inch lbs
 B. Broadcast		 ACCELERA EXT
1.	Percent Solids	96 %
2.	VOC	33 g/L
3.	Bond Strength to Concrete ASTM D 4541	400 psi, substrates fails
4.	Hardness, Shore D ASTM D2240	70
5.	Compressive Strength, ASTM C579	18,000 psi
6.	Tensile Strength, ASTM D638	2,600 psi
7.	Abrasion Resistance, ASTM D4060	27 mg loss
	C-17 Wheel, 1,000 gm load, 1,000 cycles	
8.	Pot life @ 70 F	10 – 15 minutes
9.	Gloss (ASTM D523) 60°	90
10.	Coefficient of Friction (ASTM D2047)	0.6
 C. Topcoat(s)		 ACCELERA EXT
1.	Percent Solids	96 %
2.	VOC	33 g/L
3.	Bond Strength to Concrete ASTM D 4541	400 psi, substrates fails
4.	Hardness, Shore D ASTM D2240	70
5.	Compressive Strength, ASTM C579	18,000 psi
6.	Tensile Strength, ASTM D638	2,600 psi
7.	Abrasion Resistance, ASTM D4060	27 mg loss
	C-17 Wheel, 1,000 gm load, 1,000 cycles	
8.	Potlife @ 70 F	10 – 15 minutes
9.	Gloss (ASTM D523) 60°	90
10.	Dynamic Coefficient of Friction (ANSI A326.3)	>0.42

- 2.4 Accessory materials: Provide all accessory materials not specifically indicated, but are required to achieve the finishes specified.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify Contractor of any condition that may potentially affect proper application of coatings.
- B. Measure moisture content of surfaces, do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Masonry or concrete: 12 percent.

- C. Preinstallation Testing, Evaluation and Assessment: Moisture testing of concrete substrate
- D. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION - GENERAL

- A. Mix and prepare coatings in strict accordance with manufacturer's written instructions. Thoroughly mix to ensure uniformity of color and mass, unless otherwise directed by the manufacturer of the specific coating used. Except for epoxy mixtures, strain previously opened materials to remove skins, coating lumps, and other foreign matter prior to painting. Dispose of epoxy materials which have begun to set.

3.3 APPLICATION - GENERAL

- A. Apply all materials in strict accordance with the approved manufacturer's printed instruction, and in accordance with the best trade practices. Each coat shall be reviewed and approved by the Architect before succeeding coats are applied.
- B. Do not apply successive coating until the preceding coat is thoroughly dry, except as otherwise specified, and in no case in less than minimum period of time recommended by manufacturer.
- C. Bridge sawcut joints with 3 inch wide fiberglass tape embedded in basecoat. Expansion joints must be honored.

3.4 SURFACE PREPARATION

- A. Upon acceptance of completed existing surfaces, thoroughly remove all dust and debris by sweeping or vacuum cleaning.
- B. Remove laitance, curing sealers, existing adhesives and other foreign matter from concrete surfaces with necessary techniques such as shot blasting, grinding, muriatic acid etching, surface freezing and power scarification.
- C. Thoroughly remove etching solution by washing down surfaces with clean water; flooded at least three separate times at a rate of two gallons per ten square feet; thoroughly remove all contaminants that may be engrained or latent in surfaces.
- D. Perform a test application of a square foot in three locations, such as beneath casework. Allow to set for 72 hours, and test adhesion as recommended by the manufacturer.

3.5 FLOOR SURFACING

- A. Work shall be done only under optimum conditions as recommended by manufacturer. Surfaces over which matrix is to be applied shall be completely dry and thoroughly clean. Substrate and ambient temperature shall be 50 degrees F or above; if below 60 degrees F, temperature must be stable or rising.
- B. Allow surfacing to set undisturbed for a minimum period of 48 hours. Maintain temperature at 50 degrees F minimum until floor surfacing has completely cured.

- C. Finished surfaces shall be uniform in texture and pattern, and level within a degree of tolerance of 1/4 inch in 10'-0" in any direction.

3.6 INSTALLATION

- A. System shall be installed in accordance with the manufacturer's specifications and shall include the following minimum applications:
 - 1. Bonding coat of neoprene rubber and cement composition in aqueous dispersion applied by brush or trowel.
 - 2. Rot-resistant woven cloth fabric waterproof membrane applied into thickened liquid latex applied over floors and up verticals, bases, curbs, pipe sleeves, mechanical pads.
 - 3. Troweled smoothing coat of styrene butadiene liquid emulsion combined with alumnus cement and aggregate and applied to smooth off all laps and butt joints in membrane.
 - 4. Two finish roller applications of elastomeric latex coating in color as selected by the Architect.
 - 5. Cove base shall have a minimum of 2 inch cove. Cove shall splay back to meet door frames, forming a neat, sanitary base.
 - 6. Finished floor shall be 1/4 inch thick, smooth, uniform in color and free of trowel marks.
- B. Bonding coat, waterproof membrane and smooth coat shall be applied prior to the installation of mechanical equipment and shall cover all floor surfaces, bases, mechanical pads and pipe sleeves. Colored finish coats shall be applied to all surfaces after all equipment has been installed.
- C. Apply composition flooring up vertical abutting surfaces to form a coved base terminating 4 inches above floor in a feathered edge.
- D. Feather edge where composition flooring abuts dissimilar material.
- E. Allow surfacing to set undisturbed for a minimum period of 48 hours. Maintain temperature at 50 degrees F minimum until floor surfacing has completely cured.
- F. Finished surfaces shall be flush, true to plane, and shall be level within permissible degree of tolerance 1/4 inch in 10'-0" in any direction.

3.7 CLEANING

- A. Upon completion of the work in each area, remove all coating splatters from glass, prefinished surfaces, bright metals, and from other surfaces that have not been painted or finished hereunder. Do not use abrasive paper or abrasive cleaner on any prefinished surface or bright metal. Remove all materials and debris; leave work area in a clean condition.

3.8 PROTECTION AND TOUCH-UP

- A. General: Protect finished work under provisions of Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.

- B. Clean up the work area at end of each work day. Remove all cartons, debris, emptied containers, as the work progresses, and finally at completion of work of this Section Legally dispose of same off the Site.
- C. During application of coatings, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Properly clean, repair or replace any work so damaged and soiled.
- D. Protect all finished surfaces against damage until the date of final acceptance of the work. The Architect will conduct a final review of all work performed. Re-coat or touch-up, all scratches and other blemishes on surfaces, and as directed by the Architect, any areas found which do not comply with the requirements of this Section, and bear all costs therefor. Remove and dispose of floor protection as directed by Construction Manager.
- E. Any re-coating or touch-up work, required after the work of this Section has been reviewed and accepted by the Architect, will be paid for by the Contractor.

End of Section

Section 09 77 33
SANITARY WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install the following:
 - 1. USDA approved glass fiber reinforced plastic panels.
 - 2. Installation adhesive, non-corroding fasteners, vinyl moldings, and all other components.
 - 3. Silicone sealant for all joints between panels and moldings, and between panel system and abutting materials.
- B. Install access panels occurring in plastic panels furnished by Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 06 10 00 - ROUGH CARPENTRY: Plywood substrate, and blocking.
- C. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Hollow metal door frames to receive ends of panel system.
- D. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: Shop primed access panels, occurring in partitions and walls.
- E. Section 09 30 13 - CERAMIC TILING: tile base at ceramic tiling.
- F. Section 09 29 00 - GYPSUM BOARD: Gypsum board substrate:
- G. Division 21 - FIRE SUPPRESSION: Fire suppression system.
- H. Division 26 - ELECTRICAL: Recessed electrical receptacles.

1.3 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM D 256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
 - 2. ASTM D 570 - Standard Test Method for Water Absorption of Plastics.
 - 3. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
 - 4. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - 5. ASTM D 2583 - Barcol Hardness.

6. ASTM D 5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
7. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
8. All applicable federal, state and municipal codes, laws and regulations regarding wall finishes and smoke generation.

1.4 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions.
 2. Certification: Manufacturer's written certification stating that panel system and all related components to be furnished hereunder, meet or exceed the requirements specified under this Section that all fire-resistive requirements for the indicated requirements have been met.
 3. Shop drawings: 1/4 inch scale elevations showing panel joint locations.
 4. Selection samples:
 - a. Sample card indicating Manufacturer's full range of colors available for selection by Architect.
 5. Verification samples:
 - a. 12 inch by 12 inch samples of panel illustrating material and finish.

1.5 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Qualifications:
 1. Installer specializing in applying the work of this Section with a minimum of 3 years experience and approved by product manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver panels to the project until all concrete, masonry, plaster, and other wet work has been completed and dry.
- B. Remove panels from shipping cartons/skids. Stack panels on a solid flat, dry surface. Do not stack panels direct on concrete flooring or any other surface that emits moisture. Lay Panels flat; do not stand panels on edge, do not store products near a heat source.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.8 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Kalwall Corporation, Bow, NH (Kal-lite FRP Products)
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following
 - 1. Kalwall Corporation, Bow, NH (Kal-lite FRP Products)
 - 2. Marlite Inc., Dover OH (Marlite FRP products).
 - 3. Cane Composites, Joliet, IL
 - 4. Nudo Products, Inc., Springfield, IL. (Fiber-Lite Products).

2.2 REGULATORY REQUIREMENTS

- A. Obtain certificate of compliance from authority having jurisdiction indicating approval of specified products.

2.3 MATERIALS

- A. Panels: Fiberglass reinforced plastic panels, ASTM E-84 Class A Fire Retardant Rated, having textured finish.
 - 1. Panel Thickness: 0.09 inch (2.3mm) thickness.
 - 2. Panel Width: 48"
 - 3. Panel length: 9' 10' or 12' as indicated on drawings.
 - 4. Performance Requirements:
 - a. Flexural Strength (ASTM D 790): 13.6×10^3 psi (94Mpa).
 - b. Flexural Modulus (ASTM D 790): 0.60×10^6 psi (4137 MPa).
 - c. Tensile Strength (ASTM D 638): 7.1×10^3 psi (49 MPa).
 - d. Tensile Modulus (ASTM D 638): 0.92×10^6 psi (6343 Mpa).
 - e. Hardness (ASTM D 2583): Barcol Hardness 40.
 - f. Impact Strength ASTM D 256: 12.0 ft-lb/in notched (0.64 J/mm).
 - g. Taber Abrasion Resistance (Taber Test, CS-17 wheel, 1000 gram weight, 25 cycles): 0.02% maximum weight loss.
 - 5. Panel Color and Texture: as selected by Architect from Manufacturer's standard colors and textures.
 - 6. Acceptable products include the following:

- a. Kal-lite Product: "Kal-lite FRP Products" Linen or hex texture.
- b. Crane Composites: "Variatex Collections" FRP Products

2.4 ACCESSORIES

- A. Aluminum trim: Heavy weight extruded anodized aluminum
 - 1. Finish: Anodized.
 - 2. Location: Top and, bottom edges and inside and outside corners.
- B. Fasteners: stainless steel or nylon fasteners as recommended by the panel manufacturer for the application indicated in the Drawings.
- C. Adhesive: Multi-purpose non-flammable, non-staining, construction adhesive: Kemlite No. 260, Henry No. 444, or equal.
- D. Sealant: One-part acetoxysilicone rubber sealant, USDA approved as recommended by panel manufacturer.
- E. Color Caulk: Color Sil by Color Rite, 100 percent silicone-based colored caulk, or approved equal. Color and finish to be selected by architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of blocking, backing and support framing for work of this Section. Inspect all gypsum wall and plywood substrates and verify that they are in proper condition to receive the work of this Section.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. Surfaces receiving work of this Section must be absolutely dry, free from dirt, dust, grease and other foreign materials that will prevent proper adhesion of the wall panels.
- B. Verify gypsum board substrate surfaces are flat, conforming to Gypsum Association specifications for a Level 3 finish.
- C. Plywood substrate surfaces should be flat to within 1/8" in 10 feet, Sand smooth high spots, and fill low spots with wood filler approved by panel manufacturer.

3.3 INSTALLATION, GENERAL

- A. Install work in strict accordance with the manufacturer's written instructions.
- B. Lay out paneling before installing. Locate panel joints where indicated
 - 1. Mark plumb lines on substrate at trim accessory and panel joint locations for accurate installation.
 - 2. Locate trim accessories and panel joints to allow clearance at panel edges in accordance with manufacturer's written instructions.

3. Whenever possible, locate factory edge at panel to panel joint. Cut edges should be at trim locations.
- C. Set and secure materials in place, plumb and level. Maintain 1/4" gap at ceiling. Maintain 1/8 inch gap between panels with silicone joints to allow for normal expansion and contraction. Allow 3/16 inch around pipes, electrical fitting and other projections.

3.4 APPLICATION OF PANELS WITH ADHESIVE

- A. Ensure that both panels and substrate are free of moisture, dirt, dust and other contaminants which may affect the bond of adhesive.
- B. Apply adhesive when temperature is between 50 and 90 degrees F.
- C. Trowel adhesive evenly on back of sheets, 1/4 deep with square notch trowel, or apply with cartridge gun spacing beads not more than 8 inches in center of panel and run a single bead along all edges of panel.
- D. Set panels in position and press against wall. Pull panel away from wall to flash off solvents. Press panel against wall again, apply adequate pressure to make full contact between panel and wall. Brace panel along vertical edges until adhesive is cured.
- E. Apply mechanical fasteners along top and bottom edges as specified in Article 3.04 above.

3.5 APPLICATION OF SEALANT AND MOLDINGS

- A. Install sealant and moldings, in sequence as recommended by the panel manufacturer to achieve a moisture resistant application of the panel system.
- B. After installation of panels and moldings has been completed, apply a continuous bead of specified sealant to all joints between the work of this Section and abutting surfaces. Tool the sealant to a uniformly dense surface, level with the edges of moldings. Immediately remove all excess sealant from finished surfaces.
 1. Install joint bead back-up in joints with abutting materials where joints are in excess of 5/8-inch depth, and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.
 - a. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
 2. Apply sealant into joints in accordance with sealant manufacturer's instructions, using mechanical or power caulking gun equipped with nozzle of appropriate size, with sufficient pressure to completely fill the joints.
 - a. The depth of sealant shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
 - b. Maintain the outer edge of the sealant, where side faces of joints are in the same plane, back 1/8-inch from the faces.

- c. After placement of the sealant in joints with abutting materials, concave-tool the surfaces to uniform density, using a water-wet tool. Do not use detergents or soapy water for the tooling operations.
- d. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.

3.6 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris and scraps.
- B. Completely clean all panel surfaces, clean all surfaces of adjacent surfaces which have been marked or soiled by the work of this Section, removing all excess sealants and adhesives with solvents which will not damage the surfaces in any way.
- C. Upon completion of the work of this Section, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

3.7 PROTECTION

- A. During the operation of sealant work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

End of Section

Section 09 81 00
ACOUSTICAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this Section consists of acoustical insulation where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.
- B. Furnish and install:
 - 1. Acoustical insulation as scheduled and where indicated.
 - 2. Mineral wool insulation at interior area of roof curbs as detailed on Drawings.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood framing, blocking, nailers.
- C. Section 06 20 00 - FINISH CARPENTRY: Acoustical batt insulation behind acoustical wood panels.
- D. Section 07 21 00 – THERMAL INSULATION.
- E. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Installation of wall board over acoustical insulation.
- F. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Ductwork and piping insulation.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C 518 - Thermal Transmission Properties by Means of the Heat Flow Meter.
 - 2. ASTM C 553 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - 3. ASTM C 612 - Mineral Fiber Block and Board Thermal Insulation.
 - 4. ASTM C 665 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 5. ASTM E 84 - Surface Burning Characteristics of Building Materials.
 - 6. ASTM E 96 - Water Vapor Transmission of Materials.

1.4 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
2. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

B. Storage and Handling Requirements:

1. Store materials under cover and in manner to keep them dry, protected from weather, direct sunlight and damage from construction traffic and other causes.

1.6 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Acoustical mineral fiber insulation:
 - a. Roxul, Inc., Milton, Ontario. .
 - b. Fibrex Insulations Inc., Sarnia, Ontario
 - c. Thermafiber Inc., Wabash IN.
 - d. Johns Manville, Inc., Denver CO.

2.2 MATERIALS

- A. Acoustical batt insulation at fire rated walls and partitions: Mineral wool fiber insulation batts, conforming to ASTM C665 Type 1, and ASTM C553 with a nominal density of 2.5 pounds per cubic foot, nominally 3-1/2 inches thick, or as otherwise indicated on the Drawings.
 1. Flame Spread Classification: Class A (less than 25, per testing by NFPA 255, ASTM E-84 or UL 723).
 2. Recycled content of slag in mineral wool insulation: Use maximum available percentage of material (slag). Mineral wool insulation products incorporated into the work shall contain not less than 75 percent of recycled material (slag) by weight.
 3. Acceptable products include:

- a. Roxul, Inc., product "Roxul AFB".
 - b. Fibrex Insulations Inc. product: "Fibrex Sound Attenuation Fire Batt (SAFB)"
 - c. Thermafiber, Inc. product "Thermafiber SAFB".
- B. Acoustical batt insulation at non-rated walls and partitions: Unfaced glass fiber insulation nominal 3-1/2 inches [89mm] thick conforming to ASTM C 665 Type I, of width appropriate for spacing of framing or furring members with which used.
 1. Flame Spread Classification: Class A (less than 25, per testing by NFPA 255, ASTM E-84 or UL 723).
 2. Recycled content of glass in glass-fiber insulation: Use maximum available percentage of recycled glass. Fiber glass insulation products incorporated into the work shall contain not less than 20 percent of recycled glass cullet.
- C. Acoustical batt insulation at interior areas of roof curbs: Mineral wool fiber insulation board, conforming to ASTM C612, Type IVB having a nominal density of 4.4 pounds per cubic foot.
 1. Non-combustible as tested per ASTM E-136.
 2. Flame Spread Classification: Class A (less than 25, per testing by NFPA 255, ASTM E-84 or UL 723), with flame spread rating of 0 and smoke developed rating of 0.
 3. Thickness: As indicated on Drawings.
 4. Size: As required to fit framing bays and other related conditions.
 5. Acceptable products include the following or approved equal:
 - a. Roxul, Inc., Milton, Ontario, product "Roxul ComfortBatt"
 - b. Thermafiber Inc., Wabash IN. product "Thermafiber UltraBatt."
 - c. Johns Manville, Inc., Denver CO. product: "TempControl".
- D. Acoustical Joint Sealer (Acrylic acoustical): One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable.
 1. Tremco, product "Acoustical Sealant".
 2. USG, product "USG Acoustical Sealant".
 3. Pecora, product "AC-20 FTR".

2.3 ACCESSORIES

- A. Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each insulation type.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Acoustical insulation:
 1. Install insulation in accordance with insulation manufacturer's instructions.
 2. Install in interior walls where indicated. Trim insulation neatly to fit spaces. Fit insulation tight in spaces. Leave no gaps or voids.

3.2 APPLICATION OF ACOUSTICAL SEALANT

- A. General: Install sealant and backing in accordance with the recommendations of ASTM C 919 and sealant manufacturer's recommendations.
 - 1. Perform preparation in accordance with C-790. Thoroughly clean all joints, removing all loose mortar, grease, dust, and other foreign materials that will prevent proper adhesion of primers and sealant materials.
 - 2. If so recommended and furnished by the specific sealant manufacturer, apply primer to all joint surfaces, taking care not to stain adjacent surfaces.
- B. Seal all penetrations in walls and partitions whether or not designated for "acoustical" insulation. Penetrations to receive sealant include electrical boxes, plumbing, heating and air conditioning ducts, telephone, intercom hookups, conduit, piping and similar items.
 - 1. Install joint bead backup in all joints in excess of 5/8-inch depth, and joints that have no backup therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.
 - a. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
 - b. Do not stretch back-up material into joints.
 - c. Install bond breaker wherever recommended by the sealant manufacturer to prevent bond of the sealant to surfaces where such bond might impair the Work.
 - 2. Apply sealant in continuous beads without open joints, voids or air pockets.
 - a. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
 - 3. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.

3.3 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris and scraps.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 09 91 00

PAINTING

(FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 09)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Filed Sub-Bid Contract Requirements: As provided under Section 09 00 09 – PAINTING FILED SUB-BID CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Contract includes all individual specification sections listed in Section 09 00 09.

1.2 SUMMARY

- A. Summary: This Section consists of painting work where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Painting work includes, but is not limited to the surface preparation and application of coated finishes, and subsequent touch-up, of interior and exterior items and surfaces as indicated on the Contract Drawings and as scheduled herein.
 - 1. No attempt is made in this Section to list all surfaces, fixtures and equipment requiring painting on this project. It is the responsibility of the Trade Contractor to determine for itself the scope and nature of the Work required for a complete installation from the information provided herein and in the Drawings.
- B. Surfaces and Materials: In general, without limiting the generality thereof, the following surfaces, fixtures and equipment require a painted finish:
 - 1. Gypsum board partition and wall surfaces, ceilings and soffits.
 - 2. Concrete masonry units.
 - 3. Metal doors and frames.
 - 4. Exposed to view structural steel.
 - 5. Roof top equipment.
 - 6. Exposed to view electrical conduit and raceways.
 - 7. Access panels and frames.
 - 8. HVAC supply diffusers and return grilles located in walls and at exposed-to-view locations not in ACT ceiling systems.
 - 9. Vent stacks through roof.
 - 10. Exposed exterior plumbing, gas piping and other exposed utilities pipes and conduit.
 - 11. Plywood backerboards for all trades.
 - 12. All other items indicated to be painted on the drawings.
- C. DO NOT PAINT the following surfaces and materials.
 - 1. Concealed from view surfaces, except as indicated otherwise in the Contract Documents or as specified herein.

PAINTING

2. Chrome or nickel plating, stainless steel, bronze, brass.
3. Aluminum other than mill finished or factory primed.
4. Factory finished mechanical and electrical equipment, pumps, machinery and similar items which occur in mechanical, storage or equipment rooms or areas.
5. Factory finished materials, specialties, and accessories unless otherwise specified.
6. Ceramic tile, porcelain tile, terrazzo tread/risers and tile, acoustical tile, resilient flooring, wood flooring, and other integrally finished floor, wall and ceiling finishes.
7. Prefinished millwork items.
8. Fire resistant testing and certification labels, code required labels, safety warning labels, performance rating plates, nomenclature plates, identification plates, and similar other labels.

1.3 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete partitions and walls.
- C. Section 04 20 00 - UNIT MASONRY: Concrete masonry partitions.
- D. Section 05 12 00 - STRUCTURAL STEEL FRAMING: Shop priming of structural steel framing.
- E. Section 05 50 00 - METAL FABRICATIONS: Shop priming of designated miscellaneous metals.
- F. Section 06 20 00 - FINISH CARPENTRY: Wood trim items.
- G. Section 07 92 00 - JOINT SEALANTS: Requirements for sealant and backing materials.
- H. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Filling minor surface damage, shop priming of metal frames and steel doors.
- I. Section 08 14 16 - FLUSH WOOD DOORS: Wood doors, both prefinished and unfinished.
- J. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: Shop primed access panels, occurring in partitions and walls.
- K. Section 09 00 09 – PAINTING TRADE CONTRACT REQUIREMENTS: Trade contract requirements for work of this Section.
- L. Section 09 29 00 - GYPSUM BOARD: Drywall and acoustic drywall partitions, ceilings and soffits, including joint treatment and sanding.
- M. Document 09 91 13 - EXTERIOR PAINTING SCHEDULE: Painting schedule for exterior surfaces and materials:
- N. Document 09 91 23 - INTERIOR PAINTING SCHEDULE:

1. Painting schedule for interior surfaces and materials.
 2. Painting schedule for Mechanical and Electrical Equipment.
- O. Section 10 40 00 – SAFETY SPECIALTIES: Shop priming of cabinet doors and frames; shop finishing of cabinet.
- P. Division 22 - PLUMBING: Prefinished items such as plumbing fixtures, sprinkler heads, convectors, anemostates and similar surfaces and materials.
- Q. Division 26 - ELECTRICAL: Prefinished items such as light fixtures, switch gear, electrical distribution cabinets and similar surfaces and materials.
- R. Respective sections: Mechanical, plumbing, fire protection and electrical equipment.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
1. ANSI/ASTM D 16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
 2. ASTM D 2016 - Test Method for Moisture Content of Wood.
 3. All applicable federal, state and municipal codes, laws and regulations for flammability and smoke generation of interior finishes.

1.5 DEFINITIONS

- A. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials specified herein, whether used as prime, intermediate or finish coats.
- B. Sheen: Specular gloss readings in accordance with ASTM D52
1. Flat: less than 5 (measured at 85 degrees)
 2. Eggshell: 5 – 20 (measured at 60 degrees)
 3. Satin: 15-35 (measured at 60 degrees)
 4. Low Luster: 25 – 35 (measured at 60 degrees)
 5. Semi-Gloss: 30 -65 (measured at 60 degrees)
 6. Gloss: 65 or more (measured at 60 degrees)
- C. Gloss as defined for VOC requirements. Specified specular gloss readings below are as tested in accordance with ASTM D52.
1. Flat: less than 15 (measured at 85 degrees), less than 5 (measured at 60 degrees).
 2. Non-Flat: greater than 15 (measured at 85 degrees), greater than 5 (measured at 60 degrees).

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, material compositions, and application instructions for all finishing products to be applied hereunder.
 - a. Include certification of data indicating Volatile Organic Compound (VOC) content of all paint materials.
 - 2. Samples:
 - a. Manufacturer's color selector for custom mixed colors for Architect's color scheduling.
 - b. Opaque coatings: Two 9 by 12 inch finished samples on hardboard of each color scheduled in each finish for review and approval. Identify boards with finish type, color mix number and scheduled substrate surfaces or materials.
 - c. Transparent finishes and stains: Two 9 by 12 inch finished samples on same species of solid wood and plywood to be furnished under Section 06 20 00 - FINISH CARPENTRY, of each color scheduled in each finish for review and approval. Identify boards with finish type, color mix number and scheduled substrate surfaces or materials.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 - 1. Color chips: After final approval of all colors and tints by the Architect, submit to the Owner, color chips of all coatings used, with manufacturer's name and mix designation of the coating for the purpose of future re-ordering of coatings. Color chips shall be at least six (6) square inches in size, for each color and tint.

1.7 QUALITY ASSURANCE

- A. Single source responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.
- B. Environmental Requirements for Volatile Chemicals:
 - 1. For interior applications use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24) and the following chemical restrictions:
 - a. Flat Paints and Coatings: VOC not more than 50 g/L.
 - b. Non-Flat Paints and Coatings: VOC not more than 150 g/L.
 - c. Anti-Corrosive Coatings: VOC not more than 250 g/L.
 - d. Clear wood finishes:
 - 1) Varnishes: VOC not more than 350 g/L.
 - 2) Lacquer: VOC not more than 550 g/L
 - e. Floor coatings: VOC not more than 100 g/L
 - f. Sealers:
 - 1) Waterproofing sealers: VOC not more than 250 g/L.
 - 2) Sanding sealers: VOC not more than 275 g/L.

- 3) All other sealers: VOC not more than 200 g/L.
- g. Stains: VOC not more than 250 g/L.
- 2. Do not use water based paints formulated with aromatic hydrocarbons (organic solvent with a benzene ring in its molecular structure), formaldehyde, halogenated solvents, mercury or mercury compounds, or tinted with pigments of lead, cadmium, chromium VI and their oxides. Water based paints shall be low VOC and shall have a flash point of 61 degrees C or greater.
- 3. Where it is necessary to use solvent-based paints, with less than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
- 4. The following shall be low VOC and not be formulated with aromatic hydrocarbons (organic solvent with a benzene ring in its molecular structure).
 - a. High performance water based acrylic coatings.
 - b. Pigmented acrylic sealers.
 - c. Catalyzed epoxy coatings.
 - d. High performance silicone grafted epoxy coatings.
- 5. Restricted Components: Paints and coatings used on this Project shall not contain any of the following compounds. (Excluded from this restriction are residual quantities of naturally occurring elements and chlorinated organics which are found in chlorinated water supplies; contaminate levels shall be below that of the National Primary Drinking Water Standard):
 - a. 1,2-dichlorobenzene
 - b. Alkylphenol ethoxylates (APEs)
 - c. Formaldehyde-donors
 - d. Heavy metals, including lead, mercury, cadmium, hexavalent chromium and antimony in the elemental form or compounds
 - e. Phthalates
 - f. Triphenyl tins (TPT) and tributyl tins (TBT).

1.8 FIELD SAMPLES

- A. Provide field samples under provisions of Section 01 45 00 - QUALITY CONTROL for purpose of verifying selected colors.
- B. Paint on-site sample areas, minimum 40 square feet, illustrating selected color, and tint.
- C. Locate samples where directed. The Contractor shall provide in the base Contract, a total amount of samples equal to one sample per room.
- D. Accepted samples may not remain as part of the work.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site in sealed and labeled containers; container labeling shall include manufacturer's name, type of paint, color mix designation, expected coverage, surface preparation instructions, instructions for mixing and reducing, drying time, and clean-up recommendations.

- B. Store materials, conforming with applicable codes and fire regulations, in designated spaces. Keep storage area secure when direct access is not required or when not performing work under this Section. Take precautionary measures to prevent fire hazards and spontaneous combustion, maintain a dry-chemical type fire extinguisher in all areas where materials of this Section are being stored or used.
- C. Store paint materials in a well ventilated area at minimum ambient temperature of 45 degrees Fahrenheit and a maximum of 90 degrees Fahrenheit.
- D. Do not use the sanitary system for mixing or disposal of refuse material. Carry water to mixing rooms and dump waste material in a suitable refuse receptacle. Remove oily rags and waste each day.

1.10 PROJECT CONDITIONS

- A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees Fahrenheit for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent unless required otherwise by manufacturer's instructions.
- C. Apply paints and finishes above minimum temperature conditions in strict accordance with manufacturer's instructions.
- D. Provide sufficient lighting to maintain 80 foot-candles measured mid-height at substrate surface.

1.11 SEQUENCING AND SCHEDULING

- A. The applicator of work specified herein is responsible to ensure that all paints, enamels, and coatings, proposed to be applied hereunder, are compatible with coatings used for shop-primed items and items which have been prime-coated under the work of other trades.
- B. Immediately notify the Architect in writing of conditions which may require a change in the specifications of this Section before proceeding with the work. Failure to do so, in a timely fashion, so as not to interfere with the schedule of work of this Contract, shall be construed as acceptance of the coatings specified. Perform all corrective measures, at no cost to the Owner, for any defects in the work, resulting from the use of such materials.
- C. Painting work should be scheduled so as to minimize touch-ups. Interior painting is to be without flashmarks. Should flashmarks occur due to touch-ups, the Contractor shall be required to redo the entire surrounding wall surface.
- D. Do not order materials until all required schedules have been properly submitted, reviewed by the Contractor and Approved by Architect.

1.12 EXTRA MATERIALS

- A. Provide a minimum of (2) one gallon containers of all paints and finishes, to the Owner of each color and finish scheduled herein.

1. Label each container with paint mix number, and identify locations where color and tint was used.

1.13 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Paints and general finishes:
 - a. Benjamin Moore & Company, Montvale, NJ.
 - b. California Paints, Andover MA.
 - c. Akzo Nobel Paints, LLC, Glidden Professional, Strongsville, OH.
 - d. Akzo Nobel Paints, LLC, Devoe High Performance Coatings, Strongsville, OH.
 - e. Pittsburgh Paints / PPG Industries, Inc., Pittsburgh PA.
 - f. Pratt & Lambert Inc., Buffalo, NY.
 - g. Sherwin Williams, Cleveland OH.
 - h. Tnemec Company, Inc., Kansas City, MO.
 2. Interior stains and clear finishes for wood
 - a. Samuel Cabot, Inc., Boston MA.
 - b. PPG Architectural Finishes Inc., Olympic Home Care Products Division, Pittsburgh PA.
 3. Cold galvanizing touch-up paint:
 - a. ZRC Worldwide Inc., Marshfield MA.
 - b. Duncan Galvanizing, Malden Ma.
 - c. Rustoleum Corp., Vernon Hills IL.
 4. Caulking:
 - a. Pecora Corporation, Harleysville PA.
 - b. Sonneborn Building Products Inc., Minneapolis MN.
 - c. Tremco, Beachwood OH.
 5. Concrete sealers:
 - a. Dayton-Superior, Miamisburg OH.
 - b. Nox-Crete Inc., Omaha NE.
 - c. L&M Construction Chemicals, Inc.

2.2 MATERIALS

- A. Coatings: Ready mixed, except for field catalyzed coatings with good flow and brushing properties; capable of drying or curing free of streaks or sags. Color pigments shall be processed to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating. Provide best quality grade, where manufacturer makes more than one grade of any material specified.
- B. Liquid zinc coating, for touch-up of welds, scratches, and abrasions in galvanized steel: Low VOC organic zinc-rich coating containing 92% metallic zinc, by weight in the dried film (ASTM D520, Type III) and conforming to SSPC Paint 20, Type II, Level 1. Liquid zinc coating shall be recognized under the Component Program of Underwriter's Laboratories, Inc. as an equivalent to hot-dip galvanizing; conforming to MIL-P-21035B and SSPC Paint 29, Type II, Level I, for repair of hot-dip galvanizing and meeting the requirements for Zinc-Rich Paints.
 - 1. VOC limit: not more than 250 g/L.
 - 2. Specified manufacturer and product: ZRC Worldwide, Marshfield MA, product "ZRC-221".
- C. Joint sealant for fill of minor cracks prior to painting: One component acrylic latex caulking compound, conforming to FS 19-TP-21M and ASTM C 834, paintable within 24 hours after application, with a minimum movement capability of ± 12.5 percent, equal to one of the following:
 - 1. Pecora, product "AC-20+".
 - 2. Sonneborn Building Products Inc., product, "Sonolac".
 - 3. Tremco, product, "Tremflex 834".
 - 4. Sherwin Williams product "Loxon 1K Smooth".
- D. Concrete sealer: Opaque water based acrylic sealer, maximum VOC limit of 100 g/L. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Manufacturers (interior floors):
 - a. Sherwin Williams
 - b. Benjamin Moore
 - c. PPG
 - 2. Sealer at garage to be opaque

2.3 ACCESSORIES

- A. Accessory materials: other materials not specifically indicated, but are required to achieve the finishes specified of commercial quality.
- B. Cleaning Materials:
 - 1. Tri-Sodium Phosphate (TSP) substitute products:
 - a. Savogran, Norwood MA, products "TSP-PF", or "Liquid TSP Substitute".
 - b. Custom Building Products, Seal Beach, CA., product "Custom T.S.P. Substitute".
 - c. DAP Inc., Baltimore MD., product "T.S.P. Substitute Heavy Duty Cleaner".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify Contractor of any condition that may potentially affect proper application of coatings.
- B. Measure moisture content of surfaces, do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Masonry or concrete: 12 percent.
 - 2. Interior wood: 15 percent.
- C. Beginning Work of this Section means acceptance of substrate surfaces and site conditions.

3.2 PREPARATION

- A. Furnish and lay suitable drop cloths in all areas where coating work is being done to protect floors and all other surfaces from damage during the work. Protect adjoining surfaces with painters mask tape.
- B. Prior to preparing surfaces or finishing, remove all finish hardware for painting doors and frames, except hinges and locks on exterior door; remove electrical plates, light fixture trim and fittings. Re-install hardware and other removed items after painted surfaces are thoroughly dry.
- C. Mix coatings thoroughly, unless otherwise directed by the manufacturer of the specific coating used, to ensure uniformity of color and mass. Strain previously opened coatings to remove skins, lumps, and other foreign matter prior to painting.
- D. Thin or reduce materials only as recommended by the specific material manufacturer, and only with the approval of the Architect.
- E. Impervious surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to thoroughly dry.
- F. Concrete and unit masonry surfaces scheduled to receive paint finish:
 - 1. Remove all loose scale and mortar, dirt, salt or alkali powder and other surface contaminants, using a detergent expressly formulated for cleaning of concrete and masonry.
 - 2. Remove oil and grease with a solution of tri-sodium phosphate.
 - 3. Remove stains caused by weathering corroding metals with a solution of sodium metasilicate after thoroughly wetting with water.
 - 4. Thoroughly rinse the cleaned surfaces with clear water, and allow the surfaces to completely dry, allow a minimum of 4 hours before commencing application of coatings.
- G. Uncoated steel and iron surfaces:
 - 1. Remove grease, scale, dirt, rust, and all foreign materials, down to bright metal by wire brushing, scraping, sanding, or sandblasting where heavy coatings of scale are evident.

2. Wash steel with solvent, apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned.
 3. Spot prime after repairs with alkyd base metal primer product of the finish coating manufacturer.
- H. Shop primed steel surfaces:
1. Remove rust, blistered and defective shop prime paint, and all foreign materials, down to bright metal by wire brushing, scraping, sanding, or commercial paint remover. Feather edges to make touch-up patches inconspicuous.
 2. Remove all grease or dirt with mineral spirits.
 3. Spot prime bare metal with alkyd base metal primer product of the finish coating manufacturer. Seal top and bottom edges of metals doors with primer.
- I. New galvanized surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- J. Aluminum surfaces scheduled for paint finish:
1. Remove surface contamination by steam or high pressure water.
 2. Remove oxidation with acid etch and solvent washing.
 3. Apply etching primer immediately following cleaning.
- K. Interior wood items scheduled to receive paint finish.
1. Smooth minor defects and remove all foreign matter by sanding, and if necessary, steel wool.
 2. Wash sap spots and knots with mineral spirits. When dry, touch up knots, pitch streaks, and sappy sections with commercial stain sealer.
 3. Fill up nail holes and cracks with wood putty or plastic wood after primer of first coat of finish is dry, and sand smooth.
- L. Gypsum board surfaces: Fill minor defects with latex based spackle. Spot-seal all compound surfaces and repair areas in gypsum board, with specified first coat material before application of the first coat.

3.3 APPLICATION

- A. Apply all materials in strict accordance with the approved manufacturer's printed instruction, and in accordance with the best trade practices. Each coat shall be reviewed and approved by the Architect before succeeding coats are applied.
- B. Do not apply successive coating until the preceding coat is thoroughly dry, and in no case in less than 24 hours after the preceding coat.
- C. Number of coats is indicated under Painting Schedules. Number of coats is indicated as a minimum number to be applied over scheduled substrates. An additional coat or coats may be required for proper color coverage of substrate as determined by the Architect, at no additional cost to the Owner. Examples of these conditions include, but are not limited to:
1. Dark colored substrates may require an additional primer or intermediate coat to stabilize color, if final applied top-coat color is light.

2. Pre-finished or pre-primed products may require an additional field applied coat to stabilize the shop/factory applied base color prior to application of top-coat finishes.
 3. Dark color top coat finishes may require additional finish coat over white or light colored substrates to obtain correct color density.
- D. Apply each coat to a uniform finish; Apply primer and first coat of slightly lighter in color tint than the scheduled color of the final coat.
 - E. Sand lightly between coats to achieve required finish and remove sanding dust prior to applying succeeding coat.
 - F. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
 - G. Prime back surfaces of all interior and exterior woodwork scheduled for painted finish with primer.
 - H. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.4 APPLICATION – CONCRETE MASONRY

- A. Apply epoxy block filler to concrete masonry partitions at maximum rate allowed by coating manufacturer. Apply by airless spray followed by back rolling to force material into voids. Use a squeegee to remove excess material prior to initial set, and provide a smooth surface texture. After initial set, touch-up and fill apparent voids and holidays with fresh material.

3.5 APPLICATION – CONCRETE SEALER

- A. Apply sealers with manufacturer's recommended equipment, at recommended rate of square feet per gallon. Apply second coat when sealer is dry to touch. Allow sealer to cure undisturbed for a minimum period of 6 hours. Maintain temperature at 60 degrees Fahrenheit minimum until floor surfacing has completely dry. Follow manufacturer's printed instruction for installation and curing.

3.6 CLEANING

- A. Upon completion of the work in each area, remove all coating splatters from glass, prefinished surfaces, bright metals, and from other surfaces that have not been painted or finished hereunder. Do not use abrasive paper or abrasive cleaner on any prefinished surface or bright metal. Remove all materials and debris; leave work area in a clean condition.

3.7 PROTECTION AND TOUCH-UP

- A. During painting work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Properly clean, repair or replace any work so damaged and soiled.
- B. Protect all painted surfaces against damage until the painter is complete. CM/Architect to review. Painter to include cost to touch up all painted door jambs.
- C. Any re-coating or touch-up work, required after the work of this Section has been reviewed and accepted by the Architect, will be paid for by the Contractor.

3.8 PAINTING SCHEDULE

- A. Colors: The Architect will furnish a schedule of colors for each area and surface. Tinting and matching shall be to the satisfaction of the Architect. No limit is placed on the number of colors that may be required, a maximum of four (4) colors will be utilized in any room or space with the exception of the Gymnasium where a maximum of six (6) colors will be required. Premium paints of deep-hued, bright, pigment intensive, accent and primary colors may be scheduled for up to 25 percent of all interior and exterior surfaces without additional cost to the Owner.
 - 1. Colors of priming coats (and body coats where specified) shall be lighter in tint than those of finish coat.
 - 2. Colorants: Pure, non-fading pigments, mildew-proof, ultra-violet resistant, finely ground in approved medium; and be limeproof, when used in coatings to be applied on masonry, concrete, plaster, and gypsum board surfaces.
- B. Paint Schedule for exterior surfaces and materials: Refer to Document 09 91 13.
- C. Paint Schedule for interior surfaces and materials: Refer to Document 09 91 23.
- D. Painting Schedule for mechanical and electrical equipment: Refer to Document 09 91 23.

End of Section

Section 09 91 13
EXTERIOR PAINTING SCHEDULE

(FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 09)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Filed Sub-Bid Contract Requirements: As provided under Section 09 00 09 – PAINTING FILED SUB-BID CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Contract includes all individual specification sections listed in Section 09 00 09.
- B. General: Number of coats scheduled herein below is minimum required, refer to Article entitled “APPLICATION” in specification Section 09 91 00 - PAINTING, regarding coverage.

1.2 PAINTING SCHEDULE FOR EXTERIOR SURFACES AND MATERIALS

- A. Exterior METAL, ALUMINUM, new, mill finish and as scheduled to receive paint:
 - 1. One coat primer:
 - a. California: “Rust-Stop DTM Primer/Finish”, N°. 1061.
 - b. Devoe Coatings: Devflex 4020PF DTM Primer and Flat Finish.
 - c. Moore: “Acrylic Metal Primer”, N°. P04.
 - d. Pittsburgh: “Pitt-Tech DTM Primer/Finish”, 90 Series.
 - e. Sherwin-Williams: “DTM Acrylic Primer/Finish”, B66W1 Series.
 - 2. Two coats acrylic gloss enamel:
 - a. California: Everlife 100% Acrylic Waterborne High Gloss “, N°. 521.
 - b. Devoe Coatings: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
 - c. Moore: “Acrylic Gloss Enamel”, N°. P28.
 - d. Pittsburgh: “Pitt-Tech DTM Exterior Waterborne High Gloss Enamel”, 90-300 Series.
 - e. Sherwin-Williams: “DTM Acrylic Gloss Coating”, B66 Series.
- B. Exterior METAL, FERROUS, new, shop primed and existing:
 - 1. One coat rust inhibitive primer. (touch up bare metal at existing and shop primed surfaces).
 - a. California: “Everlife Oil-based Metal Primer, N°. 21150.
 - b. Devoe Coatings: Devguard 4160 Multi-Purpose Tank & Structural Primer.
 - c. Moore: “Universal Metal Primer” N°. P07.
 - d. Pittsburgh: “Speedhide Industrial Rust Inhibitive Primers”, 7-852 Series .
 - e. Sherwin-Williams: “Kem Kromik Universal Metal Primer”, B50Z Series.

2. Two coats acrylic gloss enamel:
 - a. California: "Everlife 100% Acrylic Waterborne High Gloss ", N°. 521..
 - b. Devoe Coatings: Devflex 4208QD Waterborne Gloss Enamel.
 - c. Moore: "Acrylic Gloss Enamel", N°. P28
 - d. Pittsburgh: "Pitt-Tech DTM Exterior Waterborne High Gloss Enamel", 90-300 Series.
 - e. Sherwin-Williams: "DTM Acrylic Gloss", B66 Series
- C. Exterior METAL, GALVANIZED (including epoxy-primed items) (canopy and columns)
 1. 1st coat
 - a. S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).
 2. 2nd Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series.
 3. 3rd Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series (4.0-5.0 mils wet, 1.4 - 1.7 mils dry per coat).
- D. Exterior METAL, FERROUS, new, shop primed:
 1. One coat rust inhibitive primer. (touch up bare metal at existing and shop primed surfaces).
 - a. California: "Larcoloid Primer, N°. 21150.
 - b. Devoe Coatings: Devguard 4160 Multi-Purpose Tank & Structural Primer.
 - c. Moore: "Universal Metal Primer" N°. P07.
 - d. Pittsburgh: "Speedhide Industrial Rust Inhibitive Primers", 7-852 Series .
 - e. Sherwin-Williams: "Kem Bond High Solids Primer", B50 Series.
 2. Two coats acrylic gloss enamel:
 - a. California: "Larcoloid Acrylic", N°. 511XX.
 - b. Devoe Coatings: Devflex 4208QD Waterborne Gloss Enamel.
 - c. Moore: "Acrylic Gloss Enamel", N°. P28
 - d. Pittsburgh: "Pitt-Tech DTM Exterior Waterborne High Gloss Enamel", 90-300 Series.
 - e. Sherwin-Williams: "Pro Industrial DTM Acrylic Gloss", B66 Series.

End of Document

Section 09 91 23
INTERIOR PAINTING SCHEDULE

(FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 09)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Filed Sub-Bid Contract Requirements: As provided under Section 09 00 09 – PAINTING FILED SUB-BID CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Contract includes all individual specification sections listed in Section 09 00 09.
- B. General: Number of coats scheduled herein below is minimum required, refer to Article entitled “APPLICATION” in specification Section 09 91 00 - PAINTING, regarding coverage.

1.2 PAINTING SCHEDULE FOR INTERIOR SURFACES AND MATERIALS

- A. Specified Manufacturer for Interior Paint: To establish a standard of quality, design and function desired, Drawings and specifications have been based on products listed below. For equal products refer to section 09 91 00, 2.1 A for list of approved manufacturers.
- B. Interior concrete floors, (Where scheduled to be sealed or painted):
 - 1. Floor paint:
 - a. Sherwin-Williams: “Armorseal Floor Plex 8100” Color (up to 3 colors selected by architect
- C. Interior underside of METAL DECKING, exposed to view joists, overhead steel, sprinkler piping, conduits, exterior surfaces of interior ducts and similar items:
 - 1. Two coats waterborne acrylic dry fall finish:
 - a. California: “Economy Latex Dry Fall Spray Flat”, N°. 3701.
 - b. Glidden Professional: “Waterborne Dry Fall Flat N°. 1280”.
 - c. Moore: “Sweep-Up Spray Latex Flat, N°. 153.
 - d. Pittsburgh: “Speedhide Latex Dry Fog Spray Paint”, 6-714/715 Series.
 - e. Sherwin-Williams: “Waterborne Arcylic Dry Fall”, B42 Series.
- D. Exposed to view portions of ducts, (interior side) at diffusers.
 - 1. Two coats waterborne acrylic dry fall finish:
 - a. California: “Economy Latex Dry Fall Spray Flat”, N°. 3701.
 - b. Glidden Professional: “Waterborne Dry Fall Flat N°. 1280”.
 - c. Moore: “Sweep-Up Spray Latex Flat, N°. 153.
 - d. Pittsburgh: “Speedhide Latex Dry Fog Spray Paint”, 6-714/715 Series.
 - e. Sherwin-Williams: “Waterborne Arcylic Dry Fall”, B42 Series.
 - 1) Color: Flat black.

- E. Interior EXPOSED DUCTWORK, Insulated and Wrapped
 - 1. Apply one prime coat and two finish coats of a paint recommended by the approved paint manufacturer for application on the exposed wrapping material.
- F. Interior GYPSUM BOARD (drywall) partitions:
 - 1. One coat latex primer.
 - a. California: "Elements 100% Acrylic White Primer", N°. 74600.
 - b. Glidden Professional: "Lifemaster No VOC Primer N°. 9116".
 - c. Moore: "Eco Spec Interior Latex Primer Sealer", N°. 231.
 - d. Pittsburgh: "Pure Performance Interior Latex Primer", N°. 9-900.
 - e. Sherwin-Williams: "ProMar 200 Zero VOC Interior Latex Primer, B28 Series."
 - 2. Two coats eggshell paint:
 - a. California: "Elements 100% Acrylic Zero VOC Eggshell", N°. 731.
 - b. Glidden Professional: "Lifemaster No VOC Eggshell N°. 9300".
 - c. Moore: "Eco Spec Interior Latex Eggshell", N°. 223.
 - d. Pittsburgh: "Pure Performance Eggshell", N°. 9-300.
 - e. Sherwin-Williams: "ProMar 200 Zero VOC Interior Latex Eg-Shel", B20 Series.
- G. Interior GYPSUM BOARD (drywall) partitions, and ceilings, at toilet rooms, janitor's closets, or other areas not covered by other finishes for VOC compliant epoxy finish:
 - 1. One coat of sealer,
 - a. California: "Prime Choice ASAP Primer", N°. 50300.
 - b. Glidden Professional: "High-Hide Primer N°. 1000".
 - c. Moore: "SuperSpec Primer", N°. 253.
 - d. Pittsburgh: "Speedhide Interior Quick Drying Latex Sealer", 6-2 Series.
 - e. Sherwin-Williams: "Quick Drying Stain Blocking Primer," B51 Series.
 - f. Tnemec: PVA 51-792 Sealer.
 - 2. Two coats of semi-gloss Water Based Acrylic-Epoxy Coatings (3 mils DFT each coat).
 - a. California: No equivalent.
 - b. Devoe Coatings: "Tru-Glaze-WB N°. 4428 Waterborne Epoxy Gloss Coating.
 - c. Moore: "Industrial Acrylic Epoxy Enamel", N°s. P43/P44.
 - d. Pittsburgh: "Pitt-Glaze Water Based Acrylic Epoxy Enamels", 16 Series.
 - e. Sherwin-Williams: "Water Based Catalyzed Epoxy" B70/B60V15 Series.
 - f. Tnemec: "Tneme-Tufcoat", N°. 112.
- H. Interior GYPSUM BOARD (drywall) ceilings and underside of soffits:
 - 1. One coat latex primer.
 - a. Basis of Design: California: "Envirotech 646xx".

- b. Glidden Professional: "Lifemaster No VOC Primer N°. 9116".
 - c. Moore: "Eco Spec Interior Latex Primer Sealer", N°. 231.
 - d. Pittsburgh: "Pure Performance Interior Latex Primer", N°. 9-900.
 - e. Sherwin-Williams: "ProMar 200 Zero VOC Interior Latex Primer", B28 Series.
 - 2. Two coats eggshell paint:
 - a. Basis of Design: California: "Envirotech 735xx".
 - b. Sherwin Williams: "ProMar 200 Zero VOC Latex Eg-Shel," B20 Series.
- I. Interior METAL, ALUMINUM, shop primed and previously painted (includes counter supports):
 - 1. Touch up bare metal with latex metal primer.
 - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Devoe Coatings: Devflex 4020PF DTM Primer and Flat Finish.
 - c. Moore: "Metal Primer", N°. P04.
 - d. Pittsburgh: "Pitt-Tech DTM Primer/Finish 100% Acrylic", 90-709/712 Series.
 - e. Sherwin-Williams: "DTM Acrylic Primer Finish", B66 W1 Series.
 - 2. Two coats acrylic semi-gloss enamel:
 - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Devoe Coatings: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
 - c. Moore: "Super Spec HP DTM Semi-Gloss Enamel", N°. P29.
 - d. Pittsburgh: "Pitt-Tech Plus High Performance, Semi -Gloss DTM Industrial Enamel", 90-1210 Series.
 - e. Sherwin-Williams: "Sher-Cryl HPA Semi-Gloss", B66 Series.
- J. Interior METAL, FERROUS, excluding railings, to receive satin finish: (includes galvanized metal doors and frames):
 - 1. One coat of rust prohibitive primer for unfinished metal surfaces, and touch up bare metal at shop primed, existing and previously coated surfaces:
 - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Glidden Professional: "Devflex" N°. 4020 DTM Flat WB Primer/Finish.
 - c. Moore: "Acrylic Metal Primer", N°. P04.
 - d. Pittsburgh: "Pitt-Tech DTM Primer/Finish 100% Acrylic", 90-709/712 Series
 - e. Sherwin-Williams: "Pro-Cryl Primer," B66 Series.
 - 2. Two coats acrylic satin enamel:
 - a. Glidden Professional: "Devflex 4216HP Satin DTM WB Acrylic Enamel".
 - b. Moore: "Super Spec HP DTM Satin Enamel", N°. P29.
 - c. Pittsburgh: "Pitt-Tech Plus High Performance, Satin DTM Industrial Enamel", 90-1210 Series.
 - d. Sherwin-Williams: "Pro Industrial DTM Satin", B66 Series.

3. NOTE: Confirm compatibility of proposed coatings at exposed to view structural steel with intumescent fireproofing.
- K. Interior METAL, GALVANIZED, (includes exposed ductwork):
 1. Touch-up with metal primer.
 - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Glidden Professional: "Devflex" N°. 4020 DTM Flat WB Primer/Finish.
 - c. Moore: "Acrylic Metal Primer", N°. P04.
 - d. Pittsburgh: "Pitt-Tech DTM Primer/Finish 100% Acrylic", 90-709/712 Series.
 - e. Sherwin-Williams: "Pro-Cryl Primer," B66 Series.
 2. Two coats acrylic semi-gloss enamel:
 - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Glidden Professional: "Devflex 4216HP Semi-Gloss DTM WB Acrylic Enamel".
 - c. Moore: "Super Spec HP DTM Semi-Gloss Enamel", N°. P29.
 - d. Pittsburgh: "Pitt-Tech Plus High Performance, Semi -Gloss DTM Industrial Enamel", 90-1210 Series.
 - e. Sherwin-Williams: "Pro Industrial DTM Semi-Gloss," B66 Series.
- L. Interior exposed METAL, PIPING: Same as specified for ferrous metal.
- M. Interior WOOD, PLYWOOD TRIM and PANELS, unfinished, to receive painted (opaque) finish:
 1. One coat acrylic primer-sealer (undercoater):
 - a. Glidden Professional: "Prep and Prime Wall and Woodwork Acrylic Wood Undercoater", N° 1020-1200.
 - b. Moore: "Alkyd Enamel Underbody", N°. 217.
 - c. Pittsburgh: "Speedhide Alkyd Interior Quick-Drying Enamel Undercoater", 6-6 Series.
 - d. Sherwin-Williams: "Premium Interior Wall and Wood Primer", B28 Series.
 2. Two coats acrylic semi-gloss enamel:
 - a. California: "Fres-Cote Semi-Gloss", N°. 563.
 - b. Glidden Professional: "Ultra Hide" N°. 1416xxxx Semi-Gloss.
 - c. Moore: "Superspec Latex Semi Gloss", 276 Series.
 - d. Pittsburgh: "Speedhide Interior Semi-Gloss", 6-500 Series.
 - e. Sherwin-Williams: "Solo 100% Acrylic Interior Exterior Semi-Gloss," A76 Series.

1.3 PAINTING SCHEDULE FOR FIRE RESISTIVE AND RATED DESIGNATIONS

- A. In compliance with Massachusetts State Building Code, Ninth Edition (referencing the 2015 International Building Code) and as additionally specified herein, provide identification for all fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions and any other wall or partition which is required to have protected openings or penetrations.

1. Application:
 - a. Apply to outside of fire rated shafts, and to both sides of partitions at intervals not to exceed 30'-0" for entire length of partition or wall, or once on any partition 30'-0 feet or less in length.
 - b. Locate identification in all accessible concealed floor, floor-ceiling and attic spaces. Locate identification within 12 to 18 inches above finished ceilings.
 - c. Apply stenciled lettering by spray or brush, or provide permanent signage. Identification shall be waterproof, fade-proof and non-combustible. Signage shall be mechanically fastened or permanently adhered to partition.
 - d. Stencil character height: 1 inch minimum.
 - e. Color: Easily identifiable color, contrasting with background, acceptable to Owner.
2. Apply stenciled lettering to the following types of partitions using wording specified:
 - a. Applied identification for 3 hour fire rated partitions shall read: "3 HOUR FIRE WALL - PROTECT ALL OPENINGS".
 - b. Applied identification for 2 hour fire rated partitions shall read: "2 HOUR FIRE WALL - PROTECT ALL OPENINGS".
 - c. Applied identification for 1 hour fire rated partitions shall read: "1 HOUR FIRE WALL - PROTECT ALL OPENINGS".
 - d. Applied identification for Smoke barriers shall read: "1 HOUR SMOKE BARRIER - PROTECT ALL OPENINGS".
 - e. Applied identification for Smoke partitions shall read: "SMOKE BARRIER PARTITION - PROTECT ALL OPENINGS".

1.4 PAINTING SCHEDULE FOR MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black enamel.
- B. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
- C. Remove unfinished louvers, grilles, covers and access panels on and paint as scheduled above.
- D. Plywood backboards for electrical panels and other equipment. Paint both front and back surfaces and all edges of plywood backboards before backboards are installed.
 1. One coat latex primer-sealer (undercoater):
 - a. Glidden Professional: "Prep & Prime Odor-Less Interior Water-Based Primer-Sealer" LM 9116.
 - b. Moore: "EcoSpec Interior Latex Primer Sealer" 231.
 - c. Pittsburgh: "Pure Performance Interior Latex Primer".
 - d. Sherwin-Williams: "ProMar 200 Zero VOC Interior Latex Primer," B28 Series.
 2. Two coats latex semi-gloss paint:

- a. Glidden Professional: "Lifemaster 2000 Interior Semi-gloss" LM9200.
 - b. Moore: "EcoSpec Interior Latex Semi-gloss" N°. 224.
 - c. Pittsburgh: "Pure Performance Interior Semi-gloss", 9-500 Series.
 - d. Sherwin-Williams: "ProMaro 200 Zero VOC Semi-Gloss," B31 Series.
- E. Prime and paint insulated and exposed cold pipes, conduit, electrical boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are located in storage, mechanical or equipment spaces or those items which are factory prefinished.
- F. Exposed to view un-insulated hot pipes within finished painted areas: Two coats heat-resistant enamel conforming to Federal Specification TT-E-496, Type I, applied when surfaces are less than 140 degrees Fahrenheit.

End of Document

Section 10 11 16
MARKERBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install the following:
 - 1. Markerboards with magnetic surface.
 - 2. Tackrails, trim, marker tray, magnets, and accessories.
 - 3. And as indicated on the drawings.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.
- C. Section 09 29 00 - GYPSUM BOARD: Gypsum board substrate.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.
 - 1. ASTM A 424 - Steel Sheets for Porcelain Enameling.
 - 2. ASTM B 209 - Aluminum-Alloy Sheet and Plate.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets for each item furnished hereunder.
 - 2. Selection samples: Manufacturer's sample chain showing finishes and colors available, for both dry-marker boards, for selection by Architect.
 - 3. Selection samples: Manufacturer's fabric selection for tackboard covering.
 - 4. Provide maintenance information on regular cleaning and stain removal for marker boards.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.
- B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.6 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Provide manufacturer's standard 5 year warranty which shall include coverage of dry-marker board surfaces from discoloration due to cleaning.

1.7 MAINTENANCE

- A. Provide maintenance information on regular cleaning, stain removal for dry-marker boards.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Claridge Products & Equipment Inc., Harrison AR.
 2. Ghent Corporation, Lebanon OH.
 3. Marsh Industries, Inc., New Philadelphia, OH.

2.2 MARKERBOARD

- A. Magnetic markerboard surfaces:
1. Porcelain enamel writing surface, equal to Claridge LCS-3:
 - a. Bottom ground coat: 1.5 to 2.2 mils.
 - b. Top ground coat: 2.0 to 2.8 mils.
 - c. Color coat: 3.0 to 4.0 mils.
 - d. 5 foot high seamless units
 - e. Width as indicated on architectural drawings
 2. Face sheet color: As selected by the Architect.
 3. Core material for laminated construction: 7/16 inch fiberboard core.
 4. Backing sheet: Aluminum or steel sheet, minimum 0.015 inch thick.
 5. Exposed trim: Extruded 6063-T5 alloy aluminum, anodized, satin finished.

2.3 ACCESSORIES

- A. Provide sliding aluminum accessories, hook type, to fit display rail.
 - 1. Provide two sliding aluminum map supports for every 8 linear feet of marker board.
 - 2. For each classroom provide one flag holder.
 - 3. For each classroom provide two roller map brackets.
- B. Provide instructions for dry erase marker board cleaning on metal plate attached to perimeter frame near marker trough.
- C. Magnets as supplied by the manufacturer:
 - 1. Neodymium disc magnets, 0.125 inch thick by 0.75 inch diameter magnets in steel holders.
 - a. Provide (10) multi-color magnets per marker board.
- D. Tack strip:
 - 1. Aluminum channel/display rail, 2 inches high, full length of white board.
 - 2. Cork inserts.
 - 3. Provide hooks 6 feet on center.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and internal wall blocking are ready to receive work of this Section.
- B. Beginning of installation means acceptance of existing substrate.

3.2 INSTALLATION

- A. Install markerboards and tackboards in accordance with manufacturer's instructions. Protect porcelain enamel facing from chipping and damage during handling and installation. Install units level and plumb utilizing concealed continuous hangers wherever possible and where fasteners must be exposed, use tamperproof-type fasteners.
- B. Coordinate installation with interactive projector specified in Section 21 41 30 - VISUAL DISPLAY BOARDS

3.3 CLEANING

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Cover boards with protective cover taped to frame. Remove cover on Date of Substantial Completion.

End of Section

Section 10 14 00
SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install the following informational and directional signage:
1. Types 1A and 1B Interior Room Signage
 - a. Primary signage: Photopolymer AAB-compliant room signage adhered with double sided acrylic foam tape, typical at all permanent spaces (including but not limited to exam rooms, meeting rooms, staff offices, mechanical/electrical rooms); 0.16 inch thick, with backed acrylic polyurethane enamel paint, and raised Braille cells.
 - b. Mounting: Sixty (60) inches above finished floor to centerline of sign on latch side of door; no closer the nine (9) inches to centerline of sign from adjacent door swing or obstruction.
 - c. Sizes: Refer to Drawings and Signage Schedule
 2. Types 2A, Interior toilet room Signage
 - a. Raised pictogram, character and braille exit signage: Photopolymer AAB-compliant room signage; adhered with double sided acrylic foam tape, typical at toilet rooms
 - b. Mounting: Sixty (60) above finished floor to centerline of sign on latch side of door; no closer the nine (9) inches to centerline of sign from adjacent door swing or obstruction.
 - c. Sizes: Refer to Drawings and Signage Schedule
 3. Type 3A Interior Wayfinding Signage
 - a. Directional signage: Photopolymer AAB-compliant directional signage, adhered with double sided acrylic foam tape; locations to be reviewed and approved by the Architect
 - b. Mounting: Mounting height to be reviewed and approved by the Architect
 - c. Sizes: Refer to Drawings and Signage Schedule
 4. Type 4A, 4B and 4C Interior Informational Signage
 - a. Information Signage: Photopolymer signage with informational text per signage schedule, adhered with double sided acrylic foam tape; locations to be reviewed and approved by the Architect
 - b. Mounting: Mounting height to be reviewed and approved by the Architect
 - c. Sizes: Refer to Drawings and Signage Schedule
 5. Type 5A Interior Egress Plan Insert Holder
 - a. Egress Plan Display: Clear acrylic holder with slot for egress plan graphics, adhered with double sided acrylic foam tape, typical at all permanent spaces; plan inserts to be provided by Owner
 - b. Mounting: Mounting height and orientation to be reviewed and approved by the Architect
 - c. Sizes: Refer to Drawings and Signage Schedule

6. Type 6A: 1'-8" high three-dimensional letters and shapes with aluminum face and returns with baked enamel finish. Color selected by architect. Provide a custom shape based on vector file to be provided by the architect. Refer to drawing A12.1.
 - a. Mounting: Blind aluminum studs; letters drilled and tapped; provide spacer sleeves
 - b. Mounting height and method to be reviewed and approved by the architect.
7. Type 7A and 7B Custom Vinyl Die cut graphic. Refer to A12.1 Size indicated on drawings, mounting height to be reviewed and approved by the architect.
8. Type 10C 10D 10E
 - a. Exterior aluminum signage with painted text as indicated on the drawings.
 - 1) 10C: part# SAF-SKU-S-1845 from My Safety Sign
 - 2) 10D: part # #G5579-AL from My Safety Sign
 - 3) 10E: Part # S2-2869 from My Safety Sign
 - b. Mounting: mounting height to be reviewed and approved by the Architect
 - c. Sizes: Refer to Drawings and Sign Type Legend

1.2 RELATED SECTIONS

- A. Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS: Temporary project sign and safety signage.
- B. Section 03 30 00 – CAST-IN-PLACE CONCRETE: Installation of sign pedestal anchors into concrete.
- C. Section 06 10 00 – ROUGH CARPENTRY: In-wall support blocking
- D. Section 09 29 00 – GYPSUM BOARD: Gypsum board surface conditions.

1.3 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Manufacturer's product data sheets, specifications, physical properties for each item furnished hereunder.
 2. Schedule: The Architect will prepare and issue a schedule for all identification devices to be furnished hereunder, including character types, and colors. After receipt of the Architect's schedule, prepare and submit shop drawings and verification schedule.
 3. Shop drawings:
 - a. Plan drawing showing location of each interior and exterior sign. Coordinate plan with schedule.
 - b. Elevation drawings showing full size elevations of each sign. Indicate for each sign: sign styles, lettering and locations, and overall dimensions.
 - c. Large scale design details of signs, showing attachment clips and brackets; and complete installation details.

4. Selection samples:
 - a. Sample plastic chips indicating Manufacturer's full range of colors available for initial selection by Architect.
5. Verification samples:
 - a. Full size sample sign, of type, style and color specified including method of attachment.
 - b. Full size aluminum letter in specified size, finish and typeface, with mounting collar and stud
 - c. Full size sign in specified finish and typeface. Approved sample may be used in finished Project.

1.4 REGULATORY REQUIREMENTS

- A. Comply with all applicable federal, state and municipal codes, laws and regulations regarding signage for exits and handicapped barriers.

1.5 QUALITY ASSURANCE

- A. Sign fabricator specializing in the work of this Section with a minimum of 5 years experience.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivered packaged signs, labeled in name groups.
- B. Store all materials in an elevated dry location, protected by waterproof coverings. Store adhesive tape at ambient room temperature.

1.7 ENVIRONMENTAL CONDITIONS

- A. Do not install adhesive applied signs when ambient temperature is below 70 degrees Fahrenheit. Maintain this minimum during and after installation of signs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Interior plaque signs:
 - a. Basis of Design: Sunshine Sign, North Grafton, MA
 - b. Apco New England, Franklin, MA
 - c. Design Communications, Boston, MA
 - d. General Sign Company, Norwood, MA
 - e. Back Bay Sign Company, Somerville, MA
 2. Individual letter signage:
 - a. Basis of Design: Sunshine Sign, North Grafton, MA
 - b. ARK Ramos, Oklahoma City, OK.
 - c. Gemini Inc., Cannon Falls, MN

- d. Matthews International Corporation, Pittsburgh, PA
- e. Metal Arts, Mandan, ND.

2.2 SIGNAGE - GENERAL

- A. General: Provide sign copy to comply with the requirements indicated in the Drawings, for sizes, styles, spacing, content, positions, materials, finishes and colors of letters.
 - 1. All Signs shall conform to United States "*Americans with Disabilities Act*" and Commonwealth of Massachusetts Regulation 521 CMR: *Architectural Access Board*.
 - 2. Final placing, mounting heights and sizing of lettering shall be done as part of the shop drawing approval process, at which time the manufacturer shall make recommendations for Architect's review. Lettering shall have stroke width to height ratio and width to height ratio in accordance with the "*Americans with Disabilities Act*."
- B. Installation of all signs shall be done by vandal-proof method, fully described on the shop drawings.

2.3 INTERIOR PLAQUE SIGNAGE

- A. Photopolymer plaque signage (general requirements): Identification signs with raised tactile graphics, text, and Grade 2 Braille as indicated in schedule. Signs shall consist of 1/32 inch thick synthetic light sensitive photo emulsion permanently bonded to a rigid phenolic substrate, aluminum or acrylic plaque, in accordance with "*Americans with Disabilities Act*." Photopolymer to be bonded to sign plaque with appropriate laminating film as recommended by the photopolymer manufacturer.
 - 1. Lettering height: To be determined.
 - 2. Lettering font: Arial Regular
 - 3. Screenprinting: All screen printing graphics, including raised areas of tactile plaques except Braille, shall be screen printed in a contrasting color so as to meet the color contrast requirements of Americans with Disabilities Act.
 - a. All non-tactile text shall be screen printed with catalyzed epoxy ink. Applied vinyl lettering and graphics is not acceptable.
 - b. Apply screen printing inks evenly without pinholes, scratches or orange-peeling.
 - 4. Graphics: All text, symbols and graphics shall be reproduced utilizing computer generated digital art. All screen printed graphics shall utilize photographically prepared screens and shall be printed in accordance with industry standards. Hand-cut screens are not acceptable.
 - a. All edges and corners and letter forms shall be true and clean. Letterforms, color areas, or lines with rounded positive or negative corners, built-up edges, bleeding, spattering, etc., shall not be accepted.
 - b. Prepare artwork from typesetters reproduction of the test specified, minimum 1200 dpi resolution, camera ready artwork. All camera ready artwork and typesetting shall be no less than 75 percent of actual finished size.
 - 5. Mounting: Surface applied by means of silastic adhesive mounting.

6. Sign colors: As selected by Architect from manufacturer's standard and standard special colors.
 - a. All signs shall be two color signs.
7. Refer to drawings for designs and signage schedule.

2.4 SAFETY SIGNS

- A. Identification signage at Fire Extinguishers and AED Cabinet
 1. Allow one identification sign for every Fire Extinguisher and AED cabinet on the plans.
 2. Refer to drawings for designs and signage schedule.

2.5 EXTERIOR DOOR IDENTIFICATION SIGNAGE

- A. Signage at exterior doors: Fabricate die-cut copy characters, from opaque non-reflective cast vinyl film, with pressure sensitive adhesive backing, suitable for exterior applications, at interior and exterior sides of all exterior doors
 1. Letterform: 1.5-inch high, upper case, normal spacing with font directed by Architect
 2. Color: As Selected.

2.6 CAST METAL LETTERS

- A. Cast aluminum letters: Projecting individual cast aluminum letters, thickness and finish as indicated on the drawings, in typeface as selected by the Architect.
 1. Cast aluminum shall be solid aluminum, no scrap permitted. Cast aluminum shall be free of all porosity, with sharp corners, flat and accurate profiles. All exposed welds shall be filed smooth with all tool marks removed by fine abrasive grain air blasting or other approved method. All burrs and rough spots shall be removed and faces shall be polished to a uniform high luster finish. Aluminum shall be mechanically sanded and degreased prior to receiving finish. All coatings shall be true to form with no irregularities.

2.7 CUSTOM PRINTED VINYL WALL MURAL

- A. Basis of design: 3M: Envision Print Film 48C
 1. Description: Removable 3 mil thick non-PVC polymer film with a matte finish.
 2. GREENGUARD Gold certified
 3. Full color Digital Print: Eco-solvent Inkjet, Latex Inkjet, Solvent Screenprint or UV Screenprint, Design content to be provided by architect.
 4. Opacity: Opaque
 5. Color: White
 6. Removable with heat
 7. Dimensions: Custom size as indicated on drawings.
 8. Adhesive: Pressure-activated (slide, tack, snap-up, reposition) with air release channels, as recommended by the Manufacturer for the substrate.

2.8 ACCESSORIES

- A. Exposed mounting hardware: Chrome plated brass or bronze screws.

- B. Adhesive tape: Double sided acrylic foam tape, permanent adhesive, equal to 3M, St. Paul, MN, product: "3M VHB".
- C. Fasteners for entrance and exit signs: Concealed metal fasteners, non-corrosive to sign material or mounting surface.
- D. Anchors and inserts for cast aluminum letters:
 - 1. Mounting studs: Threaded type 304 stainless steel studs.
- E. Fasteners for existing interior brass plate signage: N°. 6 brass wood screws, round head.

2.9 FINISHES

- A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated.
- B. Metal Finishes: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations.
- C. Aluminum Finishes: Finish designations prefixed by AA conform to the system established by the Aluminum Association for designation aluminum finishes
 - 1. Class II Clear Anodized Fine Satin Finish: AA-M31C21 A31 (Mechanical Finish: Fine satin direction textured' Chemical Finish: Fine matte etched finish' Anodic Coating, Class II Architectural, clear film thicker than 0.4 mil.)
- D. Paints: Paint for signs is acrylic polyurethane enamel, eggshell finish. Paint for background of tactile photo-polymer signs is eggshell finish automotive grade lacquer. All surfaces shall be cleaned, primed and pre-treated according to the manufacturer's specifications and noted in Shop Drawings as part of the finished surface work.
- E. Inks:
 - 1. Inks for metal signs, glass and wall surfaces are Alkyd enamel based inks.
 - 2. Inks for plastic signs are lacquer based inks.
 - 3. Inks for tactile graphics on photo-polymer signs are eggshell finish Low Odor Vinyl Ink.
 - 4. Inks for filling acid-etched graphics in metal signs are semi-gloss epoxy ink.
 - 5. All inks and paints are evenly applied without pin-holes, scratches or application marks. Prime coats or other surface pre-treatments, where recommended by the manufacturers are included in the work and noted in the shop drawings as part of the finished surface work.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Locate sign units and accessories where indicated, locations in accordance with the approved shop drawings. Use mounting methods of the type described and in compliance with manufacturer's instructions.

- B. Install signs plumb, level and true to height indicated, with sign surfaces free from distortion or other defects in appearance.
- C. Shop fabricate signs where practical and deliver to site completely assembled. All joints of such fabricated work are completely smooth without apparent marks showing throughout the finish. All work "broken down" is erected so that all parts fit accurately with hairline joints, with all joints flush. Joints in lighted signs shall be light-proof.
- D. Wall and door mounted signs; All sign plaques mounted at glass door locations shall be backed with plaque of same size, thickness, material and color on opposite side to mask mounting adhesive.
 - 1. Attach to surfaces as follows:
 - a. Vinyl Tape Mounting: Use very high bond, double sided foam tape, of thickness indicated, to mount signs to smooth nonporous surface. Use construction adhesive in conjunction with foam tape.
 - b. Silicone Adhesive Mounting: Use appropriate liquid silicone adhesive to attach sign units to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape to hold the sign in place until the adhesive has fully cured.
- E. Dimensional Letters and Numbers: Mount letters and numbers using threaded studs, foam tape and construction adhesive as indicated in the detail drawings. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.

3.2 INSTALLATION - SIGN POST MOUNTED SIGN (EXTERIOR SIGN TYPE 23)

- A. Do not commence installation of sign post until immediately adjacent surfaces have been completely installed and finished.
- B. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.
- C. Set sign post absolutely level and in true line in concrete footing.

3.3 CLEANING

- A. Clean and polish installed signs.
- B. Upon completion of the work of this Section in any given area, remove tools and all rubbish and debris from the work area; leave area in broom-clean condition.
- C. Remove all names, stamps and decals of sign manufacturers, and installers. No visible advertising of any kind is permitted.

End of Section

Section 10 14 19.1
DIMENSIONAL LETTER SIGNAGE - EXTERIOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, project manual, and general provisions of the Contract, including, without limitation, General Conditions of the Contract, additional General Conditions of the Contract, and Division 1 specification sections, apply to this section.

1.2 SCOPE OF WORK

- A. The work of this Section shall include, without limitation, all labor, materials, and equipment required to install the exterior dimensional letter signage at the site entrance complete as specified. The signage shall be installed according to fabricator's recommendations and this section.

1.3 GUARANTEE & LIABILITY RELATED REQUIREMENTS

- A. Manufacturer shall guarantee all materials and workmanship for a period of one (1) year exclusive of vandalism. Powder-coated finish shall be guaranteed for 10 years. Manufacturer will be required to provide product liability insurance coverage in the minimum amounts of \$1,000,000.00 per incident.
- B. The Manufacturer will be required to provide complete installation drawings including specifications and a replacement parts list for all products.
- C. Contractor shall provide a written guarantee on his firm's letterhead for all materials and workmanship for a period of one (1) year exclusive of vandalism. Written guarantee shall be submitted to the Owner at the final inspection prior to final acceptance of the work.

1.4 REFERENCES

- A. Comply with all applicable requirements of the following standards. Where these standards conflict with other specified restrictions, the most restrictive requirements shall govern.
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM B 26 – Standard Specification for Aluminum-Alloy Sand Castings
 - b. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - c. ASTM B 221: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wires, Profiles, and Tubes
 - 2. American Architectural Manufacturers Association (AAMA)
 - a. AAMA 2605: High Performance Specification for Organic Coatings on Architectural Aluminum Extrusions.
 - 3. Federal Highway Administration
 - a. Manual on Uniform Traffic Control Devices (MUTCD), latest edition.

1.5 SUBMITTALS

- A. Product data for each type of product.
- B. Shop drawings for dimensional letter signs
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show layout of sign with all lettering, graphics, and attachment of lighting at least half size.
 - 4. Size of lettering and all graphic elements shall be compliant with FHA MUTCD.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component

1.6 QUALITY ASSURANCE

- A. Fabricator qualifications
 - 1. Fabricator shall have at least five years of fabricating similar type product in similar climatic conditions.
 - 2. Provide evidence of similar work.
- B. Installer qualifications.
 - 1. Installer shall possess at least five years experience installing similar work under similar conditions.
 - 2. Provide evidence of such experience.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Deliver materials in labeled, protective packages, when and as required.
- B. Storage and Handling Requirements:
 - 1. Store and handle in strict compliance with manufacturer's instructions.
 - a. Carefully store materials to avoid overloading any building component or structure.
 - b. Do not unpack material until it is to be set, unless un-packing is required for inspection by the Architect.
 - 2. Protect factory finished materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

1.8 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified period.

1. Failures include, but are not limited to, the following:
 - a. Deterioration of finished beyond normal weathering.
 - b. Separation or delamination of sheet materials and components.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change: 120 degrees F, ambient; 180 degree F, material surfaces.

2.2 DIMENSIONAL CHARACTERS

- A. Characters shall have uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
 1. Material: Aluminum
 2. Character height: Per Drawings
 3. Thickness: Manufacturer's standard for size of character.
 4. Finishes:
 - a. Baked-enamel or Powder-coat Finish: Manufacturer's standard, in color selected by Architect from manufacturer's full range.
 5. Mounting: No fasteners or hardware shall be exposed on the face of the signage. All hardware and fasteners shall be concealed by the sign.
 6. All lettering, numbering, graphic elements, and dimensional characters shall be compliant with FHA MUTCD, latest edition.

2.3 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
- B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- D. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as require for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. For exterior exposure, furnish stainless steel devices unless otherwise indicated
2. Sign mounting fasteners:
 - a. Fasteners shall not be visible from the face of the sign. Heads of all exposed fasteners shall be of the same color as the sign materials.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to the requirements indicated.
 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 5. Internally brace signs for stability and for securing fasteners.
 6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
 7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
 1. Aluminum brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign color unless otherwise indicated.
 2. Stainless Steel brackets – Factory finish brackets to match sign background with No. 4 finish unless otherwise indicated.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are in the same range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2605 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion cleaning, and applying and baking finish.

2.8 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 2. Directional Satin Finish: No. 4.
 - 3. Dull Satin Finish: No. 6.
 - 4. Reflective, Directional Polish: No. 7
 - 5. Mirrorlike Reflective, Nondirectional Polish: No. 8.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion, and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned. All fasteners shall not be visible from the front of the sign and shall be hidden from view.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

Section 10 28 13
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install toilet, bath, classroom sink and custodial accessories.
- B. Furnish concealed anchorage devices for handicap handrails for installation under Section 06 10 00 - ROUGH CARPENTRY.
- C. Furnish toilet and bath accessory templates, to locate anchorage reinforcement, to trades responsible.
- D. Install Owner-provided toilet accessories.
- E. Hardware to be furnished by Owner and installed in this Section

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 06 10 00 - ROUGH CARPENTRY:
 - 1. Wood blocking.
 - 2. Installation of concealed anchorage devices for grab bars in toilet rooms: Section 10 28 13 - TOILET ACCESSORIES.
- C. Section 08 80 00 - GLAZING: Frameless mirrors.
- D. Section 09 29 00 - GYPSUM BOARD: Gypsum board partitions and metal framing.
- E. Section 09 30 13 - CERAMIC TILING: Tiled walls as substrate for toilet accessories.
- F. Division 22 – PLUMBING: Plumbing fixtures.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible To and Usable by Physically Handicapped People.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, for each item furnished hereunder.
 - 2. Schedule: Complete schedule, indicating types, quantity, and model numbers of accessories for each location in which the accessories will be installed.

3. Selection samples: Sample color chips indicating each manufacturer's full range of colors available for selection by Architect.
4. 12 by 12 inch sample patch of shower curtain.
5. Verification samples: Complete units, as requested by Architect.

1.5 REGULATORY REQUIREMENTS

- A. Conform to applicable codes and accessibility regulations, and comply with ANSI A 117.1 for installation of work.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers or bundles bearing brand name, identification of manufacturer or supplier and item identification number corresponding with approved schedule.
- B. Store materials inside, under cover, and in manner to keep them dry, protected from weather, surface contamination, corrosion and damage from construction traffic and other causes.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.8 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Deliver to the Owner upon completion of the work of this Section, applicable manufacturer's standard warranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufactures and models: To establish a standard of quality, design, function desired, and appearance, Drawings and specifications have been based on manufacturers and model numbers specified herein below. Manufacturers offering products which may be considered as equal include the following:
 1. A&J Washroom Accessories, Inc., (A&J) New Windsor NY.
 2. American Specialties, Inc. (ASI), Yonkers NY.
 3. Bobrick Washroom Equipment, Inc. (Bobrick), Clifton Park NY.
 4. Bradley Corporation / Washroom Accessories Division, (Bradley) Menomonee Falls, WI.
 5. Rubbermaid Commercial Products, LLC., Winchester, VA.

2.2 TOILET ACCESSORIES

- A. Manufacturer: To establish a standard of quality, design, function desired, and appearance, Drawings and specifications have been based on manufacturers and model numbers specified herein below.

- B. Recessed Baby Changing Station (CT): Recessed-Mounted Horizontal Design Stainless Steel Baby Changing Station: Basis of Design: Model KB311-SSRE with external stainless steel bag hook as manufactured by Koala Kare Products, a Division of Bobrick. With the following characteristics:
1. Handles: Station shall have two solid handles that allow operation with less than 5 lbs. of force. Handles rest below 27" for cane detection when unit is in the down position.
 2. Front Panel shall be deep drawn, one-piece, seamless, 18-8, Type 304, 20 gauge (0.91mm) stainless steel with satin finish and laser etched logo with rounded corners.
 3. Aesthetics: Unit shall have no plastic covering or visible plastic on the front of the unit and no adhesive labels applied to the front panel.
 4. Flange: Deep drawn, one-piece seamless, 18-8, Type 304, 18 gauge (1.2 mm) stainless steel with satin finish. Flange edges and corners shall have radii that complements the arc on the top, bottom, and side edges of the front panel.
 5. Frame and Hinge Mechanism: Concealed 11-gauge chassis, compromised of 1" diameter integral steel-tubing that supports the changing bed and interacts with 11-gauge steel wall mounting bracket to provide steel-on-steel hinge stop. The wall frame shall serve as wall-mounting bracket.
 6. External Diaper Bag Hook: 18-8, Type 304, 3/4 inch (19mm) diameter, wall-mounted, solid stainless steel rod with satin-finish.
 7. Bed Surface: injection molded polypropylene with Microban® antimicrobial additive, and ISO 22196 tested for efficacy.
 8. Surface is contoured, concave and smooth. Bed surface shall be minimum 535 sq. in.
 9. Performance: Unit has minimal deflection from 90 degrees with a 200 lbs. static load placed in the center of the changing surface. Unit exceeds ASTM Standard F2285 static load requirement of 100 lbs.
 10. Complies with requirements applicable in the jurisdiction of the project, including but not limited to ADA, TAS, ICC A117.1, International Building Code (IBC), and state building code requirements as applicable. Also complies with ASTM Standard F2285, Standard Consumer Safety Performance Specification for Diaper Changing Stations for Commercial use and EN 12221 for changing units for domestic use.
 11. Dual Cavity Dispenser: Includes integral spring tab to make dispensing bed liners and diaper disposal sacks easier. Total 50 liner capacity. Equipped with tumbler lock, keyed a like Bobrick restroom accessories.
 12. Operation: Concealed pneumatic cylinder providing controlled opening and closing of the changing station bed.
 13. Instruction Graphics: Universal instruction graphics and safety messages in multiple languages.
 14. Safety Straps: Replaceable, restraining straps.
- C. Coat/robe hook (CH): Surface mounted satin finish stainless steel double robe hook, fabricated from 22 gage type 304 stainless steel, protrudes from wall nominally 1-7/8 inches.
1. Basis of Design: Bobrick model N°. B-7672.
 2. A&J, model N°. UX112-SF.

3. ASI model N°. 7345-S.
 4. Bradley model N°. 9124.
- D. Grab bars (of lengths and configurations as indicated): Stainless steel, minimum wall thickness 18 gage (Stub's gage), with non-slip knurled, peened or striated surface.
1. Grab bars: 1-1/4 inch diameter with satin finished ends, concealed 1/8 inch thick mounting flange with snap-on cover, equal to:
 - a. A&J series UG2X.
 - b. ASI series 3700.
 - c. Bobrick series B-5806.99.
 - d. Bradley series 832.
 2. Grab bar sizes:
 - a. GB1: 42 inches.
 - b. GB2: 36 inches
- E. Mirrors (M1), roll-formed angle framed: 18 inches wide by 30 inches high, having the following:
1. Frame: one piece 3/4" by 3/4 inch type 304 18 gage stainless steel roll formed frame, with continuous integral stiffener on all sides. Corners shall be heliarc welded, ground and polished smooth.
 - a. Exposed finish: Brushed satin
 2. Back: Mirror back shall be protected by full-size, shock-absorbing, water-resistant, non-abrasive 1/8" (3-mm) thick polyethylene padding. Galvanized steel backing shall have integral brackets for concealed mounting.
 3. Mirror glass: 1/4 inch thick clear glass, ASTM C 1048 with Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1, with Class 1, standard commercial quality, electro-copper back-plating protected by a corrosion-resistant zinc-coating.
 4. Corrosion resistant backing shall have minimum 15 year warranty.
 - a. Acceptable models:
 - 1) Basis of Design: Bobrick model N°. B-290.
 - 2) A&J model N°. U700-VC.
 - 3) ASI model N°. 0600
 - 4) Bradley model N°. 780.
 - 5) Meek model N°. M1210.
- F. Sanitary napkin disposal (FD): Surface mounted feminine napkin disposal unit, fabricated of type 304 stainless steel, with one piece cover.
1. Basis of Design: Bobrick model B-270 ("Contura" Series)
 2. A&J, model N°. U591
 3. A.S.I., model 0852
 4. Bradley model N°. 4722-15
- G. Coordinate the installation of Owner Furnished Contractor Installed (OFCI) toilet accessories:
1. Toilet paper dispensers.

2. Soap dispensers.
3. Wall mounted glove dispensers.
4. Paper towel dispensers.
5. Free standing waste receptacles.

2.3 LOCKS

- A. General: All locks shall be keyed alike. Provide four (4) keys, for lockable accessories, to the Owner.

2.4 INSTALLATION ACCESSORIES

- A. Fasteners, screws, and bolts: Type 304 stainless, tamperproof.
- B. Expansion shields: Fiber, lead or rubber as recommended by accessory manufacturer for component and substrate.

2.5 FABRICATION

- A. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion, scratches or dents. Weld and grind smooth joints of fabricated components.
- B. Back paint components where contact is made with building finishes to prevent electrolysis.
- C. Shop assemble components and package complete with anchors and fittings. Hot dip galvanize exposed and painted ferrous metal and fastening devices. Provide steel anchor plates, adapters, and anchor components for installation.

2.6 FACTORY FINISHING

- A. Ferrous metals: Clean and treat, spray apply one coat of baked-on rust and moisture-resistant primer, followed by two coats of baked-on synthetic enamel, in selected colors. Ensure that finish coating is uniform in color intensity and degree of gloss, throughout.
- B. Chrome/Nickel Plating: ASTM 456, Type SC2, satin finish.
- C. Stainless steel: Number 4 satin finish, except as otherwise specified above under the Article entitled "Toilet Accessories".

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide templates and rough-in measurements as required. Deliver inserts and rough-in frames to site at appropriate times for building-in by other trades
- B. Coordinate with trades responsible for providing receiving surfaces on which accessories will be installed.
- C. Exact locations of accessories within each room or area shall be as directed by the Architect.

3.2 INSTALLATION

- A. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.
- B. Install toilet accessories absolutely level and in true line, securely and rigidly anchored with theft proof fasteners of the size and type most appropriate for the specific receiving surface, concealing the fasteners as far as practicable.

3.3 ADJUSTING

- A. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

3.4 CLEANING

- A. Remove all protective films and coverings from accessories, and clean and polish each piece. Remove all rubbish, packing materials, and debris, caused by the work of this Section.

End of Section

Section 10 40 00
SAFETY SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install:
 - 1. Fire extinguisher cabinets, non-rated types, including signage
 - 2. Fire extinguisher brackets, including signage
 - 3. Fire extinguishers: Provide 20-pound capacity extinguishers at locations called out on the Drawings.
 - 4. Defibrillators and semi-recessed cabinets, including signage
 - 5. First aid kits for Chapter 74 spaces.
 - 6. Safety data sheet storage cabinets.
 - 7. Cabinet and bracket accessories.
 - 8. Lead vest hanger.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 04 20 00 - UNIT MASONRY: Concrete masonry unit partitions.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood rough-in framing and blocking.
- D. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Framed wall openings
- E. Section 09 29 00 - GYPSUM BOARD: Gypsum wallboard finishes.
- F. Division 21 - FIRE SUPPRESSION: Fire hose connections and related cabinets and accessories.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. NFPA 10 – Standard for Portable Fire Extinguishers, 2013 Edition.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, indicating: fabrication specifications, finishes, dimensions of cabinet and rough opening, and installation instructions.
 - 2. Shop drawings: Details showing unit dimensions, methods of construction, attachment clips and brackets; and complete installation details.

3. Selection samples: Samples indicating metal finishes available for selection by Architect.
 - a. Provide additional samples as requested by Architect to facilitate initial selection of colors and finishes
4. Verification samples: Fire extinguisher cabinet in specified size, finishes, and door type, if requested by Architect.

1.5 REGULATORY REQUIREMENTS

- A. Obtain certificate of compliance from authority having jurisdiction indicating approval of fire extinguisher cabinets and their installed locations.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver cabinets or extinguishers to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Store cabinets and extinguishers inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1.7 SPARE STOCK

- A. Provide one (1) spare fire extinguisher cabinet of each type specified herein.
 1. Types shall include with and without fire blankets
 2. Types shall include semi-recessed and surface-mounted.

1.8 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. J.L. Industries, Bloomington MN.
 2. Larsen Manufacturing Co., Minneapolis MN.
 3. Potter-Roemer, Union NJ.
 4. Strike First Corporation of America, Front Royal, VA (*fire extinguishers only*).
 5. Amerex Corporation, Trussville, AL (*fire extinguishers only*).

2.2 FIRE EXTINGUISHERS CABINETS AND BRACKETS

- A Semi-Recessed Fire Extinguisher Cabinets:

1. Cabinet trim style: Square
 - a. Protruding from wall: 1-1/4"
 2. Door and trim: Type 304 Stainless steel with a Number 4 (satin) polished finish.
 - a. Vertical duo design with tempered glazing.
 - b. Vigilante alarm: Provide 9-volt, battery operated (battery included), plunger activated vigilante alarm.
 - c. Handles: Red door handles having raised letters "FIRE".
 - d. Lettering: Factory applied die-cut lettering, applied to metal portion of door.
 - 1) Pattern: Vertical reading.
 - 2) Color: Red
 3. Cabinet construction:
 - a. Non-rated cabinet construction: 18 gage cold-rolled steel with factory applied baked acrylic enamel corrosion-resistant finish.
 4. Acceptable models for non-fire-resistant rated assemblies:
 - a. JL Industries "Cosmopolitan Series", model number C2036.
 - b. Larsen "Architectural Series", model number SS2712-RK.
 - c. Potter-Roemer, "Alta Series", model number 7067.
 5. Acceptable models for fire-resistant rated assemblies:
 - a. JL Industries "Cosmopolitan Series", model number 2036-FX2.
 - b. Larsen "Architectural Series", model number FS-SS2712-RK.
 - c. Potter-Roemer, "Alta Series", model number FRC7067.
- B. Wall mounting bracket: 16 gage steel surface mounted bracket, with red or black glossy polyester thermos-set coating, equal to the following, location as selected by the Architect.
1. Basis of Design: JL Industries model number "MB-810"
 2. Larsen model number "864"
 3. Potter-Roemer model "3903"

2.3 FIRE EXTINGUISHERS

- A. Extinguishers: Multi-purpose dry chemical type (mono ammonium phosphate), 20-pound capacity, multi-purpose rated '10A, 120B:C'; with metal valves and siphon tubes, replaceable molded valve stem seals, pressure gauges and hose discharge.

2.4 EMERGENCY AID SPECIALTIES

- A. Automated External Defibrillator:
1. Basis of Design: Powerheart ® G5 AED Automatic as manufacturer by Cardiac Science and shall include the following requirements:
 2. Fully automatic operation
 3. Dual language functionality
 4. RescueCoach Voce and text prompts

5. Intellisense Battery with 5-year shelf life and 4-year performance guarantee
6. 1 pair ICPR adult defibrillation pads
7. English/Spanish user manuals, getting started guides, and steps to rescue
8. AED manager reporting software with USB Communication Cable
9. Ready kit which includes nitrile gloves, razor, scissors, towel, 4-inch gauze, antiseptic wipes, one-way mask, and D-ring attachment
10. School Health AED Wall Decal
11. School Health AED Inspection Tag

B. Defibrillator cabinet:

1. Automated External Defibrillator cabinet shall be:
 - a. Recessed or semi-recessed, as shown on drawings; #4 Brushed stainless steel assembly.
 - b. Door shall be #4 brushed stainless steel, tempered glazing, pull and AED Decal.
2. Locations: As indicated on Drawings

2.5 SAFETY DATA SHEETS STORAGE CABINETS

- A. Wall mounted cabinet at each Classroom, Teaching Hub and Day Boarding, for protection and storage of safety data sheets complying with the following requirements
1. Material: 20 gage steel, minimum.
 2. Color: Manufacturer's standard safety yellow.
 3. Operation: Door held closed with integral magnetic catch.
 4. Mounting: Wall mounted at rear of cabinet.
 5. Accessories: 2-1/2-inch-thick binder to hold safety data sheets in number required for documents at each location.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Accurform, Brooksville, FL, model "ZRS390".

2.6 FIRST AID KITS

- A. Wall-mounted, plastic, industrial, general purpose first aid kit sized to serve 75 people, meeting OSHA 29 CFR 1910.151 (b) standards as well as the following:
1. Components: kit shall include minimum 200 bandages (both plastic and fabric), first aid tape, ammonia inhalants, antiseptic towelettes, burn cream, cold packs, self-adhering wraps, eyewash, first aid guide, tweezers, sting relief wipes, nitrile exam gloves, iodine infection control wipes, aluminized rescue blanket, various sized sterile gauze pads, scissors, eye pads, wire splint
 2. Locations: Classrooms and Teaching Hub, where indicated on drawings
 3. Basis of Design Product: To establish a standard of quality, design, and function desired, Drawings and Specifications have been based on W.W. Grainger, Inc., item 463M19 or approved equal.

2.7 SIGNAGE

- A. Types 8A and 8B Interior Projecting Safety Specialties Signage
 - 1. Fire extinguisher and AED location signage: Projecting V-shaped acrylic signage, mounted directly above fire extinguishers, fire extinguisher cabinets, and AED cabinets
 - 2. Sizes: Refer to Drawings and Signage Schedule

2.8 VINYL STRIP SAFETY CURTAINS AND TRACKS

- 1. At door opening D326A, and as identified on the drawings
 - a. Strip Width: 8"
 - b. Overlap: 25%
 - c. Color: Clear
 - d. Mounting: steel grommet reinforced holes
- 2. Overhead Track
 - a. 14-gauge heavy duty galvanized steel, U-shaped channel
 - b. Jamb mount
 - c. Roller Carrier: heavy-duty galvanized steel chassis with nylon rollers and stainless-steel bearings.
- 3. Acceptable Manufacturers
 - a. PlasticStripCurtain.com, (800) 795-3083
 - b. Singer Safety Company, 2300 N. Kilbourne Ave, Chicago, IL, 60639, (866) 933-2359, singersafety.com
 - c. Approved equal

2.9 LEAD VEST HANGER

- A. Wall mounted lead apron peg rack at x-ray room in location noted on drawings
 - 1. Material: .38" min. thick steel
 - 2. Color: White powder coat
 - 3. Mounting: Wall mounted – plywood blocking in wall
 - 4. Pegs: 4.3" long x 0.44" diameter
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Phillips Safety Product Inc. Middlesex, NJ. Model: RAR P2

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Verify that prepared openings are ready to receive extinguisher cabinets.

- C. Beginning of installation means acceptance of project conditions.

3.2 INSTALLATION

- A. Install fire extinguisher cabinets in accordance with manufacturer's instructions in locations indicated, and as additionally directed by regulatory authority having jurisdiction.
 - 1. Provide cabinets for locations as indicated, and as additionally directed by Architect and local regulatory authority.
- B. Do not commence installation of fire extinguisher cabinets until immediately adjacent surfaces have been completely installed and finished.
- C. Install cabinets absolutely level and in true line, with units securely anchored to the surrounding construction. Fit trim pieces accurately and tight to adjacent construction.
 - 1. Maximum variation from plumb and level: 1/8 inch.
 - 2. Maximum offset from true dimensional alignment: 1/4 inch.

3.3 CLEANING AND ADJUSTMENT

- A. Upon completion of the work of this Section in any given area, remove tools, and all packaging and debris from the work area; leave area in broom-clean condition.
- B. After adjacent work is complete:
 - 1. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.
 - 2. Remove all tape and other packing materials from fire extinguisher cabinets .
 - 3. Thoroughly clean and polish all exterior and interior surfaces of extinguisher cabinets, take care to remove dirt from corners. Clean metal and [glass] [plastic] surfaces with mild cleaning agents as recommended by manufacturer.
 - 4. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.

End of Section

Section 10 51 13
METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this Section consists of furnishing and installing metal lockers with all required closures, filler pieces where shown on the Drawings, as specified herein, for a complete and proper installation. Work includes, but is not limited to:
 - 1. Three tier, sloped-top, ventilated metal lockers at Student Corridor D317
 - 2. Five percent (5%) of the total number of each locker type or a number in accordance with applicable code requirements shall be accessible and located by the Architect.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood bases, wood sleepers and blocking behind corridor lockers.

1.3 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - 2. Warranty: Provide sample copies of manufacturers' actual warranties, clearly defining all terms, conditions, and time periods for the coverage thereof.
 - 3. Shop drawings:
 - a. Plans, at scale to match Contract Drawings, of each area with specified lockers, include layout of all lockers, closures, and filler panels and large scale details of locker construction; and details of accessory items. Plans shall show locker number sequence.
 - b. Large scale details of locker construction, showing filler panels, sloping top components, attachment clips, brackets and complete installation details.
 - 4. Selection samples: Manufacturer's color chips, comprising at least 8 different colors, for selections by the Architect.
 - 5. Verification samples: Color chips of custom colors to match Architect's sample.
- B. Submit manufacturer's warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS and in compliance with Section 01 78 36 – WARRANTIES.

1.4 QUALITY ASSURANCE

- A. Obtain lockers from a single manufacturer, or from manufacturers recommended by the prime manufacturer of lockers.

- B. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1.5 QUALIFICATIONS

- A. Manufacturer, with a minimum of 3 years' experience demonstrating previously successful work of the type specified herein.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Do not order or fabricate lockers, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Store lockers inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows, or doors to place and install the work of this Section shall be performed at no additional cost to the Owner.

1.8 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, under provisions of Section 01 78 00 – CLOSEOUT SUBMITTALS, deliver to the Owner extra materials for future repairs and maintenance.
 - 1. Furnish replacement locker doors and hardware for 5 percent of each type and color of locker specified, but not less than one of each type.
 - 2. Clearly label and package extra materials securely to prevent damage.

1.9 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Penco Products, Inc., Oaks, PA, product, "Guardian Plus"

- B. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Penco Products, Inc., Oaks, PA.
 - 2. Lyon Metal Products, Inc., Aurora, IL.
 - 3. List Industries, Inc., Deerfield Beach, FL.

2.2 MATERIALS

- A. Sheet Steel: Mild cold-rolled and leveled steel, free from buckle, scale, and surface imperfections.
- B. Expanded Metal: 3/4 inch mesh flattened carbon steel, 13 gage minimum.
- C. Fasteners: Cadmium, zinc, or nickel plated steel; exposed bolt heads, slotless type; self-locking nuts or locker washers for nuts on moving parts.
- D. Equipment: Hooks and hang rods of cadmium-plated or zinc-plated steel or cast aluminum.

2.3 LOCKER TYPES

- A. Three tier wardrobe locker 12 inches wide by 15 inches deep by 60 inches high at front.

2.4 LOCKERS GENERAL (ALL TYPES)

- 1. General design, equal to Penco Products, Inc., Oaks, PA, product: "Vanguard Lockers".
- 2. Body: Sides and backs minimum 24 gage. Tops, bottoms, shelves and sides minimum 16-gage. Flange tops, bottoms and shelves on four sides, and backs on two sides.
 - a. Form exposed ends of lockers of minimum 16-gage steel.
- 3. Door frame and cross members: 16 gage channel with continuous door stop/strike integral with frame on both sides of opening.
- 4. Door: Flush design, double wall construction, with louvers at top, 14 gage steel, formed with full channel shape on lock bar side, channel formation on hinge side and flanged top and bottom. Fabricate to swing 180 degrees.
- 5. Hinges: Three 5 knuckle, 2 inch high full loop pin hinge welded to frame and riveted to inside of door flange.
- 6. Door handle:
 - a. Latch design: operable by "club fist" required by Massachusetts Architectural Access Board Regulations.
 - b. Latching method: Two point latching with spring steel latch contained in a lock bar under tension. Lock bar contained in door channel by self-lubricating polyethylene guides. Provide frame hooks welded to door frame, furnished with soft rubber silencers at each hook.
 - c. All locker locks built-in combination locks. The built-in combination locks shall allow for five (5) combination changes, be master key controlled, and have a stainless-steel escutcheon plate. The master key shall match the Owner's existing locker master key.

7. Accessories:
 - a. Double prong hook mounted to underside of locker top or back of locker.
 - b. Single prong hook mounted on each side of locker.
8. Base: Fire retardant treated wood base and sleepers provided under Section 06 10 00 – ROUGH CARPENTRY.
9. Sloping tops: 18 gage steel minimum having a sloped rise approximately 18 to 25 degrees, finished to match lockers, in lengths as long as practicable, but not less than 4 lockers. Provide closures at ends finish to match lockers.
10. Filler panels: 16 gage steel minimum, factory-fabricated and finished to match locker units.
11. Trim: 18 gage steel minimum finished to match lockers. Secure with concealed fasteners.
12. Accessories:
 - a. Number Plates: Provide each locker door with polished aluminum number plate with black numerals not less than 1/2 inch height.
 - b. Coordinate numbering with the Owner's existing numbering schedule.
 - c. Self-Adhered universal accessible signage at selected accessible lockers.

2.5 FACTORY FINISHING

- A. Clean, degrease, and neutralize metal; prime and finish with manufacturer's standard 2 mil thick minimum powder coat baked enamel finish:
 1. Colors:
 - a. Paint locker bodies and doors in a single custom color as selected by the Architect from the manufacturer's full range of standard and custom colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that field measurements are as indicated on reviewed and approved shop drawings.
- B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. During the operation of work of this Section, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled to match original finishes.

3.3 INSTALLATION

- A. Do not commence installation of lockers until immediately adjacent surfaces have been completely installed and finished.

- B. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.
- C. Furnish and install all sloped top pieces as required, refer to the Drawings for the various conditions.
- D. Furnish and install all filler pieces as required and to align with ends of partitions. Refer to the Drawings for the various conditions.
- E. Set lockers absolutely level and in true line, with units bolted together and to the surrounding partitions, to provide a rigid and secure installation. Conceal screw heads and bolts as far as practicable, leaving exposed panels completely free from unused bolt holes.

3.4 ADJUSTING AND CLEANING

- A. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.
- B. Remove all tape and other packing materials from locker surfaces, and thoroughly clean and polish all exterior and interior surfaces.
- C. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.

3.5 PROTECTION

- A. Protect locker finish surfaces and hardware from damage until Owners Final Acceptance.

End of Section

Section 12 24 00
WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install the following:
 - 1. Chain driven, manually operated single roller-screens for interior light-filtering shading at exterior perimeter windows
 - 2. Chain driven, manually operated single roller-screens for privacy blinds at windows and at interior hollow metal frame where indicated.
- B. Locations
 - 1. Provide shades at all exterior windows except as otherwise specified herein below, refer to plans, interior and exterior elevations for sizes and types. Field verify all openings.
 - 2. Do not provide shades at the following locations:
 - a. All stairs and vestibules.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 06 10 00 - ROUGH CARPENTRY: Blocking for window shade systems.
- C. Section 09 29 00 - GYPSUM BOARD:
 - 1. Substrate for window shade systems.
- D. Section 09 51 00 - ACOUSTICAL CEILINGS: Relationship of window shades to acoustical ceilings.
- E. Division 26 - ELECTRICAL: Electrical supply wiring and switches.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section - REFERENCE. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. NFPA 701 - Standard Methods of Fire Tests for Flame-resistance Textiles and Films.
 - 2. NFPA 70 - National Electrical Code.
 - 3. UL 214 - Standard for Tests for Flame Propagation of Fabrics and Films.

1.4 PERFORMANCE REQUIREMENTS

- A. Fire performance characteristics; shade material tested in accordance with NFPA 70 1- Vertical Burn Test, rated "FR".

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - a. Provide additional information required for fabric, including: Size limitations, fire resistance information. Identify available shade cloth colors and materials.
 - b. Provide color chips for exposed painted components.
 - c. Note on submittals any deviations from specified requirements and the reasons thereof.
 2. Maintenance Information: Fabric maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
 3. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
 4. Certifications:
 - a. Certify the shade system is fully compatible with the specified electrical design.
 - b. Manufacturer shall submit notarized certificate indicating compliance with requirements of specifications and that specified warranty will be provided without restriction.
 - c. Certification of compliance with current building code and environmental regulations: Manufacturer shall certify that materials proposed for use comply with applicable building code and environmental regulations.
 - d. Authorization for Deviations From Specifications: If any deviations from specifications have been accepted, include written description and reasons for deviations. Include authorization for change signed by Owner, Architect, Engineer, and person submitting change. Authorization for change shall also clearly indicate party responsible for remedying defects.
 5. Shop drawings:
 - a. Dimensioned 1/4 inch scale drawings, bearing dimensions of actual measurements taken at the project, where practical.
 - b. Include complete fabrication details and erection drawings.
 6. Wiring Diagrams and Schematics: Submit detailed wiring diagrams and schematics of the entire system, and each component of the system with a detailed list of the components, wiring schematics, and operational characteristics at every level of operation.
 7. Selection Samples:
 - a. 3 by 5 inch size shade cloth and liner sample swatches indicating Manufacturer's full range of colors and patterns available for initial selection.
 - b. Provide additional shade cloth and liner samples, of size requested by Architect, to aid in the Architect's selection.

8. Verification Samples: One fully operational window shade sample, 24 by 24 inches complete with selected shade cloth, liner and hem bar mounted to specified roller mechanism .

1.6 QUALITY ASSURANCE

- A. Obtain shade operators and fabric products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of operator.
- B. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1.7 QUALIFICATIONS

- A. Installer, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Do not deliver shades to the project until all concrete, masonry, plaster and other wet work has been completed and is dry.
- C. Deliver prefabricated shades to site in labeled protective packages, uniquely identified for each intended location. Schedule delivery of panels to prevent delays of the Work, and minimize on-site storage.
- D. Store materials in manner recommended by shade manufacturer, inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
- E. Maintain ambient temperature between 60 and 85 degrees Fahrenheit, and a relative humidity between 20 and 50 percent for a period starting 24 hours before installation of window shades, and maintain until Owner's Final Acceptance.

1.9 FIELD MEASUREMENTS

- A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
- B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.11 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Manual operating components: Manufacturer's 10 year warranty from Date of Substantial Completion of shade installation. Warranty shall include provisions that installation shall remain operational without fault and include all operating parts, except for the bead chain which is not warranted.
- C. Motorized components: Manufacturer's 1 year warranty from Date of Substantial Completion of project. Warranty shall include provisions that installation shall remain operational without fault for the warranty period including coverage of motor, electrical controls and override circuits.
- D. Shade cloth: Manufacturer's 10 year warranty from Date of Substantial Completion of shade installation. Warranty shall include provision that shade cloth will not fade, deteriorate, sag or warp for the warranty period.

1.12 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, deliver to the Owner extra materials for future repairs and maintenance.
 - 1. Furnish 1 percent of each size, type and color of window shades specified, but not less than 2 of each type.
 - 2. Clearly label and package extra materials securely to prevent damage.

PART 2 – PRODUCTS

2.1 MANUFACTURER AND TYPE

- A. Clutch and chain mechanism shade, institutional quality mounted on one-piece roller with end support brackets and bead chain clutch operator. Shades shall be: Draper FlexShade as manufacturer by Draper Shade and Screen Co., Spiceland IN., or equal, as manufactured by one of the following:
 - 1. Draper Shade and Screen Co., Spiceland IN.
 - 2. Levolar Corporation, Sunnyvale CA.
 - 3. MechoShade, Long Island City, NY.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire performance characteristics; shade material tested in accordance with NFPA 70 1- Vertical Burn Test, rated "FR".
- B. Electrical control equipment must be wired in accordance with the shade manufacturer's wiring diagrams and in accordance with the National Electrical Code and local codes.

2.3 MANUFACTURERS AND TYPES

- A. Specified Manufacturer for manual shades: To establish a standard of quality, design and function desired, Drawings and specifications have been based on products from MechoShade, Long Island City, NY as follows:

1. Typical shades: MechoShade, product: "Mecho/5 Shade", manually operated.
2. Hunter Douglas Architectural, product "RB-500+ Heavy Duty Clutch – 4" Fascia Roller Shade System.

2.4 SHADE COMPONENTS

- A. Clutch operator: Bi-directional clutch and beaded chain mechanism, fabricated from high-strength glass-fiber -reinforced polyester and high-carbon steel springs. Control loop chain shall endless nickel-plated brass bead chain; plastic bead chain is not acceptable.
 1. Furnish flexible offset drive, where required, with universal joint permitting up to 12 degree angle between any two shades with a single operator.
 2. Provide all shades with chain hold down, spring-tension pulley and shock absorber.
- B. Rollers: Removable, 1-1/2 inch or larger diameter, extruded aluminum alloy 6063-T5 or alloy 6063-T6 tube with a minimum wall thickness of 0.065 inch.
 1. Shade mounting spline: Extruded vinyl spline, enabling shade cloth to be removed without having to remove the tube from retainer brackets or without removing brackets from wall
 2. Tube Support: Delrin cover plate shall provide protection from tube dislocation. In the event the tube is pushed out of place, the Delrin end of the mounting plates shall contain the tube preventing the tube from falling out of the bracket.
- C. Mounting Brackets: Zinc chromate finished 16 gage steel in manufacturer's standard configuration for head or wall mounting.
- D. Roller idler assembly: Type 6/6 injected molded nylon or high-strength glass-fiber -reinforced polyester outside sleeve, with zinc plated steel pin.
- E. Shade fabrics:
 1. Solar/privacy fabric, PVC-Free: MechoShade Ecoveil, 0950 series, fabricated from thermoplastic olefin (TPO) for both core yarn and jacket, woven in a 2 by 2 non-directional basketweave, meeting the following minimal requirements:
 - a. Minimum thickness: 0.030 inch (0.762 mm).
 - b. Flame retardant treated certified in conformance with NFPA 701, UL 214,.
 - c. Maximum open in weave: 1 percent.
 - d. Color: As selected by Architect.
 - e. Fading:
 - 1) UV test 200 sun-fade hours: no change.
 - 2) UV test 500 sun-fade hours: Maximum 5 percent change.
 - f. Seamless up to 126 inch width.
 - g. Hem pocket: Provide hem pocket, heat sealed or sewn with bottom weight enclosed.
 - h. Fabric warranty: Manufacturer's standard 10 year limited warranty.
- F. Recessed housing, for gypsum board ceilings with removable closure plate for access.

- G. Guide cables provide where recommended by manufacturer.

2.5 MANUAL OPERATION

- A. General: Bi-directional clutch and beaded chain mechanism with adjustable brake to permit dynamic mode with predetermined stop positions or, static mode with infinite stop positions.
 - 1. Sprocket: One piece injection molded high density Delrin, capable of full engagement with ball chain.
 - 2. Control loop chain shall endless nickel-plated brass bead chain; plastic bead chain is not acceptable.
 - 3. Brake mount: Shake-proof steel and nylon vibration-resistant locking nut to maintain selected braking friction
 - 4. Self-Adjusting linear disc brake (flat steel backing plate is not acceptable as a substitution) with concealed tension adjustment device.
 - a. System shall consist of a compression spring with two friction-absorbing nylon washers on a 1/4" steel shaft which provides continuous uniform compensating brake pressure on the one-piece sprocket brake drive component with a braking surface of not less than 2.89 square inches
 - b. Provide a compression spring which also acts as a vibration absorber.
 - 5. Flexible offset drive, where required, with universal joint permitting up to 12 degree angle between any two shades with a single operator.
 - 6. Provide anchor catch for each chain.

2.6 ELECTRICAL OPERATION

- A. System Description:
 - 1. Ultra-quiet, precision-controlled electronic drive unit housed inside roller tube, controlling shade movement.
 - 2. Audible noise: Maximum 44 dBA measured 3 feet from electronic drive unit. No audible clicks when motor starts or stops.
 - 3. Allow for all windows within designated space to be integrated under single gang controls. Work scope includes roller shades, drive units, pockets and fascias, shade controls, and power supplies.
 - 4. Control shade speed for tracking within plus or minus 0.0625 inch throughout entire travel.
 - 5. Include 10 year power failure memory for preset stops, open and close limits, shade grouping and subgrouping, and system configuration.
 - 6. Systems with multiple electronic drive units electronically synchronized to start, stop, and move in unison.
- B. Grouping:
 - 1. Keypads and contact closure inputs can control any electronic drive unit without separate group controller.
 - 2. System groups and subgroups configured at point of control without rewiring and without access to electronic drive unit.
 - 3. System may contain multiple electronic drive units.

4. Keypads and interfaces able to operate any group or subgroup of electronic drive units.
- C. System Controls:
1. Shades controlled by built-in shade columns on lighting control or by keypad.
 2. Electronic drive units, keypads, and lighting controls contain microprocessors, allowing high level programming from any source.
 3. System devices, including shades and lighting controls, connected through common communication link.
 4. Provide key switches with stainless steel wall plates. Confirm locations with Architect. ~~(Add. #4)~~
- D. System Performance:
1. One-touch control of shades by means of any combination of the following, keypad, lighting control, or infrared remote, as determined by Architect during shop drawing phase.
 - a. Black out shades shall be controlled by switch only.
 2. Capable of stopping within accuracy of 0.125 inch at any point between open and close limits.
 3. Store over 250 programmable stop points, including open, close, and any other position.
 4. Presets set by 5-second button push and hold from keypad, lighting control, or handheld remote control.
 5. Presets recalled by keypad, contact closure input, infrared receiver, or other lighting control system interface.
 6. Open and close limits programmable from electronic drive unit, lighting control, wall-mounted keypad, or handheld remote control.
 7. System components electro static discharge protected.
- E. Master Control Systems:
1. Primary control of shades shall be equal to MechoShade "Multi-Zone Controller" for sun activated, temperature or pre-programmed timer activated controls and automatic adjustment of shade positions. System shall be capable of controlling all zones individually or collectively through four low voltage control wires as indicated in electrical drawings.
 2. Each zone shall be capable of being operated by a momentary double-pole, double-throw switch located remotely, overriding automatic controls.
 3. Master Controller Hardware:
 - a. Standard IBM XT or AT compatible computer equipped with all necessary interfacing hardware to accept the following inputs:
 - 1) Analog inputs for photocells (solar level detection).
 - 2) Digital inputs for building computer priority commands.
 - 3) Inputs for fire alarm and additional non-designated ports.
 - 4) Cable: 4-wire shielded communication cable.
 4. Master Controller Software; shall be capable of providing following functions for each individual zone. These functions must be capable of adjustment or definition by the user through menu driven screens and keyboard, without the need of computer programming knowledge.

- a. Independently addressable zones.
 - b. User defined shade increment; (up to 10 increments) where increment number zero will represent the fully up position.
 - c. User defined tables which shall correspond to a range of dates and times and shade positions.
 - 1) Each table shall have a user definable set of [solar level] [temperature] [wind speed] conditions, which shall define distinct weather and sun conditions and direct the shades to a specified position.
 - d. User defined priority command positions in case of emergency alarm conditions relayed from other interacting computer systems.
 - e. User defined time of day at which Sub-Master and Local controls which have been locally accessed are returned to master control.
 - f. Display of zone status, along with solar intensity levels and indoor and outdoor temperatures.
 - g. The control system shall be capable of staggering the operation of shade motors to assure balanced loading of the electrical system.
5. Sub-Master:
- a. Each Sub-Master shall be intelligent and shall decode signals from, and respond interactively with the master.
 - b. Each Sub-Master shall handle up to eight zones as needed.
 - c. Each Sub-Master shall provide local switching by zone and shall be excluded from normal automatic commands by the master. High priority commands shall override this local status.
6. Motor Logic Controller (MLC):
- a. The Motor Logic Controller shall provide an interface for up to four shade motors in a zone on a floor of the building. Multiple Motor Logic Controllers may be ganged to handle zones with more than four motors.
 - b. In the event of a zone on a floor of the building where more than one Motor Logic Controller are ganged (more than 4 motors), one shall be a master and the rest slave Motor Logic Controllers.
 - c. The Motor Logic Controller shall have the capability of accepting a piggy-back unit to provide local switching of predetermined groups of motors within a zone.

2.7 MOUNTING SYSTEM

- A. Mounting: Wall, jamb, or overhead mounted as indicated, brackets made of 1/8 inch sheet steel to which drive assembly, idle end assembly and center support systems are attached.
- 1. Furnish center support brackets to meet span or weight requirements.
 - 2. Components of brackets shall be interchangeable or replaced without removing bracket from wall or ceiling, inside or outside mount.
 - 3. Metal support brackets cadmium plated steel. Custom color as selected by the Architect.

2.8 ACCESSORIES

- A. Fascia: One-piece extruded aluminum 6063-T5 alloy with average thickness of 0.062 inches, snap-loc clipped to the brackets without the use of glue, magnetic strip or screws, concealed fastening.
 - 1. Offset Drive - No Notch Fascia: Chain drive shall fall behind the return edge of the fascia without notching or otherwise defacing the return leg of the fascia. Fascia shall return not less than 1-1/2" from the front of the hardware fully concealing the roll and the tube, M III wide and 1-1/4" M III narrow.
 - 2. Fascia filler; readily removable to bridge mullions, transition piece between shades in same material and finish as fascia panel.
- B. Guide cables provide where recommended by manufacturer.

2.9 FABRICATION

- A. Fabrication: Fabricate units to completely fill-openings, from head-to-sill and jamb-to-jamb, unless otherwise noted. Do not commence fabrication of shade units until field measurements are confirmed.
- B. Fabric shall hang straight and flat without buckling or distortion. Fabric edges shall be straight and without ravel.

2.10 FACTORY FINISHES

- A. Steel parts, cadmium plated, satin finished, or bonderized prior to painting with baked enamel finish.
 - 1. Colors as selected by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Ensure that supporting substrate is adequate.
- B. Beginning of installation means acceptance of existing project conditions.

3.2 INSTALLATION

- A. Install units to comply with manufacturer's instructions for type of mountings and operations required. Provide units plumb and true, securely anchored in place with recommended hardware and accessories to provide smooth, easy operation.

3.3 TOLERANCES

- A. Maximum variation of gap at window opening perimeter: 1/4 inch.
- B. Maximum offset from level: 1/8 inch.

3.4 ADJUSTING

- A. Adjust units for smooth operation. Replace any units or components which do not operate smoothly and without hindrance.

3.5 CLEANING

- A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 12 30 00
CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This section specifies all work, materials, and installation for classroom, laboratory, and treatment room casework of types and sizes shown on the Drawings, as specified herein. The types of work of this section includes, but is not limited to:
 - 1. Plastic laminate clad base and wall cabinets including filler panels and other accessories as needed for a complete and proper installation.
 - 2. Solid surface countertops and splashes, for all casework provided under this Section 12 30 00 CASEWORK
 - a. Provide back and side splashes at countertops abutting wall construction and return to edge of countertop at all conditions.
 - b. Provide side splashes where countertops abut tall cabinets.
 - 3. Stainless steel countertops and splashes, as indicated on casework drawings
- B. Make all cutouts within casework items as required to accommodate sinks, piping, conduit, and other mechanical and electrical work, from templates provided by the respective mechanical and electrical trades.
- C. Furnish and provide all materials and services as may be additional or separately described under other Sections of this Specification.
 - 1. No attempt is made in this Section to list all elements of casework required on this project or to describe how each element will be installed. It is the responsibility of the Construction Manager to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings.
- D. Remove all debris, dirt and rubbish accumulated as a result of this installation, and leave the premises clean and ready for use. This shall include cleaning equipment interiors, exteriors, and worktops.

1.2 RELATED WORK

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Listing of VOC requirements for adhesives, cleaning/maintenance materials, paints, coatings, and sealants.
- B. Section 06 10 00 – ROUGH CARPENTRY: In wall wood blocking supporting casework installation.
- C. Section 06 61 16 – SOLID SURFACE FABRICATIONS : Related countertops
- D. Section 07 92 00 – JOINT SEALANTS: Sealant.
- E. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES: Vinyl base installed in toe space.
- F. Division 22 - PLUMBING:
 - 1. Connections to all plumbing work furnished under this Section.

- G. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING: Return air ductwork and finned tube radiation.
- H. Division 26 - ELECTRICAL: All electrical work related to items in this Section

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - References. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C 209 - Test Methods for Cellulosic Fiber Insulating Board.
 - 2. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 3. ASTM D 523 - Standard Specification for Specular Gloss.
 - 4. ASTM D 1037 - Test Methods of Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
 - 5. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.
 - 6. AWI (Architectural Woodwork Institute) Architectural Woodwork Standards.
 - 7. APA Grades and Specifications.
 - 8. National Lumber Grades Authority, American Lumber Standards, and Grading Rules and Standards of the various lumber associations whose species are being used, with grade-marks for same.
 - 9. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber; and Product Standard (PS):
 - a. PS-1 - Construction and Industrial Plywood Standard.
 - b. PS-20 - American Softwood Lumber Standard.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions.
 - 2. Materials schedule: A complete schedule of casework components, coordinated with the Contract Drawings.
 - 3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
 - a. Indicate all electrical devices to be located on, above, or adjacent to casework.
 - 4. Selection samples:
 - a. Plastic laminate chips for initial color selection by Architect.
 - b. Chain of PVC edging materials.
 - c. Sealant material: Manufacturer's standard strips of sealant, in all available colors, for selections by the Architect.
 - d. Provide additional samples as requested by Architect for initial selection of material colors and finishes.

5. Verification samples:
 - a. Complete sample base cabinet unit, 24 inches wide, with countertop and at least one door with specified hardware including lock, and one drawer with specified hardware and slide. Sample shall show full construction of all joints in casework and sample joint in worktop. Reviewed and accepted sample will be used for the purpose for establishing a quality control standard, and may not be incorporated into the work.
 - b. Sample of each type of hardware in specified finish.
6. Test data on chemical resistance of plastic laminate.
7. Certificates: Wood products lacking acceptable documentation for the following will be rejected and their removal required.

1.5 QUALITY ASSURANCE

- A. Certifications:
 1. All wood products furnished under this Specification Section shall be "FSC Certified" according to the rules of the Forest Stewardship Council (FSC).
 - a. FSC Certification includes the following certification bodies of forests and forest products:
 - 1) SCS Global Services.
 - 2) SmartWood.
 - 3) SGS Qualifor.
 - 4) Soil Association.
- B. Joinery: All joinery work performed under this Section shall be of Premium Quality Grade, as defined in the current edition, of the AWI (Architectural Woodwork Institute) Architectural Woodwork Standards.
 1. Heat resistance: Hot water (190 degrees-205 degrees) shall be allowed to trickle onto the surface, which shall be set at an angle of 45 degrees from horizontal for a period of 5 minutes. After cooling and wiping dry, the finish shall show no visible effect from the hot water.
 2. Moisture resistance: A cellulose sponge (2 inches by 3 inches by 1 inch) shall be soaked with water and place on the surface of the finish for a period of 100 hours. The sponge shall be maintained in a wet condition throughout duration of tests. At the end of the test, the surface shall be dried and upon examination, shall show no blushing or whitening of the finish.
 3. Impact resistance: A one pound steel ball (approximately 2 inches in diameter) shall be dropped for a distance of one foot onto the finished surface of a 1/4" thick plywood panel supported underneath by solid surface. There shall be no evidence of cracks or checks in the finish due to impact upon close examination.

1.6 FIELD MEASUREMENTS

- A. Field dimensions: The casework vendor is responsible for details and dimensions not controlled by Project conditions and shall show on his/her shop drawings all required field measurements beyond his control.
 1. The Construction Manager shall acknowledge the casework vendor's need for accurate field dimensions prior to custom fabrication.

2. The Construction Manager and the casework vendor's shall cooperate to establish and maintain these field dimensions.
3. The casework vendor shall verify confirm all dimensions at the Project site relative to casework, all, and bring any significant discrepancies to the attention of the Architect prior to casework fabrication.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.8 PRODUCT HANDLING

- A. Delivery and Storage: Deliver materials under protective cover and store within dry enclosed space.
- B. Protection: Use all means necessary to protect materials of this Section during transition, before, during, and after installation and to protect installed work and materials of all other trades.
 1. Store under cover in a ventilated building not exposed to extreme temperature and humidity changes.
 2. Do not deliver casework to site until all concrete, masonry work is dry. Do not begin installation until veneer plaster has fully cured and is dry.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect, at no change in Contract Sum.

1.9 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Provide manufacturer's two-year warranty against all defects in material or workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Case Systems production line modular casework. Moderate and reasonable variations of manufacturer or products of other manufacturers will be considered, upon Architect's approval.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Casework:
 - a. Case Systems, Midland, MI.
 - b. LSI Corporation of America, Minneapolis, MN.
 - c. TMI Systems Design Corporation, Dickinson, ND

2. Plastic laminate:
 - a. Formica Corp., Cincinnati, OH.
 - b. Pioneer Plastics Corp. (Pionite), Auburn ME.
 - c. Nevamar Corp., Odenton MD.
 - d. Ralph Wilson Plastics Co. (Wilsonart), Temple TX.
 - e. Aborite Corporation, Quebec Canada.

2.2 CASEWORK MATERIALS

- A. Wood materials:
 1. General Requirements: In general, all materials shall be the best of their respective kinds for the purpose intended and all methods used in construction shall conform to best practices including any specialized materials required.
 - a. Woods Used: All woods shall be carefully and thoroughly air-dried, then kiln dried by the laboratory equipment manufacturer in his own humidity-controlled kilns to a moisture content of 4-1/2%. All kiln dried lumber shall then be tempered to a moisture content of 6% before use. This moisture content shall be maintained throughout production.
 2. Sustainable Forest Certification: All wood shall be "Chain-of-Custody" certified as FSC Certified.
- B. Cabinetry case body, and countertops without sinks: Mattformed three-layer medium density wood particle panel (PB), graded M2 per ANSI A 208.1 with a minimum density of 48 pounds per cubic foot or equivalent hardwood plugged plywood complying with PS 51-71.
 1. "FSC": Provide board which is comprised of 75 percent FSC certified wood equal to the following;
 - a. Collins Pine Company (distributed through Panel Source International, Tacoma WA.), product: "FSC Certified Particleboard"
 2. Thicknesses:
 - a. 3/4 inch thick at cases.
 - b. 1 1/8 inch thick at counters without sinks.
- C. Casework end panels which extend to floor, and all countertops with sinks and similar wet conditions: Moisture resistant medium density fiberboard (MDF) conforming to ANSI A208.2 product class MD, fabricated from 100 percent pre-consumer recycled fiber, using formaldehyde free polyurethane/synthetic resin such as methyl diisocyanate (MDI) or (pMDI), having a minimum density of 44 pounds per cubic foot.
 1. Acceptable products include the following or approved equal:
 - a. SierrePine Inc., Moncure, NC, product "Medex".
 2. Thicknesses:
 - a. Typical: 3/4 inch thick panels, except as otherwise indicated.
- D. Drawers and doors: Minimum 3/4 inch thick particleboard.
 1. Thicknesses:
 - a. 3/4 inch thick panels, except as otherwise indicated or specified.

- b. Doors over 36 inches tall: provide 1-1/4 inch thick panels.
- E. Plastic laminate: General purpose, conforming to NEMA LD3.1 -1991 Grade GP48, nominal 0.048 inch thickness, in a low non-directional texture in color and price group selected by the Architect.
 - 1. Manufacturers and laminate colors/patterns: As indicated on Drawings or as otherwise selected by Architect.
- F. Edge banding: PVC applied utilizing hot melt adhesive and radiused by automatic trimmers. Edging shall be in color selected by the Architect.
- G. Adhesives: Zero VOC, PVA adhesive with no added urea formaldehyde, mechanically applied.
- H. Plastic laminate for casework, doors and drawers interior and exterior surfaces: GP28 vertical surface grade high-pressure laminate. Color as selected from casework manufacturer's full range of available colors.
 - 1. Plastic laminate, unfinished balancing (backer) sheet, conforming to NEMA LD3-1985 undecorated laminate, Grade BK20, 0.020 inch nominal thickness.

2.3 CASEWORK CONSTRUCTION, GENERAL

- A. All exposed edges including toe kick shall be edge banded. No exposed edges will be permitted.
- B. All end grain locations, not banded, within 6 inches from the finished floor (exposed to view or concealed), shall be sealed to prevent moisture wicking.
- C. Cabinet box style shall be flush overlay construction.
- D. All panels shall be manufactured with balanced construction.
- E. Fixed interior components including shelves, dividers, and compartments shall be full 3/4 inch thick and attached with concealed interlocking mechanical fasteners.
- F. Cabinet body front edge shall be manufacturer's standard 0.020 inch thick PVC.
- G. Mounting stretchers are 3/4 inch thick structural components fastened to end panels and back by mechanical fasteners, and are concealed by the cabinet back.
- H. When the rear of a cabinet is exposed, a separate finished 3/4 inch thick decorative laminate back panel shall be required.
- I. Backs of cabinets shall be 1/2 inch thick and surfaced on both sides for balanced construction and fully captured on both sides and bottom.
- H. Shelf clips: Transparent plastic clips for plastic laminate shelves, equal to Hafele model No. 282.27.402 or approved equal.
- I. An upper 3/4 inch thick stretcher shall be located behind the back panel and attached between the end panels with mechanical fasteners. Attach to the full sub-top capturing back panel.

2.4 BASE CABINET CONSTRUCTION:

- A. All base cabinets, except sink cabinets, shall have a solid $\frac{3}{4}$ inch thick sub-top of core material as specified and fastened between the ends with interlocking mechanical fasteners.
- B. Sink cabinets with a split removable back panel shall be supported by a concealed wooden stretcher at the front and back of the cabinet.
- C. Provide separate ladder style base, scribed to floor and walls prior to cabinet installation.

2.5 TALL CABINETS:

- A. All tall cabinets shall be provided with an intermediate fixed shelf to maintain internal dimensional stability under heavy loading conditions as well as an intermediate $\frac{3}{4}$ inch thick stretcher located behind the back panel and be secured between the cabinet ends with mechanical fasteners. The stretcher shall be secured to the shelf through the back with #8 by 2 inch plated flat head screws.
- B. Individual bases shall be constructed of FSC ACX plywood factory applied to base and tall cabinets and shall support and carry the load of the end panels, and the cabinet bottom, directly to the floor. The base shall be let in from the sides and back of the cabinet to allow cabinets to be installed tightly together and tight against a wall, also to conceal the top edge of applied vinyl base molding (not supplied by casework manufacturer). There shall be a front to back center support for all bases over 30 inches wide.
 - 1. Coordinate height of ladder base to allow for shimming and leveling of ladder base.

2.6 WALL CABINETS:

- A. All wall cabinet bottoms shall be 1-inch thick core as specified, mechanically fastened between end panels and secured to the bottom back stretcher. A lower $\frac{3}{4}$ inch thick stretcher shall be located behind the back panel and attached between the end panels with mechanical fasteners. The stretcher is also secured through the back and into the cabinet bottom.
- B. All wall cabinet exterior bottoms shall match exterior surface of cabinets.
- C. Tall and wall cabinet top edges shall be finished with 0.020 inch PVC.

2.7 DRAWER FRONTS AND SOLID DOORS:

- A. Door and drawer front edge shall be manufacturer's standard: 3mm PVC.

2.8 DRAWERS:

- A. Drawer sides and backs: Dovetail construction, 1/2-inch-thick solid hardwood of specified species.
- B. Laminated drawer fronts: High density laminate over 3/4-inch specified core material. Drawer fronts shall be applied to separate drawer body component sub-front.

- C. Drawer box shall be the maximum height that allows for proper operation of drawer and hardware
- D. Bottom: Nominal 1/2 inch with stiffeners, (1) at 24 inches, (2) at 36 inches and (3) at 48 inches MDF board with laminate face, inset into all four sides of drawer box and sealed with hot melt glue process around entire drawer bottom perimeter.
 - 1. Reinforce drawer bottoms as required with intermediate spreaders.
- E. Door and removable drawer front: 3/4 inch particleboard core with GP28 vertical surface grade high-pressure laminate, 3mm PVC banding.
- F. Finish: Provide drawer boxes with manufacturer's standard clear finish.

2.9 DOORS:

- A. Solid Doors shall be 3/4 inch thick or 1-inch-thick core as specified herein.

2.10 SHELVES:

- A. Adjustable:
 - 1. Adjustable shelves in closed cabinets shall be 3/4 inch thick except 1 inch for shelves over 30 inches wide and open cabinets.
 - 2. Adjustable shelf shall be set back 15mm from front or 23mm when locks are used.
- B. Fixed:
 - 1. Fixed shelves shall be 3/4 inch thick except 1 inch for shelves over 30 inches wide and open cabinets.

2.11 GRILLES

- A. Acceptable Manufacturers and products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Metalaire, Clearwater, FL, product: "Series 2000 Linear Bar Grilles".
 - 2. Airflex Industrial Corp, Farmingdale, NY, product: "#2004 Bar Grilles".
 - 3. Register & Grille Mfg. Co., Inc, Brooklyn, NY, product: "#EP25SE10 Flange Grille".
 - 4. Dayus Register & Grille, Windsor ON, Canada, product: "DABL" Bar Linear Grilles.
- B. Construction: Extruded aluminum face bars in 1/2" centers parallel to the long dimension; 0-degree deflection; 1-inch nominal frame border with countersunk face screw mounting holes; stainless steel square drive screw fasteners. Provide aligning pins to join multiple sections together for continuous appearance.

2.12 HARDWARE

- A. Hinges:
 - 1. Heavy-duty five (5) knuckle hinges of all-metal construction, permitting 165-degree swing; accommodate door thicknesses specified. Fully adjustable for clockwise, counterclockwise, toe in and out door alignment.

2. Base plates for maintaining 1/8" reveals between door/drawers within the same cabinet, and between doors of adjoining cabinets.
 3. One pair of hinges per door to 48-inch height. One and one-half pair of hinges per door over 48 inches in height.
 4. Hinge mounting: Flathead screws so applied to door and cabinet as to withstand a weight load of 150 pounds minimum.
- B. Pulls: Offset type staple-shape wire pull, 4 inches long, 3/8-inch diameter, clear anodized aluminum with brushed finish, with one-inch finger clearance.
- C. Drawer slides:
1. For extra heavy loads including file drawers: Full extension type, 200 pounds per pair minimum rated capacity, steel ball bearing rollers, drawer hold in feature.
 - a. Acceptable slides: Accuride N°. 3640A or approved equal.
 - b. Finish: Clear electro-zinc.
 2. For typical desk and casework drawers: Full extension type, 100 pounds per pair minimum rated capacity, steel ball bearing rollers, lever disconnect, drawer hold in detent feature.
 - a. Acceptable slides, include the following, or approved equal:
 - 1) Accuride N°. 7432.
 - b. Finish: Clear electro-zinc.
- D. Catches:
1. Base and wall cabinets: Spring-tension nylon roller catch with steel strike plate; one catch for each door required at double doors without locks.
 2. Tall cases: One pair of heavy-duty spring tension rubber roller catches for each door; positive catch and lower type latch installed on left hand door.
- E. Locks: Heavy duty, cylinder-type lock with disc tumblers. Positive tumbler operations shall be accomplished by cam action without the aid of springs.
1. Locations: All drawers and hinged doors on casework
 2. Keying: All casework locks keyed alike within each room; Masterkey all casework in Project. No two rooms shall be keyed alike unless otherwise directed by Owner's Representative. Provide 4 keys for each room, and 6 masterkeys (total).
 - a. The lock system shall guarantee security which restricts the duplicating of keys to registered locksmiths.
 3. Strike plates: Finish 26D.
- F. Shelf Clips: Transparent plastic clips for plastic laminate shelves, equal to Hafele model No. 282.47.402, seismic rated.
- G. Number Plates: None Required.
- H. Label holders: Manufacturer's standard in specified finish.
- I. Tote Trays: Molded one-piece high-impact polystyrene plastic with all top edges turned down. Trays shall be furnished with label holders and in the sizes specified. Trays shall be as manufactured by Fabri-Form of Indiana, or equal.

1. Size: 16 inches wide by 12 inches deep by 3 inches high, refer to Drawings for quantities.
 - J. Install hardware uniformly and precisely after final finishing is complete. Set hinges snug and flat in mortises for leaf concealment. Turn screws to flat seat. Adjust and align hardware so that moving parts operate freely and contact points meet accurately. Allow for final field adjustment after installation.
 - K. Hardware Finish: Satin finish stainless steel US32D, unless otherwise noted.
- 2.13 FABRICATION OF PLASTIC LAMINATE CLAD ITEMS
- A. Except as otherwise specified hereunder, fabricate plastic laminate clad items in strict accordance with the details on the Drawings, the approved shop drawings, and workmanship standards set forth in the current AWI Quality Standards, Custom Grade.
 - B. Shop fabricate all plastic laminate clad items. Adhere plastic laminate to particle board backing sheets by cold-press-method. Use of contact cements are not permitted, except at wet areas. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Apply laminate backing sheet to reverse side of tops.
 - C. Fit corners and joints hairline. Make all joints and miters tight, secure with concealed fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Erect casework straight, level and plumb and securely anchor in place. Scribe and closely fit to adjacent work. Cut and fit work around pipes, ducts.
- B. Casework shall be installed plumb, level, true and straight without distortions
 1. Use concealed shims as required
 2. Work shall be installed to a tolerance of 1/8 inch in 8 feet for plumb and levelness, including tops.
 3. There shall be no variations in flushness of adjoining surfaces.
 4. Supplemental reinforcing such as steel angles or other framing, blocking or supports shall be fully concealed.
- C. Secure casework to anchors or built-in blocking or blocking directly attached to substrates.
 1. Secure casework to grounds, furring, stripping and blocking as required with countersunk, concealed fasteners performing a complete installation.
- D. Install countertops and sinks in accordance with manufacturers' instructions; set plumb, square and true, securely anchored to cabinet framing or supporting legs as appropriate
- E. Install all items complete and adjust all moving parts to operate properly.
- F. Leave surface clean and free from defects at time of final acceptance.

3.2 TOLERANCES

- A. Maximum variation from true position 1/16 inch with a maximum of 1/32 inch offset from true alignment with adjoining surfaces intended to be flush.

3.3 ADJUSTING

- A. To whatever extent work was not completed at shop or prior to installation of casework, perform and complete the specified finishing of casework.
- B. Repair damaged and defective casework where possible eliminating defects functionally and visually.
 - 1. Where not possible to repair damaged or defective work, replace with matching new work.
 - 2. Adjust joinery for uniform appearance.
- C. Adjust doors and drawers for smooth and balanced movement, lubricate hardware for use.

3.4 CLEANING

- A. Clean Up: Remove all cartons, debris, sawdust, scraps, and leave spaces clean and all casework ready for Owner's use. Vacuum inside of all cabinets, drawers and shelves.

3.5 PROTECTION

- A. Protect all casework with heavy cardboard or similar material until direct by Construction Manager to remove the same.

End of Section

SECTION 21 00 00

FIRE PROTECTION
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Attention is directed to the general and supplementary conditions and Division 1 including all sub-divisions thereof as listed in the table of contents, which are hereby made a part of this Section.
- B. All work shall comply with all federal, state and local codes and any other authorities having jurisdiction including any special requirements of the Owner and/or Architect.

1.2 TIME, MANNER AND REQUIREMENTS FOR SUBMITTING FILED SUB-BID CONTRACT BIDS:

- A. The work of this section is work of a Publicly Bid Filed sub-bid Contractor and includes the following requirements.
- B. Filed sub-bid contract bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the City of Worcester Purchasing Division, City Hall, 455 Main Street, Worcester, MA 01608 at the time and place stipulated in the "Invitation to Bid/Notice to Contractors." Along with the time of the bid opening, the following shall appear on the upper left hand of the envelope:

Name of Filed Sub-Bidder: Print Name of Filed Sub-Bidder

Project: WTHS TUFTS VET TECH CLINIC RENOVATION
Subcontract Bid for Section: 21 00 00 – FIRE PROTECTION

- C. Each filed Sub-bid contract bid submitted for work under this Section shall be on forms furnished by the City of Worcester as required by Section 44F of Chapter 149 of the General Laws, as amended. Filed Sub-bid contract bid forms may be obtained at the Purchasing Division in person, or by written request.
- D. Filed Sub-bid contract bids filed with the City of Worcester shall be accompanied by a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the City of Worcester in the amount of five (5) percent of the bid. A filed Sub-bid accompanied by any other form of bid deposit than those specified will be rejected.
- E. Additional Requirements:
 - 1. Filed Sub-bidder's attention is directed to Massachusetts G.L. Chapter 149 §44H, as amended, which provides in part as follows:
 - 2. Each filed Sub-bidder shall list in Paragraph E of the "Form for Sub-Bid" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that sub-subtrade requires such listing, provided that, in the absence of a contrary provision in the Specifications, any sub-bidder

may, without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the Awarding Authority that he does customarily perform such class of work with persons on his own payroll and is qualified to do so. This Section of the Specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.

Class of Work	Reference Specification	Paragraphs

F. The work to be completed by the Filed Sub-Contractor for the work of this Section is shown on the following listed Drawings:

1. The Work of this Trade Contract is shown on the following Drawings:
FP1.1, FP3.1
2. Related items which may require coordination or impact work of this trade are shown on the following Drawings:
AD3.1, AD3.2, AD3.3, A1.0, A2.1, A2.2, A3.0, A3.1, A3.2, A4.1, A4.2, A5.0, A5.1, A6.1, A6.2, A6.11, A6.12, A6.13, A6.14, A8.0, A8.1, A8.2, A8.3, A8.4, A8.5, A8.6, A8.7, A8.8, A9.1, A9.2, A9.3, A10.1, A10.2, A11.1, A11.2, A11.3, A12.1, A12.2, S1.1, S1.2, S3.1, S3.2, S4.1, S4.2, P1.1, P3.1, P3.2, P3.3, DH3.1, DH4.1, H3.1, H3.2, H4.1, H4.2, H5.1, H5.2, H5.3, H5.4, E0.1, E0.2, ED1.1, ED1.2, ED1.3, EH1.1, EH1.2, EH1.3, EL1.1, EL2.1, EL2.2, EL2.3, EL2.4, EL2.5, EP1.1, EP2.1, EP3.1, EP3.2, EP4.1, EP4.2, EP4.3, EP4.4, EP4.5, EP4.6, FA0.1, FA1.1, FA2.1, FA3.1, FA3.2, SC0.1, SC1.1, SC1.2, SC2.1, TC0.1, TC1.1, TC1.2
3. The complete List of Drawings for the Project is provided in Section 00 01 15.
4. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Filed Sub-Contractor's responsibility to determine full extent of work of this Section by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Sub-Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.4 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this Section, including, but not limited to, the following:
1. Modifications to the existing sprinkler system with the removal of upright and pendent sprinkler heads throughout the work area for installation of new.
 2. Furnish all labor, materials, tools, equipment, supervision, services, and incidentals necessary for the installation of a complete "wet pipe" sprinkler system for the renovated third floor spaces, complete and ready for standard operation. Sprinklers shall be installed in all spaces. The Fire Protection Subcontractor shall obtain all necessary permits, file all necessary drawings, obtain all approvals, and pay all fees required to complete the work of this Section.
 3. The scope of work involves removing upright and pendent sprinkler heads and providing new concealed sprinkler heads in the new ceilings of the renovation area.
 4. Based on the NFPA 241 Plan from the G.C., the Worcester Fire Department requires the automatic sprinkler system to remain active during construction. The plans show installing temporary butterfly shut-off valves on the two sprinkler feeds for the gridded sprinkler system to allow the piping to be isolated and drained so that the rest of the wing can remain active. Fire watches may be required while the sprinkler system is drained. Therefore, coordinate system shut-downs and fire watches to ensure the work is completed in a timely manner. Coordinate with the Worcester Fire Department for the exact requirements.
 5. The Fire Protection Subcontractor shall furnish, install, move, and maintain in safe condition all rigging, hoisting, scaffolding, and staging as required for his use and for the proper execution of his work.
- B. Design Criteria: Pipe sizing and sprinkler head layout shown on the Drawings is provided to indicate a suggested pipe routing, zoning, and sprinkler head location and shall not be used for estimating purposes. Location of piping and heads shall be coordinated with all other trades.
- C. ALTERNATES: NONE
- D. Items To Be Furnished Only: (NONE REQUIRED UNDER THIS SECTION)
- E. Reference To Drawings: Fire Protection work shown on drawings FP1.1 and FP3.1.
- F. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
1. SECTION GENERAL CONDITIONS OF THE CONTRACT.
 - a. Cutting and drilling of holes larger than 4 in. diameter or square.
 - b. Patching of all holes.
- G. Extent: The work required under this Section, without limiting the generality thereof, includes the furnishing of all labor, materials, equipment, and services necessary for, and reasonably incidental to, the complete installation of all piping, valves, sprinklers, and all other materials, equipment, and labor necessary, whether or not such items are specifically indicated on the

Drawings or in the Specifications, to complete the fire protection systems in all respects ready for continuous and trouble free operation.

- H. Intent: It is the intent of the Contract Documents to include all work and materials necessary for erecting complete, ready for continuous use, all fire protection systems as shown on the accompanying Drawings or as hereinafter described. These Drawings shall be taken in a sense as diagrammatic; sizes of pipes, etc., and methods of running them are shown, but it is not intended to show every offset and fitting, nor every structural difficulty that will be encountered during the installation of the work.

1.5 CODES, STANDARDS AND REFERENCES

- A. All materials and workmanship shall comply with the latest editions of all applicable Codes, Local and State Ordinances, Industry Standards and Regulations.
- B. The Fire Protection Subcontractor shall notify the Architect/Engineer of any discrepancies between the Contract Documents and applicable Codes, Standards, etc...
- C. In the event of a conflict, the most stringent requirements shall apply.
- D. The following Codes, Standards and References shall be utilized as applicable:
1. Massachusetts State Building Code, 10th Edition.
 2. National Electric Code (NEC).
 3. Environmental Protection Agency (EPA).
 4. Commonwealth of Massachusetts Department of Environmental Protection (DEP).
 5. Local Ordinances, Regulations of City of Worcester.
 6. National Fire Protection Association (NFPA).
 7. Insurance Services Organization (ISO).
 8. American National Standards Institute (ANSI).
 9. American Society of Mechanical Engineers (ASME).
 10. American Society for Testing and Materials (ASTM).
 11. American Welding Society (AWS).
 12. Commercial Standards, U.S. Department of Commerce (CS).
 13. National Electrical Manufacturers Association (NEMA).
 14. American Gas Association (AGA).
 15. Underwriters' Laboratories, Inc. (UL).

1.6 SYSTEM DESCRIPTION

- A. Fire protection system for the building shall be a wet pipe system. Heat produced from a fire melts the fusible link or glass bulb on a single sprinkler head or group of sprinkler heads causing the sprinkler(s) to open. Water from the water filled pipe is discharge immediately from the sprinkler head(s) to control the fire. The fire department may pump into the system via the fire department connection to supplement the system. Sprinkler system water flow alarms activate upon system flow and indicate to the FACP an alarm condition. The sprinkler(s) continue to flow water until manually shut off.

1.7 SUBMITTALS

- A. Refer to Division 1, SUBMITTALS for submittal provisions and procedures.
- B. Submit for approval, within thirty (30) days after signing the Contract and prior to the submission of any shop drawings, an itemized list of manufacturer's of material and equipment and of Subcontractors proposed to be used under this section

- C. After approval of the list, submit for review a minimum of six (6) sets of detailed drawings. All shop drawings for equipment submitted for review shall include Specifications, including type of materials, operating pressures, capacities, performance and power requirements to determine compliance with Contract Documents. All data submitted shall be complete for all equipment and shall apply only to this specific project. Submit data sheets for the following:
 - 1. Sprinkler fabrication drawings complete with hydraulic calculations.
 - 2. Piping and appurtenances.
 - 3. Sprinkler heads.
 - 4. Flexible Sprinkler Hose with Fittings.
 - 5. Valves with Built-In Tamper switches.
 - 6. Vibration and seismic control.
- D. Regardless of any information included in the shop drawing submitted for review, the requirements of the Drawings and Specifications shall not be superseded in any way by the shop drawing review.
- E. Each submittal shall be reviewed, stamped and certified prior to submission to the Architect. Such certification shall be made by the Owner or Corporate Office of the Contractor, or by a person duly authorized by the Owner to sign binding agreements for the Contractor. The certification shall state that the data and details contained on each shop drawing, layout drawing, catalog data and brochure has been reviewed by the Contractor and that it complies with the Contract Documents in all respects. Shop drawings, layout drawings, catalog data and brochures will not be reviewed and will be returned to the Contractor unchecked unless they are certified.
- F. It is intended that the Contractor submit complete and accurate data at the first submission. If the shop drawing is returned marked "Resubmit" or "Not Accepted", only one (1) additional submission will be permitted.
- G. Equipment shall be of proper size for its allotted space. Equipment shall be disassembled as required, without invalidating the manufacturer's warranty, so that it can be installed through regular window, door, and/or louver openings.
- H. The shop drawings and manufacturer's data shall be submitted in a timely manner sufficiently in advance to give ample time for checking, correcting, resubmitting and rechecking if necessary. No claim for delay will be granted for failure to comply with this requirement.
- I. A minimum period of two (2) weeks, exclusive of transmittal time, will be required in the Engineer's office each time shop drawings, layout drawings, catalog data and brochures are submitted or resubmitted for review. The time period shall be considered by the Contractor when scheduling his work.
- J. Fabrication drawings and hydraulic calculations shall be submitted and stamped approval by the Worcester Fire Department and I.S.O. prior to submitting to the Architect for review. Fabrication drawings and hydraulic calculations shall bear the seal of registration of a qualified registered professional fire protection engineer.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Installation and alterations of fire protection: piping, equipment, specialties, accessories and repair and servicing of equipment shall be performed only by a qualified installer. The term "Qualified" means experienced in such work ("Experienced" shall mean having a minimum of 5 previous projects similar in size and scope to this project), familiar with all precautions required, and has complied with all the requirements of the authority having jurisdiction. Upon request, submit evidence of such qualifications to the

Engineer. Refer to Division 1 Section: "Definitions and Standards" for definition for "Installers".

- B. Qualifications for Welding Processes and Operators: Comply with the requirements of AWS D10.9, "Specifications for Qualifications of Welding Procedures and Welders for Piping and Tubing, Level AR-3".
- C. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
 - 1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.
- D. Regulatory Requirements: Comply with the requirements of the following codes:
 - 1. NFPA 13 - Standard for the Installation of Sprinkler Systems, 2019 Edition.
 - 2. 527 CMR – Board of Fire Prevention Regulations.
 - 3. 780 CMR – Massachusetts State Building Code, Tenth Edition.
 - 4. UL Compliance: Fire protection system materials & components shall be Underwriter's Laboratories listed and labeled and for the application anticipated.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. The Fire Protection Subcontractor shall provide for the delivery of all his materials and fixtures to the building site when required so as to carry on his work efficiently and to avoid delaying his work and that of other trades.
- B. The Fire Protection Subcontractor shall, at all times, fully protect his work and materials from injury or loss by others. Any injury or loss which may occur shall be made good without expense to the Owner. The Fire Protection Subcontractor shall be responsible for the proper protection of all his materials until the building is accepted by the Owner.

1.10 GUARANTEE/WARRANTY

- A. The Fire Protection Subcontractor shall and hereby does warrant that all work executed and all equipment furnished under this Section shall be free from defects of workmanship and materials for a period of one (1) year from date of final acceptance of this work. The Fire Protection Subcontractor further agrees that he will, at his own expense, repair and replace all such defective work and all other work damaged thereby which becomes defective during the term of the Guarantee-Warranty.

1.11 RECORD DRAWINGS

- A. Refer to DIVISION 1 - CONTRACT CLOSEOUT for Record Drawings.
- B. Record Drawings shall reflect all changes from the Contract Drawings whether by Change Order or by field conditions. Principal dimensions shall be indicated of concealed work, fire protection lines, valves, and zone flow switches.

1.12 CUTTING AND PATCHING

- A. Cutting and/or patching of all openings and holes required for the installation of fire protection in the building shall be performed by the General Contractor. All work and materials shall be installed in such a manner and at such time to keep cutting and patching to a minimum. Location for openings shall be checked by the Fire Protection Subcontractor and error, due to

- failure to coordinate work with other Divisions, shall be the responsibility of the Fire Protection Subcontractor failing to coordinate, who shall make the corrections at his own expense.
- B. Work shall include furnishing and locating sleeves or inserts required before the new walls are built, or be responsible for the cost of cutting and patching required for pipes where sleeves were not installed, or where incorrectly located. The Fire Protection Subcontractor shall do all drilling required for the installation of hangers.
 - C. Patching of all holes after installation of piping or equipment shall be performed by the General Contractor or appropriate tradesmen.
 - D. All piping, cutting, and threading shall be done in a location approved by the Architect-Engineer.
 - E. No pipe cutting or threading shall be done in areas where completed concrete floor slab is to remain as finished or be painted later. Should this area be necessary, the Fire Protection Subcontractor shall cover the entire working area with canvas tarpaulins in an approved manner.

1.13 CLEANING

- A. The Fire Protection Subcontractor shall thoroughly clean and flush all piping and clean all equipment of all foreign substances inside and out before being placed in operation.
- B. If any part of a system should be stopped or damaged by any foreign matter after being placed in operation, the system shall be disconnected, cleaned, and reconnected at no additional cost to the Owners.
- C. During the course of construction, all pipes shall be capped to insure adequate protection against the entrance of foreign matter.
- D. At all times, keep the premises clear of undue accumulation of rubbish.
- F. Upon completion of all work under the Contract, the Subcontractor shall remove from the premises, all rubbish, debris, and excess materials created by his employees and shall be responsible for disposal of same.

1.14 COORDINATION OF TRADES

- A. The Fire Protection Subcontractor shall give full cooperation to the Subcontractors of other trades, and shall furnish any information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.
- B. In areas where conflicts may occur, if so directed by the Architect-Engineer, this Subcontractor shall prepare composite sketches at a suitable scale, not less than 1/4 inch = 1 foot 0 inches, clearly showing how his work is to be installed in relation to the work of other trades.
- C. Piping and other equipment shall not be installed in congested and possible problem areas by this Subcontractor without first coordinating the installation of same with other trades and the Architect-Engineer. This Subcontractor, at his own expense, shall relocate all uncoordinated piping and other equipment installed should they interfere with the proper installation and mounting of electrical equipment, HVAC, ductwork, piping and equipment, plumbing piping, hung ceilings, and others; structural finish to be installed by other trades.

- D. This Subcontractor shall coordinate the elevations of all piping and equipment in hung ceilings for the installation of recessed lighting fixtures, duct boxes, etc. Conflicts shall be brought to the attention of the Architect-Engineer for a decision before the piping and/or equipment of other trades is installed.
- E. In areas where, due to construction conditions, more than one trade is required to use common openings in chases, shafts and sleeves for the passage of conduits, raceways, piping, ductwork and other materials, this Subcontractor must plan and locate the positions of equipment to be furnished under this Section so that all items including piping and/or equipment of other trades may be accommodated within the space available. Location and positioning shall be done prior to installation of same and to the satisfaction of the Architect-Engineer.
- F. This Subcontractor, before installing his work, shall see that it does not interfere with the clearances required for finished columns, pilasters, partitions or walls, as shown on the Contract Architectural or Structural Drawings showing foundations, floor plans, roof plans and details.
- G. Piping work that is installed under this Contract, which interferes with the architectural design or building structure, shall be changed as directed by the Architect-Engineer, and all costs incidental to such changes shall be paid by this Subcontractor at no additional cost to the Owner.

1.15 COORDINATION DRAWINGS

- A. This Subcontractor shall be responsible for preparing Coordination Drawings to coordinate his work with all other trades, indicating pipe locations and floor to center line elevations.
- B. This Subcontractor shall submit fire protection Drawings and hydraulic calculations to the Architect-Engineer and the Fire Department for approval.

1.16 PERMITS, FEES, RULES AND REGULATIONS

- A. Refer to Bidding and Contracting Requirements, including SECTION - GENERAL CONDITIONS and SECTION - SUPPLEMENTARY CONDITIONS, for requirements all of which shall be included as part of this Specification.
- B. Give the proper Authorities all requisite notices or information relating to the work under this Section. Obtain and pay for all fees, licenses, permits and certificates. Comply with the rules and regulations of all Local, State and Federal Authorities having jurisdiction, the Codes, Standards, recommended practices and manuals of the National Fire Protection Association, I.S.O., the Fitchburg Fire Department and the Public Utilities Companies serving the building.

1.17 CERTIFICATES OF APPROVAL

- A. Upon completion of all work, furnish, in duplicate, certificates of inspections.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Piping:
 - 1. Piping above ground and within the building shall conform to all requirements of NFPA 13 and shall be as follows:

- a. All CONCEALED sprinkler mains (above acoustical ceiling tiles) downstream of alarm check valves, shall be Schedule 40 or Schedule 10 seamless light wall, steel pipe with rolled grooved ends, for piping 2 in. and larger, complete with suitable couplings and fittings for rolled grooved end steel pipe.
 - b. Schedule 5 pipe with Victaulic Pressfit® fittings and couplings may be used in lieu of Schedule 40 pipe with screwed fittings. The Pressfit® shall be UL listed and FM approved for fire protection services to 175 psig.
2. Wherein before specified, piping systems shall be installed using mechanical pipe couplings of a bolted or mechanical locking device-type, with a central cavity design pressure-responsive gasket along with mechanical pipe fittings, flanges and grooved end valves and shall be approved for fire protection services. All grooved components shall be U.S. made and shall be approved by a single manufacturer and be installed per manufacturer's published literature. All grooved components shall be UL listed and FM approved and shall meet the requirements of NFPA 13.
- a. Grooved end fittings shall be ASTM A536 ductile iron or ASTM A53 forged or fabricated carbon steel with factory grooved ends designed to accept mechanical couplings of the same manufacturer.
 - b. Grooved mechanical pipe couplings shall consist of two ASTM A536 ductile iron housings, pressure-responsive, synthetic rubber gasket and plated steel bolts and nuts.
1. Rigid type couplings shall be ASTM A395 and A536 ductile iron, complete with angle pattern bolt pads to provide rigidity and support and hanging requirements corresponding to NFPA 13. With fully defined metal-to-metal visual verification at the "Install Indicators" by locking into place preventing mis-assembly due to over shift of the angle pad surfaces. Installation-Ready™ type for direct stab installation without field disassembly or per manufacturers installation guidelines; tooth and recessed shields gasket consisting of a pressure responsive center-leg acting as a pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth. Featuring "One-Touch Tightening" technology eliminates the need for alternating tightening techniques allowing flange nut to distribute load evenly; no torque requirements required. Gaskets shall be EPDM-Type A.
 - i. 1-1/4" through 12": Installation-Ready, for direct stab installation without field disassembly. Victaulic Style 009V.
 2. Flexible Type couplings shall be ASTM A395 and A536 ductile iron, for use in locations where vibration attenuation and stress relief are required, and for seismic applications in accordance with manufacturer's recommendations. Victaulic Installation-Ready Style 177N; or Style 75 and 77.
 3. Fittings shall be ASTM A 395 and A536 ductile iron, short pattern with flow equal to standard pattern. Victaulic FireLock™.
 - i. Where FireLock™ pattern is not available, Victaulic UL listed and FM approved standard fittings may be used.

- ii. Installation-Ready™ fittings for sizes 1-¼” thru 2½”, consisting of a ductile iron housing with Installation-Ready™ ends, prelubricated Grade “E” EPDM Type ‘A’ gasket; and ASTM A449 electroplated steel bolts and nuts. UL listed for a working pressure of 300 psi (2065 kPa) and FM approved for working pressure 365 psi (2517kPa)

4. Gaskets:

Fire Protection Service	Temperature Range	Gasket Recommendation
Water/Wet Systems	Ambient	Grade EPDM, Type A

- 5. All grooved components shall be U.S. made and shall be by a single manufacturer and be installed per manufacturer's published literature. Tools used for preparation of pipe shall be of the same manufacturer as the grooved components.

- i All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

c. Flexible Sprinkler Drops (Optional)

- 1. Contractor shall provide flexible piping connection to sprinkler heads for both suspended and sheetrock ceiling. All flexible piping systems shall be UL Listed and FM Approved and suitable for their intended use.
- 2. All flexible piping connections to include a zinc plated steel Male threaded nipple, Victaulic FireLock IGS Groove Style 108 coupling, union threaded connection (no required welding) or fully welded (non-mechanical fittings), braided, leak-tested sprinkler drop with a minimum internal corrugated hose diameter of one inch (1”); and a one-piece multi-port open-gate ceiling bracket (bracket shall allow installation before the ceiling tile is in place), with removable attachment hub and self securing integrated snap-on clip-ends, for attachment to ceiling grid without the need for a screw fastener.

3. Acceptable manufacturer:

- i. Vicflex as manufactured by Victaulic in lengths of 31”, 3’, 4’, 5’ and 6’.
- ii. FlexHead series 2000 as manufactured by Flexhead Industries of Holliston, MA USA (800) 829-6975 or (508) 893-9596, Fax (508) 893- 6020 in lengths of 2 feet to 6 feet.
- iii. EasyFlex, 101 Industrial Avenue, Little Ferry, NJ 07643 or (201) 853- 9005, Fax (201) 331-3656.

- d. Where piping penetrates through walls, floors, and ceilings, the Fire Protection Subcontractor shall install pipe sleeves, complete with approved type fire safing at both ends.

B. Valves: not required.

C. Sprinkler Heads:

1. Sprinkler heads shall be new, UL listed and FM approved type of intermediate temperature rating, except where excessive temperatures are anticipated. In such areas, appropriate higher temperature ratings shall be used in accordance with NFPA Standard No. 13. Heads installed where they might receive injury shall be protected with approved guards. Spacing of heads shall be for "light hazard" and "ordinary hazard" occupancy as required. Heads shall have 1/2 in. orifices. Pendant heads, where required, shall be listed by Underwriters' Laboratories, Inc. and approved by Factory Mutual Engineering Corporation as suitable for pendant use in the type of system in which installed.
 - a. Wrenches shall be provided by the sprinkler manufacturer that directly engage the hex-shaped wrench boss integrally cast in the sprinkler body. Victaulic FireLock Series.
2. Exposed upright and pendent "wet pipe" sprinkler heads for "light hazard" shall be Reliable Automatic Sprinkler Co., Inc. Model F1FR, Viking model M or Victaulic V27 Series, quick response chrome plated.
3. For ACT or gypsum board ceiling installations as shown, Reliable Automatic Sprinkler Co., Inc. model #G4FR, Victaulic model #V3802 or approved equal, quick response, adjustable concealed standard pendent automatic sprinkler, white cover plate, 165°F temperature rating, 1/2" orifice, K-factor = 5.62.
4. Sprinkler heads shall be FM approved and UL listed as manufactured by The Reliable Automatic Sprinkler Co., Inc., Viking Corporation, Firematic Sprinkler Devices, Inc. or equal. In all finish rooms or areas, sprinkler heads shall be chrome plated finish, complete with chrome plated escutcheons or have a white cover plate, as specified. Provide adjustable extended escutcheons where indicated on the Drawings or as required.

2.2 EQUIPMENT

A. Pipe Supports:

1. Metal pipe supports, hangers, clamps, etc., and all other accessories shall be of an UL listed and FM approved pattern and so placed as to conform with the requirements of NFPA Standard No. 13. Spacing of hangers shall not exceed that recommended in ANSI B31.1. All Victaulic piping shall be supported with two (2) hangers per length of pipe.
2. All piping installed under this Section of the Specifications shall be independently supported from the building structure and not from the piping, ductwork, or conduit of other trades. All supplementary steel required to meet the requirements specified herein shall be furnished and installed by the Fire Protection Subcontractor and shall be subject to the approval of the Architect-Engineer.
3. Rigid couplings may be used with IPS steel piping systems, which meet the support and hanging requirements of NFPA 13. An adequate number of flexible couplings shall also be used to compensate for thermal expansion/contraction of the pipe.

B. Wall, Floor, and Ceiling Plates: Piping passing through floors, walls, and ceilings shall be provided with metal sleeves and chromium plated steel or nickel plated cast-iron plates. The spaces between piping and sleeves shall be filled with a noncombustible material.

C. Identification of Piping Systems:

1. Furnish and install OSHA approved identification valve tags, labels and flow direction arrows for all piping and equipment included in this Section. Labels shall be as manufactured by Seton Name Plate Company, or W.H. Brady Company, or approved equal.
2. All pipes shall be color coded and marked to identify the fluid. Color coding shall conform to ANSI Bulletin A13.1 and OSHA 1910.262 for colors, location and sizes of bands and letters. Color coded tags can be used when pipes are too small for labeling.
3. Markers shall be semi-rigid plastic equal to Set Mark Type "SNA" by Seton, or approved equal. Markings shall be placed where pipes pass through walls, or partitions, at all valves, where flow changes direction, and at junctions of pipes. On long runs of pipes, markers shall be placed every 20 feet, or where necessary to avoid confusion as to identification of pipes.
4. Install color-coded adhesive dots on ceiling grids for locating shut-off valves above hung ceilings.

PART 3 - EXECUTION

3.1 EXAMINATION & PHASING

- A. Examine walls for suitable conditions where cabinets are to be installed, where required.
- B. Do not proceed until unsatisfactory conditions have been corrected.
- C. Coordinate installation with work of other trades especially the HVAC contractor. Piping shall be coordinated with ductwork installation to maximize headroom in all areas.

3.2 PIPE APPLICATIONS

- A. Install Schedule 40 steel pipe with threaded joints and fittings for 2 inch and smaller and with welded or mechanical joints for 2 1/2 inch or larger. See materials for exceptions to schedule weight.
- B. Install black steel for sprinkler piping.
- C. Use approved fittings to make all changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Hangers and supports: Comply with the requirements of NFPA 13. Hanger and support spacing and locations for piping joined with grooved mechanical coupling Manufacturer's written instructions for rigid systems. Provide seismic bracing and protection from damage from earthquakes in accordance with NFPA 13 and state codes.

3.3 PIPE JOINT CONSTRUCTION

- A. Weld Joints: AWS D10.9, Level AR-3.
- B. Threaded Joints: conform to ANSI B1.20.1, Tapered pipe threads for field cut threads. Join piping, fittings, and valves as follows:
 - a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Align threads at point of assembly.
 - c. Apply appropriate tape or thread compound to the external pipe threads.
 - d. Assemble joint to appropriate thread depth. When using a wrench on valves, place the wrench on the valve end into which the pipe is being threaded.
 - e. Damaged Threads: Do not use pipe with threads which are corroded or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.
- C. Flanged Joints: Align flanges surface parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.
- D. Mechanical Grooved Joints: Roll grooves on pipe ends dimensionally compatible with the couplings.
 - 1. Roll grooves on pipe ends dimensionally compatible with the couplings.
 - 2. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.
 - 3. Gasket should be lubricated with lubricant supplied by the manufacturer or approved for use with the gasket by the manufacturer.
 - 4. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)
- E. End Treatment: After cutting pipe lengths, remove burrs and fins from pipe ends.

3.4 SPRINKLER HEAD INSTALLATIONS

- A. Use proper tools to prevent damage during installations.
- B. Install sprinkler heads in the center of acoustical ceiling tiles. Where installed under sloped ceilings or roofs, install heads so deflectors are parallel with slope.
- C. Install heads so that roof trusses, joists and mechanical equipment does not interfere with proper coverage.
- D. Provide additional heads under mechanical ductwork and equipment exceeding 4' in width and as required to maintain complete coverage.

- E. Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.
- F. Sprinkler bulb protector shall be removed by hand after installation. Do not use tools or any other device(s) to remove the protector that could damage the bulb in any way.

3.5 TESTING

- A. The Fire Protection Subcontractor shall coordinate and perform all tests as required by NFPA 13 and NFPA 25, Insuring Agency, and the Worcester Fire Department at no expense to the Owner.
- B. The scope of work consists of the furnishing of all labor, materials, tools, equipment, supervision, services, and incidentals necessary for the installation of an automatic sprinkler system installed complete and ready for standard operation. System shall be installed in all spaces indicated on the Drawings. The Fire Protection Subcontractor shall obtain all necessary permits, file all necessary Drawings, obtain all approvals, and pay all fees required to complete the work of this Section.
- C. After the installation has passed a satisfactory hydrostatic test, all iron and steel parts shall be thoroughly cleaned. All piping and other items, except sprinkler heads, bronze or brass fittings, other corrosion resistant materials and moving parts, shall be given a priming coat of good quality, red lead type paint and a finish coat of paint, the color of which is to be determined by the Architect-Engineer.

END OF SECTION 21.00.00

SECTION 22 00 00

PLUMBING

(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Attention is directed to the general and supplementary conditions and Division 1 including all sub-divisions thereof as listed in the table of contents, which are hereby made a part of this Section.
- B. All work shall comply with all federal, state and local codes and any other authorities having jurisdiction.

1.2 TIME, MANNER AND REQUIREMENTS FOR SUBMITTING FILED SUB-BID CONTRACT BIDS:

- A. The work of this section is work of a Publicly Bid Filed sub-bid Contractor and includes the following requirements.
- B. Filed sub-bid contract bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the City of Worcester Purchasing Division, City Hall, 455 Main Street, Worcester, MA 01608 at the time and place stipulated in the "Invitation to Bid/Notice to Contractors." Along with the time of the bid opening, the following shall appear on the upper left hand of the envelope:
 - Name of Filed Sub-Bidder: Print Name of Filed Sub-Bidder
 - Project: WTHS TUFTS VET TECH CLINIC RENOVATION
 - Subcontract Bid for Section: 22 00 00 – PLUMBING
- C. Each filed Sub-bid contract bid submitted for work under this Section shall be on forms furnished by the City of Worcester as required by Section 44F of Chapter 149 of the General Laws, as amended. Filed Sub-bid contract bid forms may be obtained at the Purchasing Division in person, or by written request.
- D. Filed Sub-bid contract bids filed with the City of Worcester shall be accompanied by a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the City of Worcester in the amount of five (5) percent of the bid. A filed Sub-bid accompanied by any other form of bid deposit than those specified will be rejected.
- E. Additional Requirements:
 - 1. Filed Sub-bidder's attention is directed to Massachusetts G.L. Chapter 149 §44H, as amended, which provides in part as follows:
 - 2. Each filed Sub-bidder shall list in Paragraph E of the "Form for Sub-Bid" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that sub-subtrade requires such listing, provided that, in the absence of a contrary provision in the Specifications, any sub-bidder

may, without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the Awarding Authority that he does customarily perform such class of work with persons on his own payroll and is qualified to do so. This Section of the Specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.

Class of Work	Reference Specification	Paragraphs

F. The work to be completed by the Filed Sub-Contractor for the work of this Section is shown on the following listed Drawings:

1. The Work of this Trade Contract is shown on the following Drawings:
P1.1, P3.1, P3.2, P3.3
2. Related items which may require coordination or impact work of this trade are shown on the following Drawings:
AD3.1, AD3.2, AD3.3, A1.0, A2.1, A2.2, A3.0, A3.1, A3.2, A4.1, A4.2, A5.0, A5.1, A6.1, A6.2, A6.11, A6.12, A6.13, A6.14, A8.0, A8.1, A8.2, A8.3, A8.4, A8.5, A8.6, A8.7, A8.8, A9.1, A9.2, A9.3, A10.1, A10.2, A11.1, A11.2, A11.3, A12.1, A12.2, S1.1, S1.2, S3.1, S3.2, S4.1, S4.2, FP1.1, FP3.1, DH3.1, DH4.1, H3.1, H3.2, H4.1, H4.2, H5.1, H5.2, H5.3, H5.4, E0.1, E0.2, ED1.1, ED1.2, ED1.3, EH1.1, EH1.2, EH1.3, EL1.1, EL2.1, EL2.2, EL2.3, EL2.4, EL2.5, EP1.1, EP2.1, EP3.1, EP3.2, EP4.1, EP4.2, EP4.3, EP4.4, EP4.5, EP4.6, FA0.1, FA1.1, FA2.1, FA3.1, FA3.2, SC0.1, SC1.1, SC1.2, SC2.1, TC0.1, TC1.1, TC1.2
3. The complete List of Drawings for the Project is provided in Section 00 01 15.
4. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Filed Sub-Contractor's responsibility to determine full extent of work of this Section by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Sub-Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.4 SUMMARY OF WORK

- A. Perform work and provide material and equipment as required for a complete and operational plumbing system as shown on the Drawings and as specified in this Section. Completely coordinate with work of other trades and provide for complete and fully functional installation.
- B. The work shall include, but is not limited to, the following major items of work:
 - 1. Demolition and reworking of existing plumbing fixtures and piping within the work area to allow for the renovation work. Cut and cap piping below as required. Minimize abandoned piping.
 - 2. Provide a complete sanitary waste, vent and hot & cold water systems for the renovation area in the existing Worcester Vocational Technical High School. Installation shall be in accordance with the Commonwealth of Massachusetts Plumbing Code and all other applicable codes and authorities having jurisdiction.
 - 3. Provide a recirculation pump for the domestic hot water piping service the fit-out space.
 - 4. Provide all plumbing fixtures, floor drains and equipment as required and indicated on the drawings and as specified herein. This shall include all necessary waste, vent, cold water & hot water services. All floor drains shall be primed with a trap primer device
 - 5. Installation of Owner Supplied Equipment, including Walk-In Dog Wash Tub, and Wet Tables for Dogs.
 - 6. Obtain all permits and approvals required for work under this Section. This section shall pay all permit fees required by the local Water Department.
- C. Alternates: None
- D. This contractor is responsible for sleeving all holes required of his work prior to pouring of the concrete slabs. All holes less than or equal to 1-1/2" shall be the responsibility of this contractor to core. Sizes larger shall be cored by the G.C. However, if coring is required due to the failure of this contractor to set a sleeve prior to pouring than this contractor shall be responsible for bearing the cost of any of this additional coring work required of the G.C.
- E. Where the specifications and/or plans conflict, the more stringent (costly) requirement shall control. Clarification from Engineer shall be obtained before proceeding.

1.5 COORDINATION

- A. Before starting work, visit site and examine conditions under which work shall be performed including preparatory work by others. Report conditions which might adversely affect the work in writing to the Architect. Do not proceed with the work until the defects have been corrected and conditions are satisfactory. Commencement of work shall be construed as acceptance of preparatory work and existing conditions.
- B. Completely coordinate with work of other trades and provide for complete and fully functional installation. Although not specifically shown, provide supplementary or miscellaneous items, devices, appurtenances and materials incidental to or necessary for sound, secure and complete installation.

- C. This contractor is responsible for coring and sleeving all holes required of the respective work. All penetrations shall be sealed. All penetrations of fire rated walls, floors and ceilings shall be firestopped.

1.6 RELATED WORK

- A. Carefully examine all of the Contract Documents for requirements which affect work of this Section.
- B. Other specification sections which directly relate to the work of this Section include, but are not limited to, the following:
- Section 210000 – Fire Protection
 - Section 230000 – HVAC
 - Section 260000 - Electrical
- C. The following related work will be performed by other Divisions of the specifications:
1. Concrete work, including housekeeping pads.
 2. Cutting and patching of masonry, concrete, tile and other parts of structure, with the exception of drilling for hangers and coring as defined herein. Any piping penetrations not sleeved by this division at time of floor slab pouring or wall construction shall be core drilled by this division. Coordinate with Architect.
 3. Installation of access panels in ceilings and walls. Access panels shall be furnished by this Section.
 4. Painting, except as specified herein.
 5. Electric power wiring for all equipment. Control wiring shall be performed by this Section.
 6. Structural supports except as specified herein.
 7. Temporary light, power, water, heat, gas and sanitary facilities for use during construction and testing.

1.7 CODES, STANDARDS AND AUTHORITIES

- A. Perform all work in strict accordance with all rules, regulations, standards, codes, ordinances and laws of local, state and Federal governments, and other authorities having lawful jurisdiction, and be responsible for compliance therewith. Such authorities include but are not limited to the following: NFPA, OSHA, AGA, & EPA.
- B. Give notices, file plans, obtain licenses and permits, pay fees and backcharges and obtain necessary approvals from authorities having jurisdiction.
- C. Material and equipment shall be Underwriters' Laboratories (UL) listed for the service for which it is being used.
- D. Whenever two or more codes, regulations, etc., conflict with each other or with the Contract Documents, the more severe requirements shall govern the conduct of the work.

1.8 GUARANTEE

- A. Guarantee work performed under this Section in accordance with Division 1, General Requirements. Operation of systems or equipment for temporary services does not constitute beginning of guarantee period.

- B. The Contractor also agrees to furnish service of the equipment for the above period, such service to be rendered quickly and promptly at the request of the Owner. This shall not be misconstrued to include routine maintenance.

1.9 CONTRACT DOCUMENTS

- A. Plumbing drawings do not limit responsibility of determining full extent of work required by Contract Documents. Locations shown on drawings shall be checked against construction proper.
- B. Drawings are diagrammatic and indicate general arrangement of systems and work of this Contract.

1.10 DISCREPANCIES IN DOCUMENTS

- A. Where Drawings or Specifications indicate discrepancies or are unclear, advise Architect in writing before award of Contract. Otherwise, Architect's interpretation of documents shall be final and no additional compensation shall be permitted due to discrepancies or unclear items.
- B. Where Drawings or Specifications do not coincide with recommendations of the manufacturer of a material or piece of equipment, this shall be brought to the attention of the Architect in writing before installation of item in question. Otherwise, make changes in installation as Architect requires without additional cost to the Owner.

1.11 RECORD DRAWINGS

- A. Maintain record drawings during construction in accordance with the General Conditions of the Contract.

1.12 SUBMITTALS

- A. Submit in accordance with Section 013000, SUBMITTALS.
- B. Submit shop drawing or product data for the following:
 - 1. Plumbing fixtures, faucets and accessories.
 - 2. Piping, valves, expansion tank and accessories.
 - 3. Floor Drains.
 - 4. Thermostatic Mixing Valves for Emergency Fixtures.
 - 5. Recirculation Pump.
 - 6. Pipe insulation.
 - 7. Trap primer valves and piping for floor drains.
 - 8. Roof Drain and associated storm drain piping.

1.13 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Prior to the final inspection, the Plumbing Contractor shall provide to the Architect three (3) sets of operating and maintenance instructions. The Architect shall review the instructions for completeness prior to turning them over to the Owner.
- B. Instructions: The Contractor shall provide qualified, factory-trained manufacturers' representative to give detailed instruction to assigned Owner personnel in the operation and complete maintenance for all equipment. All such training will be at the job site.

PART 2 PRODUCTS

2.1 PRODUCTS CRITERIA

- A. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. See other specification sections for any exceptions.
- B. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
- C. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
- D. Asbestos products or equipment or materials containing asbestos shall not be used.
- E. Lead free products shall be used for all piping, fittings, valves, faucets and any other component that comes in contact with potable water.

2.2 PLUMBING FIXTURES

- A. Provide plumbing fixtures as specified herein. Fixture trim, traps, faucet, escutcheons and waste pipes exposed to view in finished spaces shall be I.P.S. brass with polished chromium plating over nickel finish. Fixtures shall have manufacturer's label or trademark indication first quality.
- B. Fixtures with wall outlet flanges shall be set proper distance from floor or wall to make first-class joint with closet setting compound or gasket.
- C. Mounting heights shall be as shown on architectural details.
- D. Each individual fixture shall be provided with supply stops for each water service.
- E. Exposed piping below handicap lavatories and sinks shall be insulated with PVC coated insulation similar to Truebro LavGuard 2 or equal. The product shall be rigid high-impact, stain-resistant PVC, 1/8" constant wall thickness with internal ribs, have UV protection, and have an E-Z Tear-To-Fit trim feature. The color shall be china white and shall be Compatibility #100 series to fit all 1-1/4" or 1-1/2" cast brass or tubular P-trap assemblies and 3/8" or 1/2" angle stop assemblies.
- F. Fixture Schedule: Unless otherwise specified, fixtures shall be as follows (Note: Model numbers are provided to set standard of fixture) :
 - 1. China Fixtures including Water Closets and Lavatories: Toto USA, American-Standard, Kohler Company, Zurn ZPPG, Eljer Plumbingware Inc., Crane Plumbing or equal.
 - 2. Lavatory Faucets: Toto USA, Symmons Industries Inc., Powers (a Watts Industries Co.), American Standard, Zurn ZPPG, Chicago Faucets, Delta Faucet Company or equal.
 - 3. Countertop Sinks: Elkay Sales Inc., Just Manufacturing Co., Kohler Company or equal.
 - 4. Countertop Sink Faucets: T&S Brass and Bronze Works, Symmons Industries Inc., American Standard, Zurn ZPPG, Chicago Faucets, Moen Incorporated, Delta Faucet Company or equal.

5. Janitor's/Service/Utility Sinks: Stern-Williams, Crane Plumbing/Fiat Products, Zurn ZPPG, E.L. Mustee & Sons, Florestone Products Co. or equal.
 6. Janitor's/Service/Utility Sink Faucets: Crane Plumbing/Fiat Products, Stern-Williams, American Standard, Chicago Faucets, Speakman Co. or equal.
 7. Clothes Washer Connection: Symmons Industries Inc., Sioux Chief, Oatey or equal.
 8. Emergency Eyewash: Chicago Faucets, Guardian Equipment, Bradley Corporation, Speakman Company, Haws, Acorn Engineering Company, or equal.
 9. Water Cooler with Bottle Filler: Elkay Sales Inc., Halsey Taylor, Oasis Corporation, Haws Corporation, Filtrine, Murdock MFG or equal.
- P-1 Wall Hung Water Closet (Handicap): American Standard #2257.101 "Afwall Millennium FloWise" (Kohler model #K-4325 "Kingston"), High Efficiency 1.28 gpf (HET), vitreous china, wall hung, conventional glaze, condensation channel, concealed trapway design, direct-fed siphon jet, elongated bowl, 1-1/2" top spud inlet, 2-1/8" ballpass fully glazed trapway, 10"x12" water surface area, static weigh load = 1000 LBS, 100% factory flush tested.
- Sloan Royal model #111-1.28, code #3910168; exposed water closet flushometer for floor mounted or wall hung top spud bowls. Flushometer shall be quiet, exposed, diaphragm type, chrome plated for left or right hand supply, water closet type with the following features:
- PERMEX™ synthetic rubber diaphragm with dual filtered fixed bypass.
 - ADA compliant metal oscillating non-hold-open handle with triple seal handle packing.
 - 1" I.P.S. screwdriver Bak-Chek® angle stop with free spinning vandal resistant stop cap.
 - Adjustable tailpiece.
 - High back pressure vacuum breaker flush connection with one-piece bottom hex coupling nut
 - Spud coupling and flange for 1-1/2" top spud.
 - Sweat solder adapter with cover tube and cast wall flange with set screw.
 - High copper, low zinc brass castings for dezincification resistance.
 - Non-Hold-Open handle, fixed metering bypass and no external volume adjustment to ensure water conservation.
 - Flush accuracy monitored by CID™ Technology.
 - Diaphragm, stop seat and vacuum breaker molded from PERMEX™ rubber compound for chloramines resistance.
- Bemis #1655SSCT commercial heavy duty plastic toilet seat, elongated, open front seat, less cover, injection molded solid plastic, four (4) molded-in bumpers, self sustaining check hinges with non-corrosive 300 Series stainless steel posts and pintles and STA-TITE® Commercial Fastening System™, color white. Church #9500-NSSC, Olsonite #955-CC, or approved equal. Toilet seats shall comply with American National Standard Z124.5 Toilet (Water Closet) Seats as a class Commercial Heavy Duty.
- Zurn Industries, Jay R. Smith, Josam, Mifab or equal hub and spigot combined waste fitting and chair carrier supports, with adjustable extensions, rear foot support and face plate with foot support & feet bolted to floor, with seat mounting height to be 15" above finished floor.
- P-2 Wall Hung Lavatory (Handicap): American Standard "Decorum" model #9024.001EC Commercial Wall Hung Lavatory with Everclean, 20"x18-1/4" nominal, 13-15/16"W x 12-13/16" front to back x 5" deep bowl, vitreous china, ADA Compliant, rear overflow, recessed self-draining deck with minimal backsplash, faucet ledge, concealed arm support.

Chicago Faucets model #3501-E2805ABCP Deck-Mounted Metering Faucet, Single Hole Mount with the following features:

- Single-hole
- Vandal Proof Pressure compensating Econo-Flo™ non-aerating laminar spray, 0.5 GPM
- Vandal Proof 1-5/8" MVP™ metering push handle
- Actuator assembly
- ECAST® design provides durable cast brass construction with total lead content equal to or less than 0.25% by weighted average
- Complies with the requirements of the Buy American Act of 1933.
- Rated Operating Pressure: 20-125 PSI
- Rated Operating Temperature: 40-140°F
- 5-Year Limited Cartridge Warranty
- Lifetime Limited Faucet Warranty
- 1-Year Limited Finish Warranty

McGuire heavy duty polished chrome-plated cast brass angle valve kits, loose key, flexible risers, escutcheons. 1-1/4" x 1-1/2" polished chrome plated cast brass adjustable "P" trap, cleanout plug, extension to wall with escutcheon.

Concealed arm carrier support with foot support to suit construction. Install with rim at 34" maximum above finished floor.

Insulate cold water, hot water, and waste beneath lavatory. Refer to paragraph 2.2.E for additional information.

- P-3 Single Compartment Exam Room Countertop Sink (Handicap): Elkay model #LRAD172065 "Lustertone Classic" 17"x20"x6-1/2" nominal sink dimensions, 14"x14" bowl, 18-gauge type 304 stainless steel, drop-in sink; highest quality; seamlessly drawn from nickel bearing stainless steel; bowl depth = 6-3/8"; 1-3/4" radius coved corners; exposed surfaces hand blended to a lustrous highlighted satin finish; underside fully protected by a heavy duty Sound Guard undercoating pads; 3-1/2" rear center drain opening; two faucet holes space 4" apart - centered.
Elkay model #LK406GN04T4 Deck-Mount Faucet; 4" Centerset with Exposed Deck Faucet with 4" Gooseneck Spout 4" Wristblade Handles Chrome. Faucet has a flow rate of 1.5 GPM, and is made of Chrome-plated Brass material, with a Quarter Turn Ceramic Disc valve. Faucet requires 2 faucet holes.
Elkay model #LK18B Drain
Elkay model #LK500 P-Trap
Chicago #STC-11-11-AB Heavy Duty lead-free, loose key stops and supplies with flexible riser and flange. 1-1/2" x 1-1/2" polished chrome plated cast brass adjustable "P" trap, cleanout plug, extension to wall with escutcheon.

- P-4 Single Compartment Countertop Sink with Eyewash (Handicap): Elkay model #LRAD191960 "Lustertone Classic" 19-1/2"x19"x6" nominal sink dimensions, 16"x13-1/2" bowl, 18-gauge type 304 stainless steel, drop-in sink; highest quality; seamlessly drawn from nickel bearing stainless steel; bowl depth = 5-7/8"; 1-3/4" radius coved corners; exposed surfaces hand blended to a lustrous highlighted satin finish; underside fully protected by a heavy duty Sound Guard undercoating pads; 3-1/2" centered drain opening; three faucet holes on 4" centers.
Chicago Faucets model #8452-TE64VPABCP Dual Handle Emergency Eyewash with Faucet, ASSE 1071 Valve, Gauge and Locking Ball Valve featuring:
- Eyewash outlet: 3.3 GPM at 50 PSI
 - Handles include color-coded index
 - Recommended for 8" installation
 - Vandal Proof Pressure compensating non-aerating laminar outlet, 1.0 GPM
 - Vandal Proof 4" Wristblade handle (pair)

- Quatern™ compression operating cartridge, right-hand
- Quatern™ compression operating cartridge, left-hand
- ECAST® design provides durable cast brass construction with total lead content equal to or less than 0.25% by weighted average
- Complies with the requirements of the Buy American Act of 1933.
- Rated Operating Pressure: 20-125 PSI (faucet); 22-116 PSI - recommended 50 PSI (eyewash)
- Rated Operating Temperature: 40-140°F (faucet); 50-90°F (eyewash)
- 1-Year Limited Material Warranty
- 1-Year Limited Finish Warranty

Chicago #STC-11-11-AB Heavy Duty lead-free, loose key stops and supplies with flexible riser and flange. 1-1/2" x 1-1/2" polished chrome plated cast brass adjustable "P" trap, cleanout plug, extension to wall with escutcheon.

Insulate piping below sink.

- P-5 Single Compartment Countertop Sink (Handicap): Elkay model #LRAD191960 "Lustertone Classic" 19-1/2"x19"x6" nominal sink dimensions, 16"x13-1/2" bowl, 18-gauge type 304 stainless steel, drop-in sink; highest quality; seamlessly drawn from nickel bearing stainless steel; bowl depth = 5-7/8"; 1-3/4" radius coved corners; exposed surfaces hand blended to a lustrous highlighted satin finish; underside fully protected by a heavy duty Sound Guard undercoating pads; 3-1/2" centered drain opening; three faucet holes on 4" centers.
Chicago Faucets model #786-GN8FCABCP Deck-Mounted Manual Faucet with 8" Centers featuring:

- 1.5 GPM (5.7 L/min) laminar flow control insert in spout inlet
- Handles include color-coded index
- 8" fixed centers
- 8" Rigid/swing gooseneck spout with 1.5 GPM flow control
- Vandal Proof 4" Wristblade handle (pair)
- Quatern™ compression operating cartridge, left-hand
- Quatern™ compression operating cartridge, right-hand
- ECAST® design provides durable cast brass construction with total lead content equal to or less than 0.25% by weighted average
- Complies with the requirements of the Buy American Act of 1933.
- Rated Operating Pressure: 20-125 PSI
- Rated Operating Temperature: 40-140°
- 5-Year Limited Cartridge Warranty
- Lifetime Limited Faucet Warranty
- 1-Year Limited Finish Warranty

Chicago #STC-11-11-AB Heavy Duty lead-free, loose key stops and supplies with flexible riser and flange. 1-1/2" x 1-1/2" polished chrome plated cast brass adjustable "P" trap, cleanout plug, extension to wall with escutcheon.

- P-5A Single Compartment Deep Countertop Sink: Elkay model #DLR191910PD "Lustertone Classic" 19-1/2"x19"x10-1/2" nominal sink dimensions, 16"x13-1/2" bowl, 18-gauge type 304 stainless steel, drop-in sink; highest quality; seamlessly drawn from nickel bearing stainless steel; bowl depth = 10"; 1-3/4" radius coved corners; exposed surfaces hand blended to a lustrous highlighted satin finish; underside fully protected by a heavy duty Sound Guard undercoating pads; 3-1/2" centered drain opening; three faucet holes on 4" centers.
Chicago Faucets model #786-GN8FCABCP Deck-Mounted Manual Faucet with 8" Centers featuring:
- 1.5 GPM (5.7 L/min) laminar flow control insert in spout inlet

- Handles include color-coded index
- 8" fixed centers
- 8" Rigid/swing gooseneck spout with 1.5 GPM flow control
- Vandal Proof 4" Wristblade handle (pair)
- Quatern™ compression operating cartridge, left-hand
- Quatern™ compression operating cartridge, right-hand
- ECAST® design provides durable cast brass construction with total lead content equal to or less than 0.25% by weighted average
- Complies with the requirements of the Buy American Act of 1933.
- Rated Operating Pressure: 20-125 PSI
- Rated Operating Temperature: 40-140°
- 5-Year Limited Cartridge Warranty
- Lifetime Limited Faucet Warranty
- 1-Year Limited Finish Warranty

Chicago #STC-11-11-AB Heavy Duty lead-free, loose key stops and supplies with flexible riser and flange. 1-1/2" x 1-1/2" polished chrome plated cast brass adjustable "P" trap, cleanout plug, extension to wall with escutcheon.

- P-6 Wall Hung Two-Station Hand Wash Sink (Handicap): Elkay model #EWMA4820SACTMC Stainless Steel 48"x20"x8" Wall Hung Multiple Station and Wash Sink Kit. Sink is manufactured from 14 gauge 304 Stainless Steel with a Buffed Satin finish, 3-1/2" center drain placement. This kit includes the following:

Two (2) Elkay model #LKB722C Sensor Faucets, AC Plug-In with 8-AA Batteries. Commercial Electronic Sensor Scrub/Handwash Battery Powered Wall Mount Faucet Chrome. Faucet has a flow rate of 1.2 GPM, and is made of Chrome-plated Brass material, with a Electronic Control Module valve. Faucet requires 1 faucet holes.

Two (2)Elkay model #LK723 Thermostatic Mixing Valves. Compliant with ASSE 1016 standards - Compliant with ASSE 1070 standards (Temperature is adjustable, but not at will.) - cUPC, AB1953, and NSF61 certified - Neoperl pressure balancing valves - Vernet sensor bar

One (1)Elkay model #LK18B Grid Drain

Chicago #STC-11-11-AB Heavy Duty lead-free, loose key stops and supplies with flexible riser and flange. 1-1/2" x 1-1/2" polished chrome plated cast brass adjustable "P" trap, cleanout plug, extension to wall with escutcheon.

- P-7 Floor Mounted Mop Sink: Fiat model #MSB-3624 molded stone mop service basin, 36"x24"x10"D, 1" wide shoulders; factory installed drain body shall be stainless steel and designed to provide for a lead caulk or QDC-3 joint to a 3" drain pipe; provide Fiat or equal #830-AA chrome plated faucet with brace and integral vacuum breaker, #832-AA heavy duty hose and hose bracket, and #889-CC mop hanger with three (3) tool hangers.

- P-8 Wet Table: Furnished by owner and installed by plumber

- P-9 Clothes Washer Connection/Laundry Box: Sioux Chief Oxbox model #696-A231BMF (or equal by Symmons model #LM600A Laundry-Mate), supply and drain unit with 1/2" supplies and 2" drain with integral stops and recessed wall boxes with wall plates.

- P-10 Recessed Eyewash: Guardian model #GBF1735DP Swing-Down Eye/Face Wash with Drain Pan, Recess Mounted.

1. Application: Recessed barrier-free swing-down eye/face wash with drain pan. Stainless steel cover provides attractive appearance and protects unit when not in use. When activated, cover serves as pan to collect waste water and return it into unit for drainage.
 2. ADA Compliance: When installed at recommended mounting height, unit complies with ADA requirements for accessibility by handicapped persons.
 3. Spray Head Assembly: Two FS-Plus™ spray heads mounted on supply arms. Each spray head has individually adjustable flow control and filter to remove impurities from water flow.
 4. Cover/ Drain Pan: 16 gauge stainless steel combination cover and drain pan. Grasping "panic bar" handle and opening cover pulls spray head assembly down from vertical to horizontal position, activating water flow. While unit is in operation, waste water is collected in drain pan and returned into cabinet for drainage. Unit remains in operation until cover is returned to closed position.
 5. Valve: 1/2" IPS brass plug-type valve with O-ring seals. Furnished with in-line strainer to protect valve and spray heads from debris and foreign matter.
 6. Mounting: 16 gauge stainless steel cabinet with flange featuring 3/8" return for recessed mounting in wall. Unit fits in standard 3-5/8" deep wall.
 7. Supply: 1/2" NPT female inlet. Waste: 2" NPT female outlet.
 8. Sign: ANSI-compliant identification sign.
 9. Quality Assurance: Unit is completely assembled and water tested prior to shipment.
- P-11 HC Water Cooler with Bottle Filler: Elkay model #LZS8WSLK ezH2O® Bottle Filling Station with Single ADA Cooler Filtered Refrigerated Light Gray. Chilling Capacity of 8.0 GPH (gallons per hour) of 50° F drinking water, based on 80° F inlet water and 90° F ambient, per ASHRAE 18 testing. Features shall include Antimicrobial*, Filtered, Green Ticker™, Hands Free, Laminar Flow, Real Drain, Visual Filter Monitor. Furnished with Flexi-Guard® Safety Bubbler. Electronic Bottle Filler Sensor with Electronic Front and Side Bubbler Pushbar activation. Product shall be Wall Mount (On Wall), for Indoor applications, serving 1 station(s). Unit shall be certified to UL 399 and CAN/CSA C22.2 No. 120.
- P-12 Walk-In 48" Dog Wash Tub: Furnished by owner and installed by plumber.

2.3 PIPE MATERIALS

- A. Storm drainage, sanitary, drainage, vent pipe and fittings above ground: 2-1/2 inches and larger - hubless cast iron, service weight soil pipe, mechanical joint. 2 inch and smaller - Type DWV, hard temper copper pipe with cast brass, 95/5 solder joints, solder joint drainage fittings. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.
1. Furnish and install hubless soil pipe couplings designated Heavy Weight (HW), made of extra wide, heavy duty corrugated type 304 stainless steel with axially slotted heavy duty, worm drive clamps tightened to 80 in lbs. of torque. Flanged gaskets to be made of neoprene rubber, meeting the requirements of ASTM C 564, with sealing rings under each stainless steel clamp. Manufacturers shall be Mission Heavy Weight, Husky 4000, Clamp-All 125, or equal.

- B. All hot water, cold water and hot water recirculating piping within the building shall be hard copper Type "L" seamless drawn tubing assembled with sweat fittings. All solder used shall be lead free, cadmium free, "Silverbrite - 100," or approved equal, complying with the latest issue of ANSI A-5.8 publication. All exposed runs to all toilet fixtures and sinks shall be chrome plated.
1. Mechanical grooved pipe couplings, fittings, Mechanical T's, and other products are acceptable to be used on piping systems and mechanical equipment connections 2" diameter and larger (in lieu of welded/flanged and threaded methods) in systems specified. Operating conditions not to exceed -30°F to 250°F temperature range according to the gasket lining selected and working pressures as shown in the coupling manufacturer's current product specifications.
 - A. Copper Piping Systems: Grooved piping products for use with ASTM B88 hard Type L copper tubing shall be copper tubing sized. (Flaring of pipe ends to IPS dimensions is not allowed.) Fittings shall be ASTM B75 or B152 wrought copper or ASTM B584-87 bronze sand casting. Couplings shall be ASTM A395 and A536 ductile iron, with angle pattern bolt pads for rigidity upon visual confirmation of metal-to-metal bolt pad contact with no torque requirement. Coupling housings coated with copper colored alkyd enamel. Gaskets shall be Style "EHP" EPDM grade to suit the intended service. Gaskets used on potable water systems shall be EPDM, UL classified in accordance with ANSI / NSF61 for both hot (180F) and cold (86F) potable water service.
 2. Press Fitting: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-Rings for copper press fittings shall be EPDM.
 - a. Manufacturers of Copper Press Fittings:
Viega, 17545 Daleview Dr., Lakewood, OH 44107, (877) 620-0016;
Rigid Tool Company, 400 Clark Street, Elyria, OH 44035, (800) 519-3456;
Elkhart Products Corporation "Xpress Press-Connect Fittings", 1255 Oak Street, Elkhart, Indiana 46515, (800) 284-4851
Nibco Press System, 1516 Middlebury Street, Elkhart, IN 46516-4740, (800)234-0227
 3. Vic-Press 304™ Fittings: In lieu of alternate piping methods, Vic-Press 304™ may be used on piping systems 1/2" through 2" in size. Pipe shall be ASTM A312 .Schedule 10 type 304/304L stainless steel.. Fittings and couplings shall be precision cold drawn austenitic stainless steel, complete with synthetic rubber O-ring. O-ring grade to suit the intended service. O-rings used on potable water systems shall be EPDM, UL classified in accordance with ANSI / NSF61 for potable water service.
 - a. Manufacturers of Vic-Press 304™ Fittings: Victaulic Company of America
 4. Solder Standard: Solder metal shall conform to the requirements of ASTM B32. Soldering fluxes shall conform to ASTM B813. Solder and fluxes used in drinking water systems shall have a maximum of 0.20-percent lead (Pb) content.

2.4 VALVES

- A. All valves in contact with potable water systems must be lead-free or meet the requirements of NSF61G. The model numbers given may not indicate this, but any submitted valve will be reviewed based on meeting the Lead Free law and NSF 61G.

- B. Each valve type shall be of same manufacturer and appropriate for service in which used, valves shall be Milwaukee, Watts, Apollo or approved equal. Valves shall comply with all requirements of the Massachusetts Plumbing and Fuel Gas Code; type proposed for each service shall be submitted for approval. In general, shut-off valves, except for exposed stops at fixtures, shall be ball valves.
- C. Each system shall be provided with valves as required by Code and as specified. Valves shall be installed for isolation and to facilitate operation, replacement and repair. Provide access panels where valves are concealed behind non-removable ceilings or walls. Provide shut-off valves for water supply piping to individual fixtures and appliances. All shut-off valves shall be full port ball valves.
- D. Ball Valves:
 - 1. On water lines inside the building, ball valves 3 in. and smaller shall be as manufactured by Consolidated Valve Industries, Inc.'s "Apollo" 95-200-03 Series stop and drain with 1-1/4 in. extended stems for piping 1/2 in. to 1 in. size; 77-100/200 Series with 1-1/4 in. extended stems for piping 1-1/4 in. to 2-1/2 in. size. Valves shall be provided with stainless steel ball, reinforced Teflon seats and seals, bronze body, 400 PSI WOG, positive 100 percent shutoff. Valves 4 in. in size shall be equal to "Apollo" 82-24A-01 with extended stem. Ball valves shall be full port style.
 - 2. Drain valves at all low points shall be "Apollo" 78-100 or 78-200 Series, 1/2 in. or 3/4 in. solder by 3/4 in. hose end with attached dust cover cap and chain.
 - 3. Ball valves shall be of one (1) manufacturer, Conbraco Industries, Inc., "Apollo," Watts Regulator, Nibco/Scott, or approved equal.
- E. Swing Check – Bronze body, 125 W.S.P., 200 W.O.G.
- F. Strainers – Strainers shall be iron body 'Y' type with bronze strainers, 250 psig steam and 400 W.O.G. Provide ball valve with hose bib for blow down similar to Watts # B-6000-CC.
- G. Balancing Valves:
 - 1. Where indicated on the Drawings, furnish and install Victaulic Tour & Andersson Y-pattern multi-turn globe style valves. Bronze or Ametal copper alloy body, calibrated with differential pressure connection points. Digital handwheel with concealed memory stop to provide full valve closure and re-opening to set position.
 - 2. Balancing valves shall be as manufactured by Tour & Andersson, Nibco, Armstrong or approved equal.

2.5 TRAPS

- A. Provide separate traps with integral cleanouts on fixtures and equipment requiring connections to sanitary system. Exceptions are fixtures with integral traps. Traps exposed to view, including connecting drain lines, shall be chrome plated. No trap shall be less than 1-1/2 inch and shall be sized as required by Code.

2.6 INSULATION

- A. All hot water and cold-water piping shall be insulated with Johns Manville Micro-Lok® AP-T plus fiberglass pipe insulation, Owens-Corning Fiberglas® Pipe Insulation, or approved equal. The insulation shall have an average thermal conductivity not to exceed .25 BTU in.

- per sq. ft. per F. per hour at a mean temperature of 75 degrees F. Thickness of the insulation shall be 1/2 in. for all cold water and recycled wastewater piping up to and including 2 in., 1 in. thick for cold water piping 2-1/2 in. and above, and 1 in. for hot water and hot water recirculating piping. Jacket shall be Johns Manville Zeston® 2000 PVC insulated fitting covers and jacketing, or equal. The insulation shall be applied over clean dry pipe with all joints butted firmly together. Longitudinal jacket laps and the butt strips shall be smoothly secured with Benjamin Foster 85-20 adhesive.
- B. All fittings and valves shall be insulated with the proper factory pre-cut fiberglass insulation and covered using the factory, pre-molded, one-piece PVC fitting covers secured with flexible off-white 10 mil polyvinyl chloride film bonded with a specially formulated adhesive that can be installed indoors and out with a strong permanent bond conforming to MIL Spec. No. 7798-A.
 - C. All exposed supply and waste piping to handicapped lavatories or sinks shall be insulated with Truebro Model 101W or 102W "Handi-Lav-Guard" trap and hot water insulation kits with accessory no. 105.
 - D. All exposed insulated piping, in public areas and storage areas, 10 ft. 0 in. up from finish floor shall be provided with an additional jacket made of high impact polyvinyl chloride 10 mil thickness, applied over herein before specified insulation, using vapor barrier mastic-adhesive.
 - E. All new storm drain piping shall be insulated with 1" thick fiberglass pipe insulation similar to cold and hot water piping.
 - F. Insulation shall be Johns Manville, Owens-Corning, CertainTeed Corp., Armstrong, or approved equal.

2.7 HANGERS

- A. Hangers shall support piping from building structure to maintain required grade and pitch of pipe lines, prevent vibration, secure piping in place and provide for expansion and contraction. Hangers shall be adjustable clevis type; trapeze hangers may be used where conditions permit.
- B. Hanger spacing shall conform to requirements of state and local plumbing codes; in no case shall horizontal piping be supported at intervals greater than 8 ft.
- C. Hanger rods shall be connected to beam clamp as required to attach to the building construction. No ram-set or shot shields will be allowed.

2.8 CLEANOUTS

- A. Cleanouts shall be provided in soil and waste pipes at changes in direction, where shown on Drawings, and at other points required by Code so that lines will be readily accessible for cleaning or rodding out; provide a minimum of 24 inch clearance for rodding. Cleanouts shall be same size as pipe in which they are installed but not larger than four inches.
- B. Cleanouts shall be installed so that cleanout opens in direction of flow of drainage line served or at right angles thereto. Cleanout plug shall be kept free of dirt and construction materials and shall not be covered with cement, plaster or other permanent finishing materials.
- C. Floor cleanouts shall have cast iron body and frame with square adjustable scoriated secured nickel bronze top. Unit shall be vertically adjustable for a minimum of two inches. When

- waterproofing membrane is used, provide clamping collar. Cleanouts shall consist of "Y" fittings and 1/8 inch bends with brass or bronze screw plugs. Cleanouts in tile floors shall have Square top covers recessed for tile insertion; in carpeted areas, provide carpet cleanout markers.
- D. Provide cleanouts a base of vertical stacks with cleanout plug located approximately 30 inches above floor. Extend cleanouts to wall with access covers. Cleanout shall consist of sanitary tees. Furnish nickel-bronze square frame and cover with minimum opening 6 x 6 inches at each wall cleanout.
- E. In horizontal runs above grade, cleanouts shall consist of cast brass screw plug in fitting or in caulked cast iron ferrule. No-hub end-cap is not allowed.

2.9 JOINTING COMPOUNDS

- A. Provide pipe dope, Teflon tape, wax rings, neoprene gaskets and other jointing compounds as required by best standard practice and only on service as recommended by the manufacturer. Work shall conform to manufacturer's recommendations with regard to use of putties, jointing compounds or both in installing plumbing fixtures and trim.

2.10 WATER HAMMER ARRESTORS

- A. Maintenance free water hammer arrestors shall be furnished and installed at all locations in the water systems where quick acting valves are installed as well as wherever water hammer may occur. Examples of such locations are as follows:
1. End of long runs of water piping ending @ hose bibs or sillcocks.
 2. Quick-closing/metering Faucets.
- B. Water hammer arrestors shall be as manufactured by Josam Manufacturing Company, J.R. Smith Manufacturing Company, Zurn Systems or Precision Plumbing Products, Inc. Arrestors shall be installed at each and every multiple of fixtures or items as listed above, water hammer arrestors may serve groups of fixtures. Sizing and placement shall be in accordance with PDI Standard PDI-WH-201 and the manufacturer's recommendations. Provide access panels.
- C. Water hammer arrestors shall be as follows:

<u>Type</u>	<u>Fixture Unit Rating</u>	<u>Model</u>	<u>WHA #</u>
1. SA "A"	1-11	Jay R. Smith 5005	100
2. SA "B"	12-32	Jay R. Smith 5010	200
3. SA "C"	33-60	Jay R. Smith 5020	300

2.11 FLOOR DRAINS

- A. Provide floor drains of the type specified hereinafter; drains shall be Jay R. Smith, Josam, Zurn, Watts Drainage or equal. Provide suitable clamping device and extensions if required, where installed in connection with waterproofing membrane.
- B. FD-1: Zurn model #ZN415BZ floor drain body assembly with Type BZ leveling strainer, Dura-Coated cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with seepage slots. Polished nickel bronze, light-duty, leveling strainer. Note: these are buried in concrete slab.

2.12 TEMPERING/MIXING VALVE

- A. Provide thermostatic mixing/tempering valves of the type specified hereinafter; mixing valves shall be Powers, Watts, Leonard Valve Company, Bradley, Symmons, Haws, Lawler or approved equal.
- B. MV-1: For the tempered water for fixture P-10, provide thermostatic mixing valve for hot and cold water supply to fixtures as specified below.
 - 1. Furnish and install at each fixture one (1) Powers HydroGuard XP Series Emergency Tempering Valve model #ES150 rated for 3.6 GPM minimum flow rate @ 5 PSI pressure drop or equal. The mixing valves shall have the following features:
 - Powers' Advanced Thermal Actuator provides precise temperature control
 - Exclusive internal cold water bypass ensures cold water flow in the event of loss of hot water
 - Flow effectively shuts down upon loss of cold water supply when tested under the condition specified in ASSE 1071 standard
 - Vandal-resistant locking mechanism to secure temperature setting
 - Factory tested
 - Rough bronze and chrome finishes
 - Checkstops to prevent cross flow.

2.13 HOT WATER CIRCULATING PUMP

- A. Furnish and install all bronze construction circulation pump, as follows:
 - 1. Pump No. (RP-1) 120 degrees – Hot Water Recirculation for project area:
Furnish and install for Vet Clinic, Taco Model #006ST4 bronze circulating pump, 1/40 HP, 3250 RPM, 1 phase, 115 volt motor with built-in overheat protection, to deliver 2.0 GPM at 7 ft. head.
- B. The pump shall be controlled by time clocks. Time clock shall be furnished, wired, and installed by the Electrical Subcontractor.
- C. Circulating pump shall be Taco, ITT Bell & Gossett Co., Grundfos, Inc., or approved equal.

2.14 PIPE IDENTIFICATION AND VALVE TAGS

- A. All piping, except that piping which is within inaccessible chases, shall be identified with semi-rigid plastic identification markers equal to Seton or approved equal Setmark pipe markers. Directions of flow arrows are to be included on each marker. Each marker background shall be appropriately color coded with clearly printed legend to identify the contents of the pipe in conformance with the "Scheme for the Identification of Piping Systems" (ANSI 13.1-1981). Setmark snap-around markers shall be used above six inch overall diameters up to six inches and strap-around markers shall be used above six inch overall diameters. Markers shall be located adjacent to each valve, at each branch, at each cap for future, at each riser take off, at each passage through wall, at each pipe passage through floors, at each pipe passage to underground and on vertical and horizontal piping at 20 foot intervals maximum. All non-portable water lines and outlets shall be identified in accordance with the requirements of the Massachusetts Uniform State Plumbing Code.
- B. All valves shall be designated by distinguishing numbers and letters carefully coordinated with a valve chart. Valve tags shall be 19 gauge polished brass, 1-1/2 inch diameter with stamped black filled letters similar to Seton S type 250-BL or approved equal. Lettering shall be 1/4 inch high for type service and 1/2 inch for valve number. Tag shall be attached to valves with approved brass "S" hooks, or brass jack chin. Whenever a valve is above a hung ceiling, the valve tag shall be located immediately above the hung ceiling.

- C. Furnish a minimum of two typed valve lists to be framed under glass or plexi-glass. Each chart shall be enclosed in an approved .015-inch thick plastic closure for permanent protection. Valve numbers shall correspond to those indicated on the Record Drawings and on the printed valves lists. The printed list shall include the valve number, location and purpose of each valve. It shall state other necessary information such as the required opening or closing of another valve is to be opened or closed. Printed framed valve lists shall be displayed in each Mechanical Room or in location designated by the Owner.
- D. Equipment nameplates shall be 3/4 inch by 2-1/2 inch long .02-inch aluminum with a black enamel background with engraved natural aluminum letters similar to Seton Style 2065-20. Nameplate shall have pressure sensitive taped backing.
- E. Provide a brass will plaque, minimum .020-inch thickness, secured to the exterior wall just above the grade line for all buried serviced entrances or exits. Samples of such are: Water Service Below; Sanitary Sewer Below; Kitchen Waste Below; Storm Drain Below; etc.

2.15 AUTOMATIC TRAP PRIMER VALVE

- A. Furnish and install automatic trap primer where indicated or required as manufactured by Precision Plumbing Products, Model P-1 or P-2, as noted on the Drawings, with vacuum breaker and adjustment set screw.
- B. Provide distribution unit(s) as required to supply multiple floor drains as manufactured by Precision Plumbing Products.

PART 3 EXECUTION

3.1 SPECIAL RESPONSIBILITIES

- A. Cooperate and coordinate with other trades in executing work of this Section. Perform work such that progress of entire project including work of other trades shall not be interfered with or delayed. Provide information on items furnished under this Section to be installed by other Sections.
 - 1. Obtain detailed information from manufacturers of equipment as to proper method of installation. Give full information so that openings required for work of this Section may be coordinated with other work and other openings and many be provided for in advance. In case of failure to provide information, cutting and patching will be done at the expense of this Section to the satisfaction of the Architect.
 - 2. Notify Architect of location and extent of existing piping and equipment not shown on the Drawings which interferes with new construction. With approval of Architect, relocate existing equipment to permit new work to be installed as required by Contract Documents. With approval of Architect, remove non-functioning or abandoned piping and equipment.
- B. During progress of work, remove and properly dispose of resultant dirt and debris and keep premises reasonably clean. Upon completion of work, remove equipment and unused material provided for work.
- C. Conduct work so as not to interfere with functioning of existing sewer, water and gas mains. Extreme care shall be observed to prevent debris from entering piping. Confer with Architect as to disruption of water service or there utilities due to testing or connection of new work to existing.

3.2 MATERIALS AND WORKMANSHIP

- A. Work shall be executed in a workmanlike manner and shall present neat appearance when completed. Piping shall run concealed except in mechanical rooms and areas where no hung ceiling exists. Material and equipment shall be installed according to manufacturer's recommended best practice.
- B. Materials and equipment shall be new, unless otherwise noted, and supplies, appliances and connections necessary for complete and operational installation shall be provided.
- C. Finish of materials, components and equipment shall not be inferior to industry good practice. Owner shall not be responsible for material and equipment before testing and acceptance.

3.3 ESCUTCHEONS

- A. Escutcheons shall be installed around exposed pipe passing through finished floor, wall or ceiling. Escutcheons shall be heavy cast brass, chrome-plated, adjustable, of sufficient outside diameter to cover sleeve opening and to fit snugly around pipe or insulation.

3.4 SLEEVES AND INSERTS

- A. Sleeves for piping between floors and through fire walls or smoke partitions shall be installed with approved packing between sleeves and piping to provide firestop.
- B. This contractor is responsible for sleeving all pipe penetrations before pouring of slab. If additional holes are required this contractor shall core drill such holes in coordination with the general contractor and with prior consent of the Architect.

3.5 INTERIOR WATER SUPPLY SYSTEM

- A. Water supply piping shall be run as indicated on the Drawings, including new connections to mains and supplies to fixtures. Connections to fixtures shall be from top of mains and piping shall be pitched at least 1 inch in 40 feet in the direction of flow so that it can be drained completely at low points. Provide drain valves where necessary. Piping shall be pitched up towards fixtures for proper air relief.
- B. All copper tubing shall be cut true with cutters; the ends shall be reamed out to the full inside diameter of the pipe. Cap all open ends to prevent the entrance of debris.
- C. Provide water hammer arrestors of proper size and type at end of each water branch with flush valves and as shown on the drawings.
- D. Provide ball type shut-off valves on water branches to individual areas and to each bathroom group.

3.6 SANITARY, DRAINAGE AND VENT PIPING

- A. Interior horizontal sanitary and drainage piping shall be installed in practical alignment at uniform grade of 1/8 inch per foot minimum up to 1/4 inch per foot if possible or if required by code such as for waste piping smaller than 4". Piping within building shall be coordinated closely with the work of other trades, in particular the HVAC ductwork.

- B. All changes in pipe size and direction on waste lines shall be made with Y's and cleanouts, reducing fittings or recessed reducers. Y's and 45° fittings, or 45° combination fittings shall be used wherever possible.
- C. When installing a fitting or making repairs to an existing soil stack, vent stack or storm drain, said fittings or repairs shall be made of the same material as the existing stock or drain using the same jointing method.

3.7 VENTS THROUGH ROOF

- A. All vents extending through the roof which serve the sanitary and waste systems shall extend to no less than 18" and no more than 24" above the roof.
- B. No vent terminal shall be located directly beneath any door, window, or other ventilating opening of the building or of any adjacent building, nor shall any vertical terminal be within 10 feet horizontally of such an opening unless it is at least 2 feet above the top of such opening.

3.8 JOINTS AND CONNECTIONS

- A. Joints and connections of piping shall be made permanently gas and water tight.
- B. Dielectric couplings or unions shall be used where dissimilar piping materials are joined.
- C. Final plumbing and gas connections to all equipment furnished or installed by others shall be by this Section.

3.9 INSTALLATION OF EQUIPMENT

- A. Install equipment to avoid interference with structure and work of other Sections, preserve adequate headroom and clear doors and passageways, to satisfaction of Architect, and in accordance with Code requirements. Installation shall permit clearance for access to equipment for repair, servicing and replacement.
- B. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the equipment being installed, printed copies of these recommendations shall be furnished to the Architect prior to installation.

3.10 DISINFECTION

- A. The domestic water distribution piping system for the project area shall be thoroughly disinfected with solution containing not less than 50 parts per million of available chlorine. Solution shall be introduced into system for period of eight hours, during which time valves and faucets shall be opened and closed several times. After disinfection, solution shall be flushed from system with clean water until residual chlorine content is not greater than 0.2 parts per million.

3.11 CLEANING

- A. Upon completion of work but prior to final system testing, all parts of installation shall be thoroughly cleaned. Fixtures, pipe, valves and fittings shall be completely cleaned of grease, metal cuttings, dirt, etc. Protective covers shall be removed and fixtures shall be cleaned and ready for use.

3.12 TESTING

- A. Provide testing of plumbing systems as required by authorities having jurisdiction, including Owner and Architect. Tests shall be conducted as part of work of this Section and shall include labor, equipment, apparatus and services required to perform tests.
- B. Prior to final acceptance, furnish Architect with certificates of testing and inspection for plumbing systems indicating approval of authorities having jurisdiction and conformance with requirements of Contract Documents.
- C. Notify Architect and authorities involved at least 48 hours prior to testing and inspection. Do not paint, cover or conceal work prior to testing, inspecting and obtaining approval.
- D. Provide temporary piping and connections for testing, flushing or draining systems to be tested. Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to like-new condition. Piping must be absolutely tight before it will be accepted and joints shall be made tight without caulking.
- E. Tests For Plumbing Systems: Soil, waste, vent, gas, and water piping shall be tested by the Plumbing Subcontractor and approved before acceptance. Underground soil, rain conductor, and waste piping shall be tested prior to backfilling. Equipment required for tests shall be furnished by the Plumbing Subcontractor at no additional cost to the Owner. All tests shall be witnessed and approved by the Plumbing Inspector.
- F. Drainage And Venting System Piping: All vent, soil, waste, acid waste, acid vent, and rain conductor shall be tested with water or air before the fixtures are installed.
 - 1. Water Test: Water test shall be applied to the drainage and venting system in their entirety or in sections. If the entire system is tested, all openings in the pipe shall be tightly closed, except the highest opening, and the system shall be filled with water to the point of overflow. If the system is tested in sections, each opening, except the highest opening of the section under test, shall be tightly plugged and each section shall be filled with water and tested with at least a 10 ft. head of water. In testing successive sections, at least the upper 10 ft. of the next preceding section shall be tested so that each joint of pipe in the building, except the uppermost 10 ft. of the system, has been submitted to a test of at least 10 ft. head of water. The water shall be kept in the system, or in the portion under test, for at least two (2) hours before the inspection starts. The system shall be tight at all joints.
 - 2. Air Test: If tests are made with air, a pressure of not less than 5 lbs. per sq. in. shall be applied with a force pump and maintained at least one (1) hour without leakage.
- G. Water System: When the roughing-in is complete, and before fixtures are set, the entire hot water recirculation and cold water piping system shall be tested at a hydrostatic pressure of not less than 125 PSI gauge and proved tight at this pressure for not less than four (4) hours in order to permit inspection of all joints. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately as specified for the entire system. All water entrance piping up to PRV-station shall be tested at 50 PSI in excess of the street pressure, but not to exceed 200 PSI.
- H. Defective Work: If inspection or test indicates defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests repeated. Repairs to piping shall be made with new materials. No caulking of screwed joints or holes will be acceptable.

3.13 ACCESS AND ACCESS PANELS

- A. Perform work so as to provide proper access to material or equipment which may need inspection, replacement, repair or service. If proper access cannot be provided, confer with Architect as to best method for minimizing effect of reduced access.
- B. Furnish access panels for installation under other Sections where controls, valves, or other items requiring access are concealed in floor, wall, furred space or above ceiling.
- C. Lay-in tile ceilings do not require access panels. Locations of devices shall be marked with thumbtack on finish ceiling panel and noted on record drawings.
- D. Access panels shall be Milcor, Knapp, Lector or equal; coordinate with other Sections providing similar panels. Access panels shall have UL rating conforming to requirements of area in which they are installed. The panel(s) shall be adequate to allow for complete access to the concealed equipment; minimum size shall be 12 x 12 inches. The panels shall be factory fabricated completely flush with heavy metal door and frame.
- E. Frames shall be welded construction of not less than 14 gauge steel, with hinges set flush with frame, and shall be secured in a closed position; key locked panels will not be accepted. In toilet rooms and other wet locations, access panels shall be constructed of stainless steel.

3.14 PAINTING

- A. Equipment installed under this Section shall have shop coat of non-lead gray paint, unless otherwise specified. Hangers and supports shall have one coat of non-lead red primer. Machinery shall be stenciled with equipment name. Finish painting, including painting of pipe systems, shall be done under other Sections.

3.15 LUBRICATION

- A. After complete installation by the Contractor of any equipment which depends on lubrication for efficient operation, the Contractor shall properly lubricate per instructions of the manufacturer. This shall be done before any test runs or final operation.

3.16 LABELING

- A. Provide pipe markers of either pressure sensitive tape or laminated plastic, color coded and indicating the type and direction of flow of the plumbing service. All exposed CW, HW and gas piping exposed shall be labeled.

3.17 FLOOR DRAINS

- A. Floor drains shall be furnished and installed by this contractor; he shall be responsible for correctly setting these drains to the proper grade to assure proper drainage from all surrounding areas. Sizes of drains shall be the same size as the pipe it serves.

END OF SECTION 22.00.00

SECTION 23 00 00

HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section. Where paragraphs of this Section conflict, the more stringent requirements shall govern.
- B. All work shall comply with all federal, state and local codes and any other authorities having jurisdiction.

1.02 TIME, MANNER AND REQUIREMENTS FOR SUBMITTING FILED SUB-BID CONTRACT BIDS

- A. The work of this section is work of a Publicly Bid Filed sub-bid Contractor and includes the following requirements.
- B. Filed sub-bid contract bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the City of Worcester Purchasing Division, City Hall, 455 Main Street, Worcester, MA 01608 at the time and place stipulated in the "Invitation to Bid/Notice to Contractors." Along with the time of the bid opening, the following shall appear on the upper left hand of the envelope:
 - Name of Filed Sub-Bidder: Print Name of Filed Sub-Bidder
 - Project: WTHS TUFTS VET TECH CLINIC RENOVATION
 - Subcontract Bid for Section: 23 00 00 – HVAC
- C. Each filed Sub-bid contract bid submitted for work under this Section shall be on forms furnished by the City of Worcester as required by Section 44F of Chapter 149 of the General Laws, as amended. Filed Sub-bid contract bid forms may be obtained at the Purchasing Division in person, or by written request.
- D. Filed Sub-bid contract bids filed with the City of Worcester shall be accompanied by a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the City of Worcester in the amount of five (5) percent of the bid. A filed Sub-bid accompanied by any other form of bid deposit than those specified will be rejected.
- E. Additional Requirements:
 - 1. Filed Sub-bidder's attention is directed to Massachusetts G.L. Chapter 149 §44H, as amended, which provides in part as follows:
 - 2. Each filed Sub-bidder shall list in Paragraph E of the "Form for Sub-Bid" the name and bid price of each person, firm or corporation performing each class of work or part thereof

for which the Section of the Specifications for that sub-subtrade requires such listing, provided that, in the absence of a contrary provision in the Specifications, any sub-bidder may, without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the Awarding Authority that he does customarily perform such class of work with persons on his own payroll and is qualified to do so. This Section of the Specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.

Class of Work	Reference Specification	Paragraphs
Sheet Metal	23 00 00	2.01 & 2.02
Insulation	23 00 00	2.09
Auto. Temperature Control	23 00 00	2.28
Testing, Adj. & Balancing	23 00 00	3.05

F. The work to be completed by the Filed Sub-Contractor for the work of this Section is shown on the following listed Drawings:

- The Work of this Trade Contract is shown on the following Drawings:
AD3.1, AD3.2, AD3.3, A1.0, A2.1, A2.2, A3.0, A3.1, A3.2, A4.1, A4.2, A5.0, A5.1, A6.1, A6.2, A6.11, A6.12, A6.13, A6.14, A8.0, A8.1, A8.2, A8.3, A8.4, A8.5, A8.6, A8.7, A8.8, A9.1, A9.2, A9.3, A10.1, A10.2, A11.1, A11.2, A11.3, A12.1, A12.2, S1.1, S1.2, S3.1, S3.2, S4.1, S4.2
- Related items which may require coordination or impact work of this trade are shown on the following Drawings:
FP1.1, FP3.1, P1.1, P3.1, P3.2, P3.3, DH3.1, DH4.1, H3.1, H3.2, H4.1, H4.2, H5.1, H5.2, H5.3, H5.4, E0.1, E0.2, ED1.1, ED1.2, ED1.3, EH1.1, EH1.2, EH1.3, EL1.1, EL2.1, EL2.2, EL2.3, EL2.4, EL2.5, EP1.1, EP2.1, EP3.1, EP3.2, EP4.1, EP4.2, EP4.3, EP4.4, EP4.5, EP4.6, FA0.1, FA1.1, FA2.1, FA3.1, FA3.2, SC0.1, SC1.1, SC1.2, SC2.1, TC0.1, TC1.1, TC1.2
- The complete List of Drawings for the Project is provided in Section 00 01 15.
- Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Filed Sub-Contractor's responsibility to determine full extent of work of this Section by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.

1.03 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Sub-Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and

warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.04 SUMMARY OF WORK

- A. Provide all materials, labor and equipment required to perform the work of this section, as shown on the Contract Drawings and as specified herein, to include the following. When the word "provide" is used in this specification it shall mean to furnish & install. Provide the following:
1. Selective cut, cap and drop to floor existing HVAC systems for demolition.
 2. Complete HVAC duct system including diffusers, registers, grilles, dampers, etc.
 3. Miscellaneous steel, dunnage, supports, hangers, pads, etc., as shown, and as required.
 4. Ductless Split Air Conditioning Units.
 5. Electric cabinet and baseboard heaters.
 6. Packaged Dedicated Outdoor Air Energy Recovery units.
 7. VRF System Heat Pump with Fan Coil Units and Heat Recovery Branch Circuit Controllers
 8. Exhaust and supply fans.
 9. Hydronic piping, pumps and all related hydronic accessories.
 10. Refrigerant piping and all related accessories.
 11. Condensate drain piping and traps.
 12. Insulation, thermal and/or acoustic, for ductwork and piping.
 13. Variable Air Volume Terminals
 14. Automatic temperature controls.
 15. Motor starters and drives.
 16. Instruction manuals and startup instructions.
 17. Testing and balancing.
 18. Water treatment.
 19. Equipment bases and supports.
 20. All rigging and hoisting of equipment as required.
 21. Coring, sleeving and firestopping all holes required of the respective work.
 22. Access doors on sheet metal ductwork, sheet metal panels and enclosures.
 23. Prefabricated or field erected curbs.
 24. Obtain and pay for all permits, fees and approvals required for work under this Section.
- B. Related Work Specified Under Other Divisions
1. n/a
- C. For cutting and patching, this contractor shall refer to and conform to the requirements of 01 73 29 - Cutting and Patching. All penetrations through the structure shall be sealed air and water-tight or where penetrating a fire rated element must be firestopped. All penetrations of the floors and ceiling shall be firestopped. Refer to section 07 84 00 Firestopping for products, etc...
- D. Provide seismic bracing as required by the Commonwealth of Massachusetts building code 780 CMR, 10th edition, Chapter 16. Contractor shall hire a seismic consultant to comply with

- requirements of the code. All ductwork shall be seismically supported and all piping over 2" unless specifically exempt by 780 CMR Chapter 16. All equipment must be seismically restrained regardless of code exception.
- E. Reference To Drawings: Work specified is shown on the HVAC drawings and also includes all of the Contract Drawings.
1. The HVAC Contractor shall refer to all the Drawings enumerated in the List of Drawings on the title sheet for a full comprehension of the work to be done and for conditions affecting the location and placement of his equipment and materials. These Drawings are intended to be supplementary to the Specifications and any work indicated, mentioned, or implied in either is to be considered as specified by both. Should the character of the work herein contemplated or any matter pertaining thereto be not sufficiently explained in the Specifications or Drawings, the HVAC Contractor may apply to the Architect-Engineer for further information and shall conform to such when given, as it may be consistent with the original intent. The Architect-Engineer reserves the right to make any reasonable changes in location prior to installation at no expense to the Owner. All lines are diagrammatic and exact locations are subject to the approval of the Architect-Engineer.
 2. The HVAC Contractor shall, at all times, have a foreman or superintendent on the project authorized to make decisions and receive instructions as if the HVAC Trade contractor himself were present. The foreman or superintendent shall not be removed or replaced without the express approval of the Architect-Engineer after construction work begins. The HVAC Contractor shall employ only competent and experienced workmen at a regular schedule in harmony with the other tradesmen on the job. The HVAC Contractor shall also exercise care and supervision of his employees in regard to proper and expeditious layout of his work.
- F. Air Filters:
- It is the intent of this specification that all equipment requiring or specified with air filters be furnished with four (4) spare sets of filters for each piece of equipment in addition to those supplied with the unit. Presuming the unit has not been operated during construction (operation during construction only allowed with written approval from Architect) the set of filters initially installed in the unit shall be utilized during testing and balancing and building flush out. After flush out, a new set of air filters shall be installed leaving the Owner with three (3) full spare sets. All filters shall have minimum efficiency of MERV 13 with the exception of non-ducted fan coil units in which MERV 8 or other manufacturers filter is provided. All filter sections on DOAS units must be fitted with differential pressure gauges. Gauges shall be connected to EMS where specified elsewhere in this specification.
- G. Belts & Spare Stock:
- It is the intent of this specification that all equipment requiring or specified with belt drives (i.e. fans, energy recovery wheels in ERU's, etc...) be furnished with two (2) spare sets of belts for each piece of equipment in addition to those supplied with the unit.
- In addition, any items considered consumable or required for routine maintenance and service replacement within the first 12 months of an equipment's operation shall be supplied of adequate quantity to operate the equipment for a period of 12 months.

1.05 SUBMITTALS

- A. Refer to Section 01 33 00, SUBMITTALS for submittal provisions and procedures. Contractor must also refer to and comply with Section 018113 - Sustainable Design Requirements.
- B. Product data: within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit (7) copies of the following:
1. Coordinated shop drawings, showing proposed layout of equipment, piping, ducts, registers, grilles, controls and other components of the system. All heights, transitions, dimensions, etc... shall be clearly shown.
 2. Manufacturers catalog cuts, Samples and other items needed to fully demonstrate the quality of the proposed materials and equipment. In addition to the submittals formerly mention herein submit equipment specification sheets and dimensional data on all equipment including but not limited to the following:
 - Ductwork, diffusers, registers, grilles, etc..
 - Flue Piping, Combustion air louver and ductwork and accessories
 - Electric cabinet and baseboard heaters.
 - Ductless Split A/C Units
 - Packaged Dedicated Outdoor Air Energy Recovery units
 - VAV and EVAV terminals.
 - Exhaust and Supply Fans
 - HEPA Filter Sections
 - VRF Heat Pump Unit with associated Fan Coil Units.
 - Duct Mounted Hot Water Coils.
 - Piping and all related hydronic accessories.
 - Insulation, thermal and/or acoustic, for ductwork and piping.
 - Automatic temperature controls.
 - Motor starters and drives.
 - Instruction manuals and startup instructions.
 - Testing and balancing.
 - Water treatment.
- B. Record Drawings
1. Include a copy of the Record Drawings in each copy of the operation and maintenance manual described below. A reproducible set of as-built drawings shall be updated continually through the project and delivered to the Architect at project completion. Record drawings shall also be delivered in both ACAD format and PDF format on a CD.
- C. Testing and Balancing Reports
1. Submit four (4) copies of a certified testing and balancing report to the Architect for review and approval. Include all air flow, water flow and temperature readings as outlined herein.
- D. Operating Instructions
1. Prior to the completion of all work and the final inspection of the installation by the owner, four (4) copies of a complete Instruction Manual, bound in booklet form and suitably indexed, shall be submitted to the Architect for review and approval. All written material contained in the manual shall be typewritten. In addition, provide a copy of the manual in an index PDF format on a CD.

1.06 INSTRUCTION OF OWNER'S PERSONNEL

- A. After completion of all work and all tests and at such time as designated by the owner, provide the necessary skilled personnel to operate the entire installation for a period of twenty-four (24) hours. Training shall be broken up into multiple four (4) hour periods at the direction of the Owner. Training must be recorded by the contractor and distributed to the Owner on a USB drive with a copy in each O&M manual.
- B. During the operating period, fully instruct the owner's representative in the complete operation, adjustment and maintenance of the entire installation.
- C. It shall be division 23 00 00 responsibility to provide all personnel as required to fully coordinate with the commissioning agent. The hours of training and instruction outlined in division 23 00 00 and the Testing and Balancing requirements shall be in addition to those tests and requirements outlined in Commissioning section and required to fulfill commissioning obligations.

1.07 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. The Contractor's superintendent shall conduct all coordination between the Contractor, the Architect, the Engineers, etc., and shall fully represent the Contractor's position in his absence. All decisions by the superintendent shall become the responsibility of the Contractor and binding to the Contract. The Contractor shall be responsible for the drawings, and that which is written or implied in the specifications.
- C. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.
- D. Completely coordinate with work of other trades and provide for complete and fully functional installation. Although not specifically shown, provide supplementary or miscellaneous items, devices, appurtenances and materials incidental to or necessary for sound, secure and complete installation
- E. Before submitting the final proposal examine the site of the proposed work to determine existing conditions that may affect the work, as this section will be held responsible for any assumption in regard thereto.
- F. All equipment, ductwork, piping and materials utilized for this project must be protected from exposure to weather until installed. Interior equipment and materials shall not be installed unless the area in which they are being installed is adequately weather tight.
- G. Condensate evaporation trays are expressly forbidden on all HVAC equipment.

- H. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.

1.08 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

1.09 GUARANTEE

- A. The Contractor shall guarantee every component part of each system for a minimum of one-year parts and labor. The contractor shall also provide the Owner with factory warranties for all equipment. For equipment with compressors such as the condensing units, packaged rooftop and ERU units, etc... provide extended five-year warranty on compressors. For VRF heat pump units provide extended 10-year warranty on compressors. Refer to respective specification sections herein for additional warranty requirements.

1.10 SEQUENCING/PROJECT COORDINATION

- A. Coordinate work of this Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.01 DUCTWORK

- A. All duct runs shall be checked for clearances before installation of any ductwork. Above hung ceilings, duct locations, and elevations must be coordinated with work of other trades to avoid conflicts with structure, piping, conduit, light fixtures, and cable trays.
- B. All sheet metal ducts shall be constructed of galvanized iron sheet G-90 galvanized steel meeting ASTM A924 and A653 of bend forming quality. The following specialty ducts shall be used:
 - 1. Ducts serving clothes dryers shall be fabricated from heavy gauge aluminum.

- C. Duct construction shall be in accordance with best practices and latest SMACNA requirements for metal gauges, joints, reinforcing, and supports. Ductwork within the building within 10 feet of the DOAS energy recovery units (ERU) supply and return or exhaust fan shall be minimum 18 gauge or 2 gauges heavier than SMACNA standard, whichever is greater (heavier gauge), to reduce breakout noise. All ductwork shall be rated for a minimum pressure classification of 3" w.g., unless higher rating is recommended by SMACNA standards. Exhaust ductwork serving the fume extraction system for the welding area shall be rated for not less than 6" of external static. All exposed ductwork shall be constructed and hung to provide a neat, smooth, finished appearance. Cadmium plated sheet metal screws shall be used on all exposed ductwork. Ducts shall be free from expansion or contraction noises or rattling when fans are turned on or off.
- D. Round ductwork shall be spiral formed galvanized steel of standard gauge as manufactured by United Sheet Metal, Spiramatic, Semco, or equal. Refer to Articles on Spiral Round for additional information.
- E. Duct sizes change in shape or dimensions and offset as required to clear structural members and to coordinate with other trades. All changes must maintain the same friction loss as the original duct (i.e. similar free area) and must meet the latest ASHRAE and SMACNA standards.
- F. The centerline radius of all duct elbows where shown on Drawings shall be at least one and one-half the width of the duct. Where building conditions do not allow for this radius, provide double wall airfoil turning vanes or, if in a sound attenuated duct, provide acoustical attenuating turns.
- G. Duct sections 1 ft. 6 in. wide or less shall be butted together and jointed with flat drive cleats 2-1/8 in. wide. Top and bottom cleats shall be cut flush with duct and side cleats bent over to make a tight joint. Standing bar slips as specified for ducts over 18 in. may be used at the HVAC Trade contractor's option.
- H. Ducts from 18 in. to 30 in. wide shall be jointed with 1/8 in. standing bar slips made of metal the same as or heavier than duct sheets. Joints in ducts with either dimension over 30 in. shall have 1 in. standing bar slips on those sides over 30 in. Where sides are over 42 in., the standing bar slips will be reinforced with 1-1/2 in. by 1-1/2 in. by 1/8 in. angles. Additional angle stiffeners not over 60 in. apart shall be provided between joints. Ducts over 60 in. in width shall be jointed with 1-1/2 in. by 1/8 in. angle irons riveted to ductwork on all sides with 1/8 in. rivets at not more than 4-1/2 in. on centers, sections bolted with 3/16 in. stove bolts at not over 6 in. centers, sheets turned over angles into joint at least 1/4 in.
- I. Sheet metal screws 3/4 in. No. 10 may be used to attach stiffener angles to ductwork to secure seams, spaced not over 12 in. on centers and not less than two (2) per side of 12 in. or more, except where specified otherwise. Button punching shall not be used, except for pre-erection attachment of fittings.
- J. Provide hinged galvanized steel access and inspection doors opposite each motorized & gravity damper, at each fire damper, and at every duct mounted control device. In addition, provide access doors of sufficient quantity and location to allow for complete internal access of all ductwork systems for future cleaning and inspection but in no case less than every 20 feet and at every change in direction. Doors shall be of rigid construction with cast type rotary latches. Where space limitations do not allow full swing of the access door, two (2)

- rotary type latches shall be used. Doors located in insulated ducts shall be furnished with extended frames to serve as a stop for insulation. Insulate doors located in insulated ductwork. All doors shall be gasketed. Door shall be 10 in. by 12 in. minimum except where limited by duct width and shall be larger where necessary for access to fire damper fusible links or other devices. Access on exposed ductwork shall be located so as to conceal them from obvious view from building occupants (i.e. top side of ductwork).
- K. Hangers for all rectangular ducts 4 sq. ft. in area or above shall be round bar type fastened to 1-1/4 in. by 1-1/4 in. by 1/8 in. angles under the ducts.
1. Ducts less than 4 sq. ft. in area shall be hung with black 1 in. by 1/8 in. strap iron bent 1 in. under bottom side of the duct and fastened to the duct with sheet metal screws, using not less than two (2) screws per side and as many more so that they are not greater than 6 in. centers.
- L. Supports for round and oval ductwork shall be 1 in. by 1/8 in. black strap iron rolled to the perimeter of the duct with ends bent on top of duct and bolted. Hangers at supply diffusers shall be similar but separated at bottom and riveted to ductwork as required for adequate support.
- M. Hangers for the round ductwork shall be 1 in. by 1/8 in. black strap iron bolted to supports and lagged into the ceiling construction. Hangers over 24 in. long shall be 3/8 in. rod type with bolted and threaded ends and angle bracket at ceiling.
- N. Hangers are to be placed on not greater than 8 ft. 0 in. centers or closer where required so that the ductwork can support the weight of a 200 pound man at any point.
- O. Wherever sound insulation lining is called for, the sheet metal duct size shown on the Drawings must be increased to provide the clear inside dimensions or cross sectional area shown on the Drawings. Dimensions shown on the drawings are clear inside.
- P. Duct joint sealing, reinforcing, flanges, etc. for square sheet metal ducts shall be based on maintaining airtight ducts at 2 in. w.g maximum static pressure with maximum of 5 percent leakage of total fan capacity, 1/2 of one percent for round and oval ducts. All joints in round and rectangular ductwork shall be sealed with UL classified NFPA approved duct sealer. Seal all ductwork at joists and seams with water based duct sealer DuctMate® EZ-Seal or approved equal. All ductwork shall be pressure tested as required by code.
- Q. Upon completion of construction and before testing, the interior of all plenums shall be vacuum cleaned. When unit is first turned on, open duct access doors and blow out all foreign matter. Do not run fan without filter.
- R. At branch ducts, provide manually operated dampers of the type and arrangement shown on the Drawings, two gages heavier than the duct in which installed and equipped with locking quadrants. All branch take-offs shall be made with 45° or full Bellmouth type fittings. Spin-in and stick-on take-offs shall not be allowed.
- S. Volume dampers, provide single and multi blade manually adjustable dampers as shown on drawings in all duct splits and branch connection of supply and exhaust air systems. For kitchen exhaust hood airstream provide UL 710 listed NFPA 96 compliant adjustable locking balancing dampers as manufactured by Streivor, Halton or approved equal.
- T. Flexible duct shall be 2.2" thick insulated low-pressure type with foil vapor barrier as manufactured by Automation Industries, Thermaflex type MKE ATCO Greenguard or equal.

- Minimum installed R-value shall be 6.0 within the heated building envelope. Maximum length of flex duct is 5 feet. Secure with tie straps and seal with duct tape. Flexible duct shall not be allowed in areas where the duct is not concealed by a ceiling. All flexible ductwork must be installed in accessible spaces and shall not be located above a hard inaccessible ceiling.
- U. Acoustic insulation: All supply, return, and exhaust air ducts as well as return air duct plenums shall be lined internally with 1.5" inch thick acoustical liner equal to Owens Corning QuietR® Type R-6 or Knauf Insulation Rigid Plenum Liner Board manufactured with ECOSE® Technology or equal, $k=0.25$ at 75 degree F. mean temperature for rectangular ductwork and Owens Corning QuietZone® 1.5" thick spiral duct liner, $k=0.25$ at 75 degree F. mean temperature for spiral and round ductwork. Minimum installed R Value shall be 6.0. Liner shall extend for a minimum of 15 feet (or more if indicated on drawings) from all air moving equipment (RTU & ERU's & FC's). Liner shall be clipped and cemented to the inside of the duct. All seams and edges of liner shall be sealed to prevent fraying in the airstream. Liner shall have an acrylic polymer fiberglass reinforced facing with an antimicrobial coating. Liner shall conform to NFPA and U.L. and ASTM C1071 & ASTM C1104 requirements and have a 25/50 flame/smoke rating.
- V. Provide seismic bracing as required by the Commonwealth of Massachusetts building code 780 CMR, 10th edition, Chapter 16. Contractor shall hire a seismic consultant to comply with requirements of the code. All equipment and ductwork shall be seismically supported and all piping over 2" unless specifically exempt by 780 CMR Chapter 16.
- W. All ductwork specified in article 2.01 and 2.02 and all other ductwork shall be shipped to the site with protective film on all open connections to prevent dust from entering. Film shall be reapplied to all open ends as the duct is installed until such time as building is clean and system is ready for start-up.
- X. All ductwork shall be pressure tested to its design pressure, 3" w.g. minimum or higher as specified.

2.02 SPIRAL DUCTWORK

A. GENERAL

All round and/or flat oval spiral duct and fittings shall be manufactured by a company whose has been in the business of manufacture of ductwork and spiral duct and fittings for at least ten (10) years. All spiral duct and fittings shall be manufactured by the same firm and shall be as shown on the contract drawings. Acceptable manufactures shall be SEMCO Incorporated or approved equal sheetmetal fabricator. Requirements of Article 2.01 shall also apply to this Article.

All spiral duct and fittings shall be manufactured from G-90 galvanized steel meeting ASTM A924 and A653 requirements. Corrugations between spiral seams on all exposed applications shall not be accepted.

Pressure rating for fume extraction ductwork shall be not less than 6" w.c.

B. CONSTRUCTION

Branch connections shall be made with 90° conical and 45° straight taps as shown on the drawings. All branch connections shall be made as a separate fitting. Factory or field

installation of taps into spiral duct shall not be allowed without written approval of the engineer. Manufacturer's published individual fitting performances shall be on file with the design engineer ten (10) days prior to bid.

90° and 45° elbows in diameters 3" round through 10" round shall be stamped or pleated elbows. All other elbows shall be of the gored type, fabricated in accordance with the following:

	<u>Centerline Radius</u>	<u>Elbows less than 30°</u>	<u>Elbows 37° thru 71°</u>	<u>Elbows 72° thru 90°</u>
Up to 1000 fpm	1.0 x diameter	2 gores	2 gores	3 gores
1001 to 1500 fpm	1.0 x diameter	2 gores	3 gores	4 gores
Above 1500 fpm	1.5 x diameter	2 gores	3 gores	5 gores

Where it is necessary to use two-piece mitered elbows, they shall have a minimum number of vanes in accordance with the following:

<u>Duct Diameter</u>	<u>Number of Vanes</u>
3" thru 9"	2
10" thru 20"	3
21" and up	5

Circumferential and longitudinal seams of all fittings shall be a continuous weld or spot welded and sealed with mastic. All welds shall be painted to prevent corrosion.

All field joints for round ducts up to and including 36" diameter and oval ducts up to and including 41" major axis shall be made with a 2" slip-fit or slip coupling. Diameters 38" round and larger shall be provided with AccuFlange, or equal, flanged connections. AccuFlange, or equal, flanged connections may also be used in lieu of slip connections on smaller sizes.

Access doors shall be supplied by the duct manufacturer at all fire and/or smoke dampers.

All flanges and access doors shall be factory installed. Shipments of loose flanges, access doors, or taps for field installation into spiral duct will not be allowed.

C. METAL GAUGES

Metal gauges for single wall round ducts shall be as follows:

1. Round Ducts with Maximum 2" W.G. Positive Static Pressure. Ducts within 15 feet of ERU supply, return and exhaust fans shall be minimum 10 gauge to reduce breakout noise.

<u>DUCT DIAMETER</u>	<u>SPIRAL DUCT</u>	<u>FITTINGS AND LONGITUDINAL SEAM DUCT</u>
3" thru 26"	26	24
28" thru 36"	24	22
38" thru 50"	22	20
52" thru 60"	20	18

62" thru 78" 18 16

2. Round Ducts with Maximum -2" W.G. Negative Static Pressure.

<u>DUCT DIAMETER</u>	<u>SPIRAL DUCT</u>	<u>FITTINGS AND LONGITUDINAL SEAM DUCT</u>
3" thru 17"	26	24
18" thru 20"	24	22
21" thru 22"	24	20
24" thru 26"	22	20
28" thru 30"	22	18
32" thru 34"	20	18
36" thru 42"	20	16
44" thru 48"	20	18 (Note 1 & 3)
50" thru 60"	18	18 (Note 2 & 3)

Notes:

1. Reinforce with 1" x 1" x $\frac{1}{8}$ " girth rings every 6 ft.
2. Reinforce with $1\frac{1}{4}$ " x $1\frac{1}{4}$ " x $\frac{3}{16}$ " girth rings every 4 ft.
3. When companion flange joints are used as reinforcement,
44" to 48" diameter shall be 2" x 2" x $\frac{3}{16}$ "
50" to 60" diameter shall be $2\frac{1}{2}$ x $2\frac{1}{2}$ x $\frac{3}{16}$ "

- D. All ductwork shall be pressure tested to its design pressure, 3" w.g. minimum or higher as specified.

2.03 AIR INLETS/OUTLETS

- A. Diffusers, registers and grilles shall be installed where shown on the drawings and shall be of the type, sizes and quantities as indicated on drawings. Manufacturers shall be Price, Titus, Krueger or MetalAire. For square neck supply diffusers connecting to a round duct, the transition piece shall have a minimum 45 deg. angle.
- B. Final custom color selection of all diffusers registers and grilles shall be by Architect. Submit color chart for review however, color selection shall be presumed custom.
- C. All diffusers, registers and grilles shall be shipped with protective film on face and connections to prevent dust from entering.
- D. Furnish and install steel or aluminum directional louvered face diffusers of the sizes and mounting types shown on the plans and air distribution schedule. Diffusers shall consist of an outer frame assembly, which facilitates mounting in the application shown. A collar that allows connection to the square (or rectangular) duct size indicated shall be an integral part of the frame assembly. An inner core assembly consisting of fixed louvers capable of producing the air flow discharge pattern indicated on the plans shall be fully removable from the installed diffuser frame for access to any dampers or other ductwork components located in or near the diffuser neck. A set of adjustment vanes shall be provided on each side of the diffuser to allow for field adjustment from horizontal to vertical air flow discharge. Finish shall be B12 white powder coat or as otherwise specified by the Architect. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

- E. Furnish and install supply registers of the sizes and mounting types indicated on the plans and outlet schedule. Registers shall be double deflection type with two sets of fully adjustable airfoil shaped deflection blades spaced 3 /4 in. on center. The front set of blades shall run parallel to the (long / short) dimension of the register. Both blades and border shall be of heavy extruded aluminum construction. The integral volume control damper shall be of the opposed blade type and shall be constructed of cold rolled steel (optional aluminum construction 22DAL). The damper shall be operable from the register face. The damper shall be coated steel (mill finish aluminum 22DAL). The grille shall be finished in B12 White Powder Coat / B15 Aluminum Powder Coat or other color as specified by the Architect. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.
- F. Furnish and install return and/or exhaust registers of the sizes and mounting types indicated on the plans and outlet schedule. Registers shall be 45 degree deflection fixed louver type with blades spaced 3 /4 in. on center. The blades shall run parallel to the (long/short) dimension of the register, as indicated in the outlet schedule. Both blades and border shall be of heavy extruded aluminum construction. The optional integral volume control damper shall be of the opposed blade type and shall be constructed of cold rolled steel. The damper shall be operable from the register face. The optional damper shall be coated steel. The grille shall be finished in B12 White Powder Coat or other color as specified by the Architect. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

2.04 PIPING MATERIALS – GENERAL

- A. Reference is made to specifications of recognized authorities to establish quality. Latest edition of their publications at time of bidding shall be in force.
- B. All piping shall have manufacturer's name or trade mark rolled into each and every length of pipe.
- C. All threads for screwed joints shall be National Taper Pipe Thread conforming to ANSI B2.1.
- D. Grooved mechanical joint pipe, fittings and couplings shall be allowed as an acceptable substitution for welded, threaded or flanged pipe fittings except as otherwise not allowed by applicable codes. Product shall be as manufactured by Victaulic Company of America, Grinnell Mechanical Products, Anvil International Gruvlok or an Engineer approved equal. Fittings shall comply ASTM A536 with grooves or shoulders to accept grooved end couplings. Mechanical couplings shall consist of ductile iron housing, synthetic rubber gasket of a central cavity pressure-responsive design, nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
 - 1. Rigid type: Housings (12" and smaller) shall be cast with offsetting, angle-pattern bolt pads or tongue and groove design to provide system rigidity and support and hanging in accordance with ASME B31.1 and B31.9..Only designs that require metal-to-metal pad contact permitted. Designs that permit spaces or gaps at bolt pads or require a torque as a primary means of ensuring joint rigidity per written manufacturer's instructions not permitted. Victaulic Style 107H, Style 07 or W07 or Gruvlok Style 7401, Style 7402, Style 7400.

2. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Victaulic Style 177, 77 and W77 or Anvil International Gruvlok Style 7001.. Three (3) flexible couplings may be used in lieu of each flexible connector at major equipment in accordance with published guidelines.
 3. Flange Adapters: Ductile iron housing, flat face, for use with grooved end pipe and fittings, for mating directly with ANSI Class 125, 150, and 300 flanges. Victaulic Style 741, W741 or 743 or Anvil International Gruvlok Style 7012, 7013 or 7788.
- E. Copper Hydronic Pipe Mechanical Fittings by Viega ProPress or approved equal by Elkhart or Nibco: Bronze or copper shall conform to the material requirements of ASME B16.18 or ASME B16.22, and the performance requirements of IAPMO PS117, and ICC LC1002. ProPress fittings ½-inch thru 4-inch for use with ASTM B88 copper tube type K, L, or M and ½-inch up to include 1-1/4-inch annealed copper tube. ProPress fittings shall have an EPDM sealing element and Smart Connect (SC) feature. 2-1/2-inch thru 4-inch shall have a 420 stainless steel grip ring, PBT separator ring, EPDM sealing element and Smart Connect (SC) feature. Sealing elements shall be verified for the intended use

ProPress bronze, or copper fittings: Pipe ends shall be cut on a right angle (square) to the pipe. Pipe ends shall be reamed and chamfered, all grease, oil or dirt shall be removed from the pipe end with a clean rag. Visually examine the fitting sealing element to insure there is no damage, and it is properly seated into the fitting. Insert pipe fully into the fitting. Make a mark with a felt tip pen on the pipe at the face of the fitting. Always examine the tube to insure it is fully inserted into the fitting prior to pressing the joint. ProPress fittings ½-inch thru 4-inch shall be joined using Ridgid ProPress Tools. 2-1/2-inch thru 4-inch ProPress copper fittings shall utilize Ridgid ProPress XLC Rings, and 2-1/2-inch thru 4-inch bronze ProPress fittings shall utilize Ridgid ProPress XL Rings. ProPress fittings shall be installed according to the most current edition of the Viega installation guidelines. Sealing elements shall be verified for the intended use. Installers shall attend a Viega ProPress installation training class.

After ProPress fittings have been installed a "step test" shall be followed. Utilizing air, water, or dry nitrogen, pressurize the system not to exceed 85 psi. Walk the system and check for leaks. If you do not locate any leaks proceed to pressurize the system to the recommended pressures, not to exceed 600 psi. Should you locate a leaking joint that has not been pressed, relieve the pressure from the system, ensure the tube is fully inserted into the fitting and press the fitting. Resume test procedure, after the necessary repairs have been made. This test shall be in addition to the required hydrostatic tests specified elsewhere within the specification. (Add. #5)

- F. Steel Hydronic Pipe Mechanical Fittings by Viega MegaPress or approved equal via welded, threaded or grooved piping system method: ½-inch through 2-inch shall conform to ASME B31.1, ASME B31.3, or ASME B31.9 MegaPress fittings with zinc and nickel coating for use with IPS carbon steel pipe conforming to ASTM A53, ASTM A106, ASTM A135, or ASTM A795. MegaPress fittings shall have an EPDM sealing element, 420 stainless steel grip ring, separator ring, and an un-pressed fitting leak identification feature. Sealing elements shall be verified for the intended use. Installation must be in accordance to manufacturer's instructions and specifications

Mega Press Systems: Pipe ends shall be cut on a right angle (square) to the pipe. Pipe ends shall be reamed chamfered and all paint, laqaur, grease, oil or dirt shall be removed from the pipe end with an abrasive cloth or Viega pipe end prep tool. Visually examine the fitting sealing element to insure there is no damage, and it is properly seated into the fitting. Insert pipe fully into the fitting. Make a mark with a felt tip pen on the pipe at the face of the

fitting. Always examine the pipe to insure it is fully inserted into the fitting prior to pressing the joint. MegaPress fittings shall be joined using Ridgid MegaPress Tools. MegaPress fittings shall be installed according to the most current edition of the Viega installation guidelines. Sealing elements shall be verified for the intended use. Installers shall attend a Viega MegaPress installation training class.

2.05 STEEL PIPE: HEATING WATER SUPPLY AND RETURN (HWS&R)

- A. Pipe: Black, Schedule 40 conforming to ANSI B125.2 or B125.1. Pipe to be used for welding shall be furnished with beveled ends.
- B. Fittings:
 - 1. 2 in. and smaller, screwed, 125 lb. cast iron conforming to ANSI B16.4.
 - 2. 2-1/2 in. and larger, screwed, 150 lb. malleable iron conforming to ANSI B16.3.
 - 3. For welded pipe, all sizes, standard weight black steel welding pattern conforming to ANSI B16.5, B16.9, and B16.25.
- C. Joints: Screwed joints shall be made up with Teflon pipe thread tape, Teflon liquid, or other approved non-hardening joint compound applied to male thread only. Welded joints shall be made by oxyacetylene or electric arc process and comply with latest ASA "Code for Pressure Piping" requirements.
- D. Any pipe 1-1/4 in. and larger may be welded, no pipe larger than 3 in. shall be screwed.
- E. Coil connections are to be made so the coil can be removed without cutting pipe.

2.06 HEATING WATER SUPPLY AND RETURN (HWS&R), (LESS THAN 3 IN.) AND CONDENSATE DRAIN (C) PIPING (ALL SIZES)

- A. Copper Tube Pipe: Type L, hard drawn, conforming to ANSI H23.1.
- B. Fittings: Wrought copper solder pattern conforming to ANSI B16.22.
- C. Joints: Made with 95-5 tin-antimony solder using non-corrosive flux.
- D. The Contractor has the option to use copper pipe on heating supply and return and heating/cooling water supply and return for 2 in. diameter piping or less.

2.07 REFRIGERANT PIPING & ACCESSORIES

- A. All refrigerant piping, liquid, and suction shall be type "ACR" copper tube, hard drawn, shipped to job site with end caps in place. Fittings shall be refrigerant grade copper fittings. Pipe and fittings shall conform to ANSI B31.5 and ANSI B9.1. Piping shall be complete with all refrigerant specialties, of line size, as indicated on the Drawings, and as required by installation requirements. Joints shall be silver soldered or brazed.

- B. Piping shall be ASTM B88 type L hard drawn copper tube, cleaned and capped in accordance with ASTM B280, and marked "ACR", with ANSI B16.22 wrought copper or forged brass solder-type fittings. Mechanical fittings shall not be allowed except for flared type connections at components.
- C. For refrigerant piping penetrating the roof furnish a roof penetration housing system similar to the Vault AWI series as manufactured by Roof Penetration Housing or approved equal. Device shall incorporate an R-40 insulated roof curb for flashing by the project roofer. Device shall be of the size required to properly turn and terminate the roof and be IECC 2021 compliant. Unit shall be constructed of power coated 0.080 inch thick aluminum and have stainless steel fasteners and a gasketed lid capable of withstanding wind speeds up to 225 MPH.
- D. REFRIGERANT PIPING ACCESSORIES
Provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 450 psig and a maximum working temperature of 225 deg F. For systems using R-32 or 454B, provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 800 psig and a maximum working temperature of 225°F.

Flexible pipe connectors: Double braided bronze hose flexible pipe connectors with brazed end connections.

Filter Dryers: For circuits 15 tons and over provide angle pattern filter dryers with replaceable core. For circuits below 15 tons provide straight pattern filter dryers without replaceable core.

Sight glasses: Two-piece brass construction with brazed end connections. Include color indicator for sensing moisture.

Solenoid Valves: Two way normally closed with two piece brass body, full port, stainless steel plug, stainless steel spring, teflon diaphragm and solder end connections. Provide replaceable coil assembly.

Hot Gas Bypass Valves: Provide with integral solenoid valve, external equalizer connection and adjustable pilot assembly.

Thermostatic Expansion Valves: Brass body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.

Charging Valves: Provide 1/4" SAE brass male flare access ports with finger tight, quick seal caps. Provide 2-inch long copper extension sections.

Check valves: Spring loaded type with bronze body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.

E. PREPARATION

Remove all foreign material from interior and exterior of pipe and fittings.

F. ERECTION & INSTALLATION

Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Do not route piping through transformer vaults or above transformers, panel boards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

Refrigeration piping to be installed by firms who are experienced in installation of such piping.

All joints to be brazed and have a melting point greater than 1,125 degrees F. Filler impurities shall not exceed 0.15%. Tubing to be new and delivered to the job site with the original mill end caps in place. Purge all lines with nitrogen during brazing. Provide manual shut-off and check valves as required.

No refrigerant is to be vented directly to the atmosphere except that which may escape through leaks in the system during leak testing. During evacuation procedures, use equipment designed to recover and allow recycling of the refrigerant.

Leak test the system by charging the system to a pressure of 10 psig with an HFC refrigerant, with the compressor suction and discharge valves closed and with all other system valves open. Increase pressure to 300 psig with dry nitrogen. Rap all joints with a mallet and check for leaks with an electric leak detector having a certified sensitivity of at least one ounce per year. Seal any leaks that may be found and retest.

After completion of the leak test, evacuate the system with a vacuum pump to an absolute pressure not exceeding 1500 microns while the system ambient temperature is above 60°F. Break the vacuum to 2 psig with the refrigerant to be used in the system. Repeat the evacuation process, again breaking the vacuum with refrigerant. Install a drier of the required size in the liquid line, open the compressor suction and discharge valves, and evacuate to an absolute pressure not exceeding 500 microns. Leave the vacuum pump running for not less than two hours without interruption. Raise the system pressure to 2 psig with refrigerant and remove the vacuum pump.

Charge refrigerant directly from original drums through a combination filter-drier. Each drier may be used for a maximum of three cylinders of refrigerant and then must be replaced with a fresh drier. Charge the system by means of a charging fitting in the liquid line. Weigh the refrigerant drum before charging so that an accurate record can be kept of the weight of refrigerant put in the system. If refrigerant is added to the system through the suction side of the compressor, charge in vapor form only

2.08 UNIONS

- A. Unions shall be of the same class and material as the pipe and fittings of the system in which they are installed. In black steel piping systems, they shall be 200 lbs. black malleable iron with brass ground joint equal to Dart Figures 0832, 0834, 0835, 0836, or 0838. In copper and brass piping, they shall be 125 lb. bronze or brass with ground joint.
- B. Flanged unions for welded pipe shall be weld neck, 150 lb. raised face. Flanged joints shall be packed with impregnated asbestos gaskets placed inside the bolt circle with graphite applied to both faces.

- C. Dielectric unions shall be provided between ferrous and non-ferrous piping to prevent galvanic corrosion. The dielectric unions shall meet the requirements for tensile strength of pipe fittings in accordance with Federal Specification WW-U-531 and shall be suitable for temperatures and pressures encountered. The ends shall be threaded, flanged, brazed, or soldered to match adjacent piping. The metal parts of the union shall be separated so that the electrical current is below 1 percent of the galvanic current which would exist with metal to metal contact.

2.09 INSULATION

A. General

1. Provide materials complying with NFPA Bulletin 90-A, as determined by UL method 723, NFPA 225-ASTM E 84, and complying with the governing code, with flame spread rating under 25 and smoke developed rating under 50.
2. Insulation properties must meet or exceed the minimum R-values required by the IMC 2012, the applicable Stretch Energy Code adopted by the City/Town as applicable and those indicated herein.
3. Where vapor barriers are used, provide intact and continuous throughout.
4. Minimum post consumer recycled content of 58.5%.
5. Acceptable manufacturers:
 - Owes/Corning Fiberglass
 - Knauf
 - Manville
 - Certainteed

B. Supply, Return & Relief Air Ductwork

1. The following ductwork shall be insulated:
 - All supply air, return air and mixed air ductwork shall be insulated. Supply and mixed air ductwork located within a return air ceiling plenum must be insulated and are not exempt from insulation. Return air ductwork located within a ceiling cavity within the building thermal envelope, where a conditioned area matching the air conditions of the conveying duct is located above and below this ceiling cavity need not be insulated.
 - Relief and exhaust air ductwork from the discharge point to the backdraft or isolation damper (see outdoor air ductwork).
 - All supply air duct and exhaust air ductwork connecting to an energy recovery unit. This includes recovery unit exhaust air ductwork from the unit to the building envelope discharge point.
2. Above ductwork shall be insulated with 2.25 inch-thick flexible blanket duct insulation with vapor barrier, 1.0 lbs. per cu. ft. density glass fiber with maximum K factor of 0.25 at 75 degree F. mean temperature with fire retardant foil/Kraft (FSK) vapor barrier facing. Product shall be Owens Corning SOFTR™ Type 100 or equal with an installed R-value of 6.0 or greater. All seams and joints shall be taped with matching fiberglass reinforced foil vapor barrier tape. Exposed supply and return ductwork located within the conditioned it serves need not be insulated. Duct indicated as being internally lined need not be externally insulated except when located on the roof or within an unconditioned space.

C. Outdoor Air Ductwork

1. All outdoor air ductwork including combustion air ductwork and outdoor and relief/exhaust air louver plenums shall be insulated with 3 inch thick flexible blanket duct insulation with vapor barrier, 1.5 lbs. per ft. density glass fiber with maximum K factor of 0.24 at 75 degree F mean temperature with fire retardant foil/Kraft (FSK) vapor barrier facing. Ductwork within mechanical rooms shall be rigid type insulation. Product shall be Owens Corning SOFTR™ Type 150 or equal. All seams and joints shall be taped with matching kraft paper vapor barrier tape. Minimum installed R-value shall be 12.

D. Exterior Ductwork

1. Exterior Supply & Return Air Ductwork and DOAS unit Exhaust: All supply air and return (and DOAS unit exhaust) air ductwork located outside the heated building envelope shall be insulated with 2" thick polyisocyanurate closed-cell rigid duct insulation, ASTM C 591, type IV, K=0.19), for use at temperatures up to 149 degree C (300 degree F) regardless of whether internal lining is present. Insulation shall be sloped so as to pitch water towards edge of ductwork. Ductwork shall also be insulated.
2. Provide covering on all exterior insulated ductwork. Product shall be field-applied or pre-applied protective finishing and/or vapor sealing, operating within the range of -94°F (- 70°C) and 300°F (149°C), jacketed with laminated, flexible, self-adhering, protective jacketing, vapor barrier and weather proofing membrane, having a high performance acrylic adhesive capable of installation with no additional mechanical attachment. Material is to be VentureClad 1577CW (5ply) Natural, White (White Membrane "WM"), or approved equal finish selected based on availability and desired final appearance of insulated system. Jacketing material is to have a maximum flame spread/smoke developed index of 10/20 per UL 723 test, a .000 water vapor permeance rating per ASTM E-96, and mold inhibitors incorporated. All products are UV stable. Fabrication and installation shall conform to the manufacturer's installation instructions and Midwest Insulation Contractors Association National Insulation Standards Manual. If there is conflicting information, manufacturer's installation instructions are to be followed.

E. Piping Insulation

1. All new hot water piping (supply and return) shall be insulated with 1.5" thick pipe insulation with a conductivity of 0.21 BTU-inch/HR-SF-F. Hot water piping insulation shall be equivalent to Owens Corning Fiberglas™ SSL II Paper Free all service jacket. All condensate piping and domestic water feed lines to the hydronic system shall be insulated with minimum ½" thick pipe insulation similar to that specified above. Provide Zeston, Proto or equal polymer fittings at all elbows and fittings. Seal all joints and seams vapor tight. For piping 2" or greater in size provide high-density crush resistant (calcium silicate blocking or equal) insulation at all hangers. Provide 14 gauge 18" insulation shields at every hanger. Vapor barrier must be maintained continuously on all piping.
2. Refrigerant liquid and vapor (suction, hot gas and evaporating liquid) piping shall be insulated with 1" thick closed cell pipe insulation as manufactured by Armorcell or equal with seams and joints cemented vapor tight. All insulation exposed to the exterior of the building shall have a PVC jacket applied over it and sealed water tight.

E. Refer to Ductwork Article for internal acoustical insulation.

2.10 HANGERS AND SUPPORTS

- A. Provide seismic bracing as required by the Commonwealth of Massachusetts building code 780 CMR, 10th edition, Chapter 16. Contractor shall hire a seismic consultant to comply with requirements of the code. All equipment and ductwork shall be seismically supported and all piping over 2" unless specifically exempt by 780 CMR Chapter 16. See articles on vibration and seismic control.

All horizontal piping shall be supported for its entire length. Suspended piping shall have hangers located within 2 ft. 0 in. of elbows and spacing shall be reduced, where required, to support heavy groups of fittings and valves. Grinnell Figure numbers are used to establish the desired style and quality. Other equal manufacturer, as approved by the Architect-Engineer, will be acceptable. All hangers shall be UL or FM approved for the application and use.

- B. Maximum spacing of hangers and supports shall be as follows:

1. Steel Pipe: 1-1/2 in. and smaller - 6 ft. 0 in.
2. Steel Pipe: 2 in. to 8 in. - 8 ft. 0 in.
3. Copper Tube: 1-1/4 in. and smaller - 5 ft. 0 in.
4. Copper Tube: 1-1/2 in. and larger - 8 ft. 0 in.

- C. Pipe attachments shall be as follows:

1. All piping up to 2 in. diameter shall be supported using pipe rings or bands.
2. All systems 2-1/2 in. to 6 in. pipe sizes and insulated pipe 1-1/2 in. and smaller - Grinnell Figure 260 adjustable clevis type.
3. All systems, bare or insulated pipe 6 in. and larger - Grinnell Figure 174 or 181 adjustable swivel roll type.
4. All systems, where overhead space is limited and pipes are close to underside of beams or slabs - Grinnell Figure 171 double rod roll hanger. Pipe installed on rack supports shall be supported on pipe roll chairs or stands equal to Grinnell Figure 175 or Figure 271.
5. All vertical drops of pipe 2-1/2 in. and larger shall be supported from the floor, including all pump suction and discharge piping.
6. Pipe attachments in metal-to-metal contact with copper and brass pipe shall be copper plated or PVC coated.
7. On all insulated pipes, provide attachments sized for outside diameter of insulation to permit insulation to pass through hanger. Include pipe covering protection shields at all hangers.

- D. Supporting rods for hangers shall be adjustable, threaded with locknuts sized as follows:

1. Pipe: 2 in. and smaller - 3/8 in.

2-1/2 in. to 3-1/2 in. - 1/2 in.
4 in. and 5 in. - 5/8 in.

2. Where double rod hangers are used, the rod size may be reduced one (1) size below the above sizes.
- E. Hanger rods shall be secured to building by one of the following approved structural attachments:
1. To concrete structure - use inserts, Grinnell Figure 28, galvanized steel. Where additional supports are needed after concrete work is completed or where required in solid masonry, use self-drilling inserts equal to Phillips "Red Head" or expansion shields equal to Grinnell Figure 117. Cadmium plated piping 10 in. and larger is to be supported from wall, floor, or steel structure.
 2. To overhead steel deck not filled with concrete – Not allowed.
 3. To structural steel beams for pipes 2-1/2 in. to 5 in. - by beam clamps, Grinnell Figure 229, 265, or 267; 6 in. to 10 in. by bolted and welded beam attachments - Grinnell Figure 66 or 252. For pipes 2 in. and smaller, use malleable iron C-type beam clamps with retaining clip, Grinnell Figure 87; all piping is to be hung from the top chord of all steel joists. All piping 4 in. and larger shall be supported from 2 in. angle iron spanning between two (2) joists to spread loading. For joists, pipes and/or supplemental support steel must be attached to top of joist at panel points.
- F. Pipes running along walls or close to floor shall be supported as follows:
1. Piping along walls may have hanger rods supported from welded steel brackets, Grinnell Figure 195, or in lieu of the above, for 4 in. and larger, may rest on adjustable roll stands supported by welded channel or I-beam wall brackets.
 2. 2 in. and smaller - supported from floor on legs of angle iron, channels, or pipe legs.
 3. 2-1/2 in. to 4 in. - adjustable pipe saddles, Grinnell Figure 264, supported from floor to pipe legs.
 3. 4 in. and larger - pipe roll and plate, Grinnell Figure 277 supported as masonry piers and shimmed to provide proper pitch as required, or Grinnell Figure 276 adjustable pipe roll stands supported on masonry piers, welded steel channels, or I-beams.
- G. Groups of horizontal pipe 3 in. and smaller, running at the same elevation, may be supported by means of vertical hangers and horizontal angles, channels, or "Unistrut" on which pipes shall rest and be held in alignment with suitable pipe clamps. Building attachments must be sized for total load of all pipes. Details of such hangers must first be approved by the Architect-Engineer. No contact between dissimilar metal is permitted.
- H. Equipment Supports:
1. All floor mounted machinery and equipment shall be installed on minimum 4 in. thick concrete housekeeping bases with top edge of base chamfered at a 45 degree angle. Bases will be provided under other Sections of these Specifications. Furnish scaled layouts of all required bases, with dimensions of bases, and location to column center lines. Furnish templates, anchor bolts, and accessories necessary for base construction.

2. Furnish and install all supplementary steel, channels, and supports required for the proper installation, mounting, and support of all equipment. Supplementary steel and channels shall be firmly connected to the building construction.
 3. The type and size of the supporting channels and supplementary steel shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.
 4. All supplementary steel and channels shall be installed in a neat and workmanlike manner parallel at the walls, floor, and ceiling construction. All turns shall be made with 90 degree and 45 degree fittings, as required to suit the construction and installation conditions. Provide factory-fabricated tank saddles for tanks mounted on steel stands.
 5. Where ceiling mounting is indicated or specified, use suspended platform or hangers, brackets, or shelf, whichever is most suitable for equipment and its location. Construct structural steel members, steel plates, rods, as required; brace and fasten to building structure or to inserts as approved.
- I. Rooftop pipe support shall be similar to Portable Pipe Hangers item number PP10 w/roller. Base Material: Injection molded high impact polypropylene with UV-inhibitors and Antioxidants. Hardware: Nuts, Washers, Rod and Roller: Hot Dip Galvanized. Coordinate with roofer prior to installation."
 - J. Rooftop condensing units shall be set and fixed on a rail support system by Roof-Pro model #PF-1-T or equal by Uni-Strut. Supports system shall consist of four (4) UV resistant base supports with adjustable height (minimum 12" high) and galvanized steel rails. Anchor unit to supports.

2.11 PIPE SLEEVES AND ESCUTCHEONS

- A. Standard IPS steel or wrought iron sleeves shall be provided wherever exposed pipes pass through masonry walls or partitions. Pipe sleeves are to be two (2) pipe sizes larger than line size. On insulated piping, sleeves shall be sized to allow insulation to pass through the sleeve without gouging. Within continuous vertical enclosed pipe chases, sleeves through floors may be 24 gauge galvanized sheet steel in lieu of iron pipe.
- B. Iron pipe sleeves shall be provided through "wet" floors (such as kitchens, toilets, janitor's closets) and shall be extended 1 in. above finished floors. Sheet metal screws may be used in other locations and shall be cut flush with floor. Pipe sleeves in walls shall be flush with face of wall both sides. Pipe sleeves through outside walls must be caulked watertight or installed with Eclipse flanged service entrance sets.
- C. Provide escutcheons equal to Grinnell Figure 10 or Figure 13, chrome plated, at all locations (except inside unfinished mechanical equipment rooms and enclosed pipe chases) wherever exposed bare pipes 4 in. or smaller pass through walls, floors, or ceilings.

2.12 VALVES

- A. All valves shall be of a design, which the manufacturer lists for service and shall be of the materials allowed by the latest edition of the ASME Code for pressure piping for the pressure

and temperature contemplated, unless higher grade or quality is specified herein. All valves shall be of the same manufacturer except for special applications.

- B. The system shall be supplied with valves in all branch mains and risers, at all pumps, tanks, reducing and control valves, heating and cooling surfaces and at all apparatus; so located, arranged and operated as to give complete shut-off. Except where flanged valves are used, each connection to equipment shall be made with screwed or flanged unions on the equipment side of the valves.
- C. All valves 2" in diameter and smaller shall be bronze with bronze bodies. Valves 2-1/2" in diameter and over shall have iron bodies with bronze trim (except where otherwise noted).
- D. Ball valves shall be full port bronze body, bronze or stainless steel ball and stem, Teflon seats and seals, threaded ends, 400 psig cold W.O.G. by Apollo, Watts or Jenkins.
- E. All bronze and iron valves shall be furnished with Teflon impregnated packing.
- F. Butterfly valves shall only be allowed on piping 3" and larger and shall be tight shut-off type with angle/worm gear handle mechanism with position marker.
- G. All valves on PVC piping systems shall be PVC full port ball type.
- H. Provide valves of the type as shown on the drawings as specified herein and as scheduled:

<u>Service</u>	<u>Valve Type</u>	<u>Rating</u>	<u>Remarks</u>
Water	Ball	400 W.O.G.	all sizes
Water Throttling	Globe	200	3" and larger
Water Shut-off & Thrott.	Butterfly	200	3" and larger
Drain Valves	Ball	200 W.O.G.	Hose end & cap

2.13 ELECTRIC CABINET HEATERS

- A. Electric heaters shall be factory assembled for surface mount field installation. Enclosures shall be 16-gauge steel with corrosion resistant finish; custom color selection shall be by Architect. Cabinet heaters shall be Berko, Qmark, Electromode or equal.
- B. Coils shall be single terminal, long life electrical fin tube with helical coiled fins. Fan shall be either squirrel cage type or propeller. Provide automatic reset thermal overload protector, integral tamper resistant thermostat, fan speed switch and disconnect switch. Provide EMS interface package for EMS operation where noted or required elsewhere by the specification or on the plans.

2.14 VAV & EVAV TERMINALS

- A. Provide variable air volume (VAV) terminals as scheduled and shown on the drawings and specified herein. Units shall be manufactured by Krueger, Titus, Nailor or approved equal.

- All terminals shall be certified under ARI Standard 880-94. Physical size and dimension of box and sound criteria is critical to acceptance as an approved equal.
- B. The terminal casing shall be constructed of minimum 22 gauge galvanized steel, internally lined with 1" dual density glass fiber insulation with moisture resistant and anti-microbial coating all complying with UL 181 and NFPA 90A.
 - C. The damper shall be constructed of heavy gauge steel with shaft rotating in bronze self-lubricating bearings. Damper shall include a synthetic seal to limit full closed damper leakage to no more than 4 CFM at a pressure difference of 1.5" w.g.
 - D. All boxes shall be furnished or field provided with electronic digital controls matching the building EMS including flow/velocity sensor, modulating damper motor & actuator. Fully coordinate with EMS contractor for factory or field installed controls. Refer to Automatic Temperature Controls for additional information. All box controls shall match DDC system control manufacturer.
 - E. For all EVAV terminals (and select VAV terminals) where scheduled to operate at a minimum airflow below pitot limits provide an Ebtron #EF-x1000-T airflow station. EVAV's shall be ordered without there flow station with the Ebtron unit field installed
 - F. Hot water coils on VAV's where scheduled shall be copper tube type with aluminum fins leak tested to 300 psi and burst tested to 2000 psi. All coils shall be tested and rated in accordance with ARI Standard 410.

2.15 SPECIALTIES

- A. See also valve and other sections for additional information.
- B. Swing Check – Bronze body, 125 W.S.P., 200 W.O.G.
- C. Grooved-ended Swing Check valves from Victaulic shall be styles 716, 716H, 779 (300 psi CWP) or W715 (230 psi CWP), ductile iron body, EPDM seat, stainless steel or ductile iron disc or Anvil International Gruvlok style 7800.
- D. Strainers – Strainers shall be iron body 'Y' type with stainless steel strainers, 250-psig steam and 400 W.O.G. Provide ball valve with hose bib for blow down similar to Watts # B-6000-CC.
- E. Grooved-ended Strainers:
 - 1. Y-Pattern: 300 psi CWP, ductile iron body, stainless steel strainer screen. Victaulic styles 732/W732 or Anvil International Gruvlok style 758G.
- F. Dielectric unions or waterways – Provide where joining to dissimilar metals, Watts series #3000, Victaulic Clearflow, Anvil International Gruvlok 7088, 7089, 7090, 7091 or approved equal.
- G. Air Vents – Provide automatic air vents at all high points within the system and at all coils. Air vents shall be Sparco model #FV 147A.

- H. Balancing Valves – Provide calibrated balancing valves where shown on the drawings and as specified herein, Taco model #ACUF circuit setters, Victaulic/Tour & Andersson Y-pattern globe style, Anvil International Gruvlok GBV Y-pattern globe style or Engineer-Approved equal. Provide one at each location: 1) at every water coil; 2) at every baseboard branch, unit heater and cabinet heater; 3) at every hydronic fan coil unit. In addition, HVAC Subcontractor shall furnish to the Owner a Differential Gauge meter Taco model #789 or similar with durable carrying case and hose connections.
1. Valves ½" through 2" style 786 (solder ends) or 787 (threaded ends), non-ferrous metal brass copper-alloy body, EPDM o-ring seals. Hidden, tamper-proof locking mechanism to allow for full valve closure and re-opening to set position.
 - a. Coil hook-up assemblies may be used to reduce space requirements and installation time. Victaulic Series 799 or 79V Koil Kit coil pack assembly. Coil pack can include; Victaulic Series 78U union port fitting, Series 78Y strainer/ball valve or Series 78T union/ball valve combination, and two flexible hoses or Anvil International Gruvlok KNX.
 2. Valves 2-1/2" through 16" style 788 (flanged ends) or 789 (grooved ends), ductile iron body, all other parts Ametal brass copper alloy, EPDM o-ring seals. Hidden, tamper-proof locking mechanism to allow for full valve closure and re-opening to set position.
- I. Expansion Compensators – Provide housed expansion compensators with associated pipe alignment guides and anchors where shown on the drawings or as required where line lengths exceed 100 feet. Compensators shall have double wall stainless steel bellows housed in carbon steel enclosure. Provide Metraflex Joints or approved equal at seismic separation joints within building where shown on plans. In other locations, compensators shall be by Senior Flexonics or approved equal.
- J. Grooved-end Expansion Compensators and offsets:
- a. 2" Through 6": Packless, gasketed, slip-type expansion joint with grooved end telescoping body for installation with Victaulic Style 107 or 07 rigid couplings or Gruvlok Style 7401, 7400 or 7402. Provides axial end movement to 3", designed for water services up to 230°F and working pressure to 350 psi. Victaulic Style 150 Mover or Anvil International Gruvlok 7240.
 - b. 2-1/2" and larger: Combination of short nipples and Victaulic Style 177, 77 or W77 or Gruvlok Style 7001, 7000 flexible couplings joined in tandem for increased expansion. Joint movement and expansion capabilities dependent on number of couplings/nipples used in the joint. Pressure rating dependent on size and style of flexible couplings used. Victaulic Style 155.
 - c. Victaulic flexible style couplings or Anvil International Gruvlok flexible style couplings may be used on piping offsets to accommodate thermal expansion/contraction in accordance with published guidelines.
- K. For roof mounted condensing units provide a galvanized steel frame with adjustable height legs with PVC weight distribution pads as manufactured by Roof-Pro or approved equal. There shall be a minimum of four weight distribution pads per frame assembly with additional pads as length of frame expands to accept more than 2 units. No pad shall carry more than 200 pounds of load. Coordinate with structural engineer.

2.16 SYSTEM WATER TREATMENT

- A. All new hydronic systems (piping, coils) shall be thoroughly flush with clear water and then filled with clear water and circulated for a period no less than 8 hours. Drain water, clean all strainers and then refill the hot water system with clean water and chemically treat.
- B. If existing system has anti-freeze glycol, system must be charged with equivalent mix and product (propylene glycol).

2.17 VIBRATION ISOLATION AND FLEXIBLE CONNECTIONS (See also 2.18 Vibration and Seismic Control for additional information)

- A. At duct connections to equipment, provide glass-fabric flexible neoprene connections with a minimum of 6 inch full length and approved by the governmental agencies having jurisdiction.
- B. Hot water unit heaters and ducted fan coil units shall be suspended with double deflection neoprene hangers similar to Mason Industries model #HD.
- C. At roof mounted ACHP units provide a dual layer of corrugated neoprene with galvanized steel shim vibration isolators with thru bolt anchor to mount snow stand to roof sleepers. Anchor unit to snow stand.

2.18 VIBRATION AND SEISMIC CONTROL (See also 2.17 for additional information)

A. Intent:

- 1. All mechanical equipment, piping and ductwork as noted on the equipment schedule or in the Specification shall be mounted on vibration isolators and with flexible connections to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.
- 2. All isolators and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.
- 3. It is the intent of the seismic portion of this Specification to keep all mechanical building system components in place during a seismic event.
- 4. All such systems must be installed in strict accordance with seismic codes, component manufacturer's and building construction standards. Whenever a conflict occurs between the manufacturer's or construction standards, the most stringent shall apply.
- 5. This Specification is considered to be minimum requirements for seismic consideration and is not intended as a substitute for legislated, more stringent, national, state or local construction requirements (i.e. MA Codes, IBC Building Code, California Title 24, California OSHPD, or other requirements).
- 6. Any variance or non-compliance with these Specification requirements shall be corrected by the Contractor in an approved manner.
- 7. Seismic restraints shall be designed in accordance with seismic force levels as detailed in Section H.

B. The work in this Section includes, but is not limited to, the following:

1. Vibration isolation for piping, ductwork and equipment.
2. Equipment isolation bases.
3. Flexible piping connections.
4. Seismic restraints for isolated equipment.
5. Seismic restraints for non-isolated equipment.
6. Certification of seismic restraint designs and installation supervision.
7. Certification of seismic attachment of housekeeping pads.
8. All mechanical systems. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is typical.
(Equipment not listed is still included in this Specification).

AC Units
Ductwork
Fan Coil Units
Piping
DOAS Units
Unit Heaters
Condensing Units

C. Definitions:

1. Life Safety Systems:
 - a. All systems involved with fire protection including sprinkler piping, fire pumps, jockey pumps, fire pump control panels, service water supply piping, water tanks, fire dampers and smoke exhaust systems.
 - b. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers and all flowpaths to fire protection and/or emergency lighting systems.
 - c. All medical and life support systems.
 - d. Fresh air relief systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.
 - e. All life safety equipment has an asterisk on the equipment schedule.
2. Positive Attachment: A positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided "C" type beam clamps for support rods of overhead piping, ductwork, or any other equipment are not acceptable on this project as seismic anchor points.
3. Transverse Bracing: Restraint(s) applied to limit motion perpendicular to the centerline of the pipe, duct or conduit.
4. Longitudinal Bracing: Restraint(s) applied to limit motion parallel to the centerline of the pipe, duct or conduit.

D. Manufacturer's Data:

1. The manufacturer of vibration isolation and seismic restraints shall provide submittals for products as follows:
 - a. Descriptive Data:
 - (1) Catalog cuts or data sheets on vibration isolators and specific restraints detailing compliance with the Specification.
 - (2) Detailed schedules of flexible and rigidly mounted equipment, showing vibration isolators and seismic restraints by referencing numbered descriptive Drawings.
 - b. Shop Drawings:
 - (1) Submit fabrication details for equipment bases including dimensions, structural member sizes and support point locations.
 - (2) Provide all details of suspension and support for ceiling hung equipment.
 - (3) Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.
 - (4) Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
 - c. Seismic Certification and Analysis:
 - (1) Seismic restraint calculations must be provided for all connections of equipment to the structure. Calculations must be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.
 - (2) All restraining devices shall have a preapproval number from California OSHPD or some other recognized government agency showing maximum restraint ratings. Preapprovals based on independent testing are preferred to preapprovals based on calculations. Where preapproved devices are not available, submittals based on independent testing are preferred. Calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the state of the job location. Testing and calculations must include both shear and tensile loads as well as one test or analysis at 45 to the weakest mode.
 - (3) Analysis must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in

Section H acting through the equipment center of gravity.
Overturning moments may exceed forces at ground level.

E. Code and Standards Requirements:

1. Typical Applicable Codes and Standards - most recent or enforced code:
 - a. Massachusetts State Building Code.
 - b. International Mechanical Code (IMC).
 - c. NFPA 90A.

F. Manufacturer's Responsibility:

1. Manufacturer of vibration isolation and seismic control equipment shall have the following responsibilities:
 - a. Determine vibration isolation and seismic restraint sizes and locations.
 - b. Provide vibration isolation and seismic restraints as scheduled or specified.
 - c. Provide calculations and materials if required for restraint of unisolated equipment.
 - d. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.

G. Related Work:

1. Housekeeping Pads:
 - a. Housekeeping pad reinforcement and monolithic pad attachment to the structure details and design shall be prepared by the restraint vendor if not already indicated on the Drawings.
 - b. Housekeeping pads shall be coordinated with restraint vendor and sized to provide a minimum edge distance of ten (10) bolt diameters all around the outermost anchor bolt to allow development of full drill-in wedge anchor ratings. If cast-in anchors are to be used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.
2. Supplementary Support Steel: Contractor shall supply supplementary support steel for all equipment, piping, ductwork, etc. including roof mounted equipment, as required or specified.
3. Attachments: Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirements of the vibration vendor's calculations.

H. Seismic Force Levels

1. The force levels described in the building code shall be used on this project.

I. Product Intent:

1. All vibration isolators and seismic restraints described in this section shall be the product of a single manufacturer. Mason Industry's products are the basis of these Specifications; products of other manufacturers are acceptable provided their systems strictly comply with the Specification and have the approval of the specifying engineer. Submittals and certification sheets shall be in accordance with Section D.
2. For the purposes of this project, failure is defined as the discontinuance of any attachment point between equipment or structure, vertical permanent deformation greater than 1/8 in. and/or horizontal permanent deformation greater than 1/4 in.

J. Product Description: Vibration Isolators and Seismic Restraints:

1. Two (2) layers of 3/4 in. thick neoprene pad consisting of 2 in. square waffle modules separated horizontally by a 16 gauge galvanized shim. Load distribution plates shall be used as required. Pads shall be Type Super "W" as manufactured by Mason Industries, Inc.
2. Bridge-bearing neoprene mountings shall have a minimum static deflection of 0.2 in. and all directional seismic capability. The mount shall consist of a ductile iron casting containing two (2) separated and opposing molded neoprene elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. The shock absorbing neoprene materials shall be compounded to bridge-bearing Specifications. Mountings shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Mountings shall be Type BR as manufactured by Mason Industries, Inc.
3. Sheet metal panels shall be bolted to the walls or supporting structure by assemblies consisting of a neoprene bushing cushioned between 2 steel sleeves. The outer sleeve prevents the sheet metal from cutting into the neoprene. Enlarge panel holes as required. Neoprene elements pass over the bushing to cushion the back panel horizontally. A steel disc covers the inside neoprene element and the inner steel sleeve is elongated to act as a stop so tightening the anchor bolts does not interfere with panel isolation in three (3) planes. Bushing assemblies can be applied to the ends of steel cross members where applicable. All neoprene shall be bridge bearing quality. Bushing assemblies shall be Type PB as manufactured by Mason Industries, Inc.
4. A one piece molded bridge bearing neoprene washer/bushing. The bushing shall surround the anchor bolt and have a flat washer face to avoid metal to metal contact. Neoprene bushings shall be Type HG as manufactured by Mason Industries, Inc.
5. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4 in. neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and leveling valves Type LV as manufactured by Mason Industries, Inc.
6. Restrained spring mountings shall have an SLF mounting as described in Specification 5, with a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer

shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of ½ inch shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position there must be an internal isolation pad. Housing shall be designed to resist all seismic forces. Mountings shall have Anchorage Preapproval "R" Number from OSHPD in the state of California certifying the maximum certified horizontal and vertical load ratings. Mountings shall be SLR as manufactured by Mason Industries, Inc.

7. Spring mountings as in Specification 5 built into a ductile iron or steel housing to provide all directional seismic snubbing. The snubber shall be adjustable vertically and allow a maximum of ¼ inch travel in all directions before contacting the resilient snubbing collars. Mountings shall have an Anchorage Preapproval "R" Number OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Mountings shall be SSLFH as manufactured by Mason Industries, Inc.
8. Air Springs shall be manufactured with upper and lower steel sections connected by a replaceable flexible nylon reinforced neoprene element. Air spring configuration shall be multiple bellows to achieve a maximum natural frequency of 3 Hz. Air Springs shall be designed for a burst pressure that is a minimum of three times the published maximum operating pressure. All air spring systems shall be connected to either the building control air or a supplementary air supply and equipped with three (3) leveling valves to maintain leveling within plus or minus 1/8 inch. Submittals shall include natural frequency load and damping tests performed by an independent lab or acoustician. Air Springs shall be Type MT and leveling valves Type LV as manufactured by Mason Industries, Inc.
9. Restrained air spring mountings shall have an MT air spring as described in Specification 8, within a rigid housing that includes vertical limit stops to prevent air spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of ½ in. shall be maintained around restraining bolts and between the housing and the air spring so as not to interfere with the air spring action. Limit stops shall be out of contact during normal operation. Housing shall be designed to resist all seismic forces. Mountings shall be SLR-MT as manufactured by Mason Industries, Inc.
10. Hangers shall consist of rigid steel frames containing minimum 1-1/4 in. thick neoprene elements at the top and a steel spring with general characteristics as in Specification 5 seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. To maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 arc from side to side before contacting the rod bushing and short circuiting the spring. Submittals shall include a hanger Drawing showing the 30 capability. Hangers shall be Type 30N as manufactured by Mason Industries, Inc.
11. Hangers shall be as described in 10, but they shall be precompressed and locked at the rated deflection by means of a resilient seismic upstop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a Drawing of the hanger showing the 30 degree capability. Hangers shall be Type PC30N as manufactured by Mason Industries, Inc.

12. Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two (2) and arranged to provide all-directional restraint. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two (2) clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges. Cable assemblies shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California verifying the maximum certified load ratings. Cable assemblies shall be Type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod nut and the clevis or SCBV if clamped to a beam all as manufactured by Mason Industries, Inc.
13. Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connectors shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment. Seismic solid brace assembly shall have anchorage preapproval "R" Number from OSHPD in the state of California verifying the maximum certified load ratings. Solid seismic brace assemblies shall be Type SSB as manufactured by Mason Industries, Inc.
14. Steel angles, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California. Rod clamp assemblies shall be Type SRC as manufactured by Mason Industries, Inc.
15. Pipe clevis cross bolt braces are required in all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross braces shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California. Clevis cross brace shall be Type CCB as manufactured by Mason Industries, Inc.
16. All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushing shall be replaceable and a minimum of 1/4 in. thick. Rated loadings shall not exceed 1000 psi. A minimum air gap of 1/8 in. shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. Neoprene bushings shall be rotated to insure no short circuits exist before systems are activated. Snubbers shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Snubber shall be Type Z-1225 as manufactured by Mason Industries, Inc.
17. All directional seismic snubbers shall consist of interlocking steel members restrained by shock absorbent rubber materials compounded to bridge bearing Specifications. Elastomeric materials shall be replaceable and a minimum of 3/4 in. thick. Rated loadings shall not exceed 1000 psi. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 in. nor more than 1/4 in. Snubbers shall be installed with factory set clearances. The capacity of the seismic snubber at 3/8 in. deflection shall be equal or greater than the load assigned to the mounting grouping controlled by the snubber multiplied by the applicable "G" force. Submittals shall include the load deflection curves up to 1/2 in. deflection in the x, y and z planes. Snubbers shall have an anchorage preapproval "R" Number from OSHPD in the

state of California verifying the maximum certified horizontal and vertical load ratings. Snubbers shall be series Z-1011 as manufactured by Mason Industries, Inc.

18. Stud wedge anchors shall be manufactured from full diameter wire, not from undersized wire that is "rolled up" to create the thread. The stud anchor shall also have a safety shoulder which fully supports the wedge ring under load. The stud anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying its allowable loads. Drill-in stud wedge anchors shall be Type SAS as manufactured by Mason Industries, Inc.
19. Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying to its allowable loads. Drill-in female wedge anchors shall be Type SAB as manufactured by Mason Industries, Inc.
20. Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Centrifugal refrigeration machines and pump bases may be T or L shaped where space is a problem. Pump bases for split case pump shall include supports for suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 14 in. provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1 in. Bases shall be Type WF as manufactured by Mason Industries, Inc.
21. Vibration isolation manufacturer shall furnish rectangular steel concrete pouring forms for floating and inertia foundations. Bases for split case pumps shall be large enough to provide for suction and discharge elbows. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6 in. The base depth need not exceed 12 in. unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of ½ in. bars welded in place on 6 in. centers running both ways in a layer 1-1/2 in. above the bottom. Forms shall be furnished with steel templates to hold the anchor bolts sleeves and anchors while concrete is being poured. Height saving brackets shall be employed in all mounting locations to maintain a 1 in. clearance below the base. Wooden formed bases leaving a concrete rather than a steel finish are not acceptable. Base shall be Type BMK or K as manufactured by Mason Industries, Inc.
22. Curb mounted rooftop equipment shall be mounted on spring isolation curbs. The lower member shall consist of a sheet metal Z section containing adjustable and removable steel springs that support the upper floating section. The upper frame must provide continuous support for the equipment and must be captive so as to resiliently resist wind and seismic forces. All directional neoprene snubber bushings shall be a minimum of 1/4 in. thick. Steel springs shall be laterally stable and rest on 1/4 in. thick neoprene acoustical pads. Hardware must be plated and the springs provided with a rust resistant finish. The curbs waterproofing shall consist of a continuous galvanized flexible counter flashing nailed over the lower curbs waterproofing and joined at the corners by EPDM bellows. All spring locations shall have access ports with removable waterproof covers. Lower curbs shall have provision for 2 in. of insulation. The roof curbs shall be built to seismically contain the rooftop unit. The unit must be solidly fastened to the top floating rail, and the lower Z section anchored to the roof structure. Curb shall have anchorage

preapproval "R" from OSHPD in the state of California attesting to the maximum certified horizontal and vertical load ratings. Curb shall be Type RSC as manufactured by Mason Industries, Inc or approved equal.

23. Flexible spherical piping connectors shall employ peroxide cured EPDM in the covers, liners and Dacron tire cord frictioning. Solid steel rings shall be used within the raised face rubber ends to prevent pullout. Flexible cable bead wire is not acceptable. Sizes 2 in. and larger shall have two spheres reinforced with a ring between spheres to maintain shape and complete with split ductile iron or steel flanges with hooked or similar interlocks. Sizes 16 in. to 24 in. may be single sphere. Sizes 3/4 in. to 1-1/2 in. may have threaded bolted flange assemblies, one sphere and cable retention. 14 in. and smaller connectors shall be rated at 250 psi up to 190 F with a uniform drop in allowable pressure to 190 psi at 250 F. 16 in. and larger connectors are rated 180 psi at 190 F and 135 psi at 250 F. Safety factors to burst and flange pullout shall be a minimum of 3/1. All joints must have permanent markings verifying a 5 minute factory test at twice the rated pressure. Concentric reducers to the above Specifications may be substituted for equal ended expansion joints. Pipe connectors shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods, as control rods are not desirable in seismic work. If control rods are used, they must have 1/2 in. thick Neoprene washer bushings large enough in area to take the thrust at 1000 psi maximum on the washer area. Expansion joints shall be installed on the equipment side of the shut off valves.

Flexible pump connectors shall be installed at each base mounted pump discharge and suction connection. Connections shall be spool type multi-ply stainless steel bellows with tie rods, rated for 150 psig, Keflex type 150.

Submittals shall include two (2) test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves. Expansion joints shall be SAFEFLEX SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR as manufactured by Mason Industries, Inc.

24. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3 in. and larger shall be flanged. Smaller sizes shall have male nipples. Minimum lengths shall be as tabulated:

<u>Flanged</u>	<u>Male Nipples</u>
3 x 1410 x 26	1/2 x 91-1/2 x 13
4 x 1512 x 28	3/4 x 10 2 x 14
5 x 1914 x 30	1 x 112-1/2 x 18
6 x 2016 x 32	1/4 x 12 8 x 22

Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible. Hoses shall be Type BSS as manufactured by Mason Industries, Inc.

25. For vertical riser application more than 3 stories in height, all-directional acoustical pipe anchor, consisting of two sizes of steel tubing separated by a minimum 1/2 in. thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should

not exceed 500 psi and the design shall be balanced for equal resistance in any direction. All-directional anchors shall be Type ADA as manufactured by Mason Industries, Inc.

26. For vertical riser application more than 3 stories in height, pipe guides shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum ½ in. thickness of 60 durometer neoprene. The height of the guides shall be preset with a shear pin to allow vertical motion due to pipe expansion or contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of $\pm 1\text{-}5/8$ in. motion, or to meet location requirements. Pipe guides shall be Type VSG as manufactured by Mason Industries, Inc.
27. Split Wall Seals consist of two bolted pipe halves with minimum 3/4 in. thick neoprene sponge bonded to the inner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping. Concrete may be packed around the seal to make it integral with the floor, wall or ceiling if the seal is not already in place around the pipe prior to the construction of the building member. Seals shall project a minimum of 1 in. past either face of the wall. Where temperatures exceed 240 deg. F., 10 lb. density fiberglass may be used in lieu of the sponge. Seals shall be Type SWS as manufactured by Mason Industries, Inc.
28. The horizontal thrust restraint shall consist of a spring element in series with a neoprene molded cup as described in Specification 5 with the same deflection as specified for the mountings or hangers. The spring element shall be designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4 in. movement at start and stop. The assembly shall be furnished with one (1) rod and angle brackets for attachment to both the equipment and the duct work or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrical on either side of the unit. Horizontal thrust restraints shall be Type WBI/WBD as manufactured by Mason Industries, Inc.
29. At all other platform (no curb) mounted equipment such as condensing units and the like provide 6"x6" neoprene vibration pads at all support points and as shown on the drawings, minimum of six per unit. Pads shall be similar to Mason Industries model #WMFB composite pad of two neoprene layers sandwiching a galvanized steel shim with through hole. Exposed edges of steel shim shall be painted with 2-coats of rustproof primer. Vibration isolators shall be securely bolted to unit and structural support frame with neoprene coated stainless steel bolts, washers and nuts. If required by the equipment manufacturer, provide continuous rail vibration support systems and submit for review and approval.

K. Execution - General:

1. All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.
2. Installation of vibration isolators and seismic restraints must not cause any change of position of equipment, piping or duct work resulting in stresses or misalignment.
3. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.

4. The Contractor shall not install any equipment, piping, duct or conduit which makes rigid connections with the building unless isolation is not specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls.
5. Coordinate work with other trades to avoid rigid contact with the building.
6. Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible Contractor's expense.
7. Bring to the architects/engineers attention any discrepancies between the Specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible Contractor's expense.
8. Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the Contractor's expense.
9. Overstressing of the building structure must not occur because of overhead support of equipment. Contractor must submit loads to the structural engineer of record for approval. Generally bracing may occur from:
 - a. Flanges of structural beams.
 - b. Upper truss cords in bar joist construction.
 - c. Cast in place inserts or wedge type drill-in concrete anchors.
10. Specification 12 cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment, piping or conduit.
11. Specification 12 cable assemblies are installed taut on non-isolated systems. Specification 13 seismic solid braces may be used in place of cables on rigidly attached systems only.
12. At locations where Specification 12 or 13 restraints are located, the support rods must be braced when necessary to accept compressive loads with Specification 14 braces.
13. At all locations where Specification 12 or 13 restraints are attached to pipe clevis's, the clevis cross bolt must be reinforced with Specification type 15 braces.
14. Drill-in concrete anchors for ceiling and wall installation shall be Specification type 18, and Specification type 19 female wedge type for floor mounted equipment.
15. Vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not permitted on this project.
16. Hand built elastomeric expansion joints may be used when pipe sizes exceed 24 in. or specified movements exceed Specification 23 capabilities.
17. Where piping passes through walls, floors or ceilings the vibration isolation manufacturer shall provide Specification 27 wall seals.

18. Air handling equipment and centrifugal fans shall be protected against excessive displacement which results from high air thrust in relation to the equipment weight. Horizontal thrust restraint shall be Specification type 28 (see selection guide).

19. Locate isolation hangers as near to the overhead support structure as possible.

L. Vibration Isolation of Piping:

1. Horizontal Pipe Isolation: The first three (3) pipe hangers in the main lines near the mechanical equipment shall be as described in Specification 11. Specification 11 hangers must also be used in all transverse braced isolated locations. Brace hanger rods with SRC clamps Specification 14. Horizontal runs in all other locations throughout the building shall be isolated by hangers as described in Specification 10. Floor supported piping shall rest on isolators as described in Specification 6. Heat exchangers and expansion tanks are considered part of the piping run. The first three (3) isolators from the isolated equipment will have the same static deflection as specified for the mountings under the connected equipment. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have 0.75 in. deflection for pipe sizes up to and including 3 in., 1-1/2 in. deflection for pipe sizes up to and including 6 in., and 2-1/2 in. deflection thereafter. Hangers shall be located as close to the overhead structure as practical. Where piping connects to mechanical equipment install Specification 23 flexible piping connection or Specification 24 stainless hoses if 23 is not suitable for the service.
2. Riser Isolation: Risers shall be suspended from Specification 10 hangers or supported by Specification 5 mountings, anchored with Specification 25 anchors, and guided with Specification 26 sliding guides. Steel springs shall be a minimum of 0.75 in. except in those expansion locations where additional deflection is required to limit load changes to + 25% of the initial load. Submittals must include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.

M. Seismic Restraint of Piping:

1. Seismically restrain all piping listed as a, b or c below. Use Specification 12 cables if isolated. Specification 12 or 13 restraints may be used on unisolated piping.
 - a. Gas piping, that is 1 in. I.D. or larger.
 - b. Piping located in boiler rooms, mechanical equipment (fan) rooms, and refrigeration equipment rooms that is 1-1/4 in. I.D. and larger.
 - c. All other piping 2-1/2 in. diameter and larger.
2. Transverse piping restraints shall be at 40' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
3. Longitudinal restraints shall be at 80' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.

4. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
5. For fuel oil and all gas piping transverse restraints must be at 20 ft. maximum and longitudinal restraints at 40 ft. maximum spacing.
6. Transverse restraint for one (1) pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24 in. of the elbow or TEE or combined stresses are within allowable limits at longer distances.
7. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.
8. Branch lines may not be used to restrain main lines.
9. Cast-iron pipe of all types, glass pipe and any other pipes joined with a four band shield and clamp assembly in Zones 2B, 3 and 4 shall be braced as in sections 3.02.C.2 and 3. For Zones 0, 1 and 2A, 2 band clamps may be used with reduced spacings of $\frac{1}{2}$ of those listed in sections 3.02.C.2 and 3.

N. Vibration Isolation of Ductwork:

1. All discharge runs for a distance of 50' from the connected equipment shall be isolated from the building structure by means of Specification 10 hangers or Specification 5 floor isolators. Spring deflection shall be a minimum of 0.75 in.
2. All duct runs having air velocity of 1000 fpm or more shall be isolated from the building structure by Specification 11 hangers or 5 floor supports. Spring deflection shall be a minimum of 0.75 in.

O. Seismic Restraint of Ductwork:

1. Seismically restrain all duct work with Specification 12 or 13 restraints as listed below:
 - a. Restrain rectangular ducts with cross sectional area of 6 sq. ft. or larger.
 - b. Restrain round ducts with diameters of 28 in. or larger.
 - c. Restrain flat oval ducts the same as rectangular ducts of the same nominal size.
2. Transverse restraints shall occur at 30' intervals or at both ends of the duct run if less than the specified interval. Transverse restraints shall be installed at each duct turn and at each end of a duct run.
3. Longitudinal restraints shall occur at 60' intervals with at least one restraint per duct run. Transverse restraints for one duct section may also act as a longitudinal restraint for a duct section connected perpendicular to it if the restraints are installed within 4' of the intersection of the ducts and if the

restraints are sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.

4. The ductwork must be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze.
 5. A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.
 6. Walls, including gypsum board non bearing partitions, which have ducts running through them may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.
- P. All mechanical equipment shall be vibration isolated and seismically restrained as per the schedules in paragraph S of this Specification.
- Q. Seismic Restraint Exclusions:
1. Piping:
 - a. All piping less than 2-1/2 in. in diameter except those listed below.
 - b. All gas piping less than 1 in. I.D.
 - c. All piping in boiler and mechanical equipment rooms less than 1-1/4 in. I.D.
 - d. All clevis or trapeze supported piping suspended from hanger rods where the point of attachment is less than the 12 in. in length from the structure to the structural connection of the clevis or trapeze.
 - e. All PVC and fiberglass suspended waste or vent pipe 6 in. in diameter and smaller.
 2. Ductwork:
 - a. Rectangular, square or oval ducts less than 6 sq. ft. in cross sectional area.
 - b. Round duct less than 28 in. in diameter.
 - c. Duct supported by hanger rods where the point of attachment is less than 12 in. in length from the structure to the structural connection of the duct work.
- R. Suspended Equipment: Fan powered equipment weighing less than 50 lbs. and rigidly connected to the supply side of the duct system and supported with a minimum of 4 hanger rods.
- S. Schedules:

1. Equipment Isolator and Seismic Restraint Schedule:

Equipment Schedule	Vibration Isolation and or Seismic Restraint	
	Specification	Static Deflection
Fan Coil Unit	4 & 18	
In-Line Fans	10, 12, 19	.75 in.
Unit Heaters	10, 12, 19	.75 in.
Cabinet Heaters	4 & 18	
Suspending Fan Coil	10 & 12	

2.19 VARIABLE REFRIGERANT VOLUME AIR CONDITIONING – Three Pipe Heat Recovery and Two Pipe Heat Pump

B. This section includes the design, performance, refrigerant details, controls and installation requirements for Daikin VRV systems (variable refrigerant volume) or equal by Mitsubishi.

1. All units shall be listed and rated by ANSI/AHRI Standard 1230-2010 and meet all minimum IEER performance requirements as scheduled.
2. The units shall be ANSI/UL STD 1995 listed and listed by Electrical Testing Labs (ETL) and bear the cETL label.
3. All wiring shall be in accordance with the National Electric Code (NEC).
4. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
5. Acceptable manufacturer: Daikin or Mitsubishi.
6. Units must be provided with accessories needed for stable operation down to -13F in heating mode and -4F in cooling mode.

C. SYSTEM DESCRIPTION

1. The variable capacity air conditioning system shall be a Daikin Variable Refrigerant Volume system as specified. The system shall consist of multiple evaporators, branch selector boxes, REFNET™ joints and headers, a two or three pipe refrigeration distribution system using PID control and Daikin VRV condensing unit. The condensing unit shall be a direct expansion (DX), air-cooled or water-cooled, multi-zone air-conditioning system with variable speed inverter driven scroll compressors using R-32 (or alternate vendor R454B) refrigerant. The condensing unit may connect to an indoor evaporator capacity up to 200% of the condensing unit capacity. Each zone shall be capable of operating separately with individual temperature control. Each indoor unit or group of indoor units shall be able to provide independent temperature set points via a

local remote controller, a centralized Intelligent touch screen controller, or a BMS interface.

2. VRF system shall automatically vary the target evaporating and condensing temperatures based on building load and weather conditions to increase part load efficiency (Variable Refrigerant Temperature). The condensing unit shall also feature customizable operating modes which allows for the manual setting of target evaporating and condensing temperatures.
3. Standard T style joints are not acceptable for a variable refrigerant volume system. Manufacturer specific Y joints shall be supplied by the VRV manufacturer.
4. Heat Recovery
 - a. Operation of the system shall permit individual heating and cooling of each indoor unit simultaneously, or of all indoor units associated with each branch selector port.
 - b. A dedicated hot gas pipe shall be used to ensure optimum heating operation performance. Two-pipe, heat recovery systems utilizing a lower temperature mixed liquid/gas refrigerant to perform heat recovery shall provide system heating capacity at design temperature to the consultant before bidding. Capacity losses from factors such as piping lengths, defrost cycles and lower discharge air temperatures resulting from a 2-pipe only heat recovery system shall be taken into account.
 - c. Branch selector boxes shall be located as shown on the drawing. Each branch of the branch selector box shall consist of three electronic expansion valves. The branch selector box shall control the operational mode of the subordinate indoor units. The use of three EEV's ensures continuous heating during defrost (multiple condenser systems only), no heating impact during changeover and reduced sound levels. The use of solenoid valves for changeover and pressure equalization shall not be acceptable due to refrigerant noise.
5. VRV IV FEATURES
 - a. VRV system shall feature Variable Refrigerant Temperature, where the system automatically varies the target evaporating and condensing temperatures based on building load and weather conditions. The condensing unit shall also feature customizable operating modes which allows for the manual setting of target evaporating and condensing temperatures.
 - b. Each system shall be available with a configurator software package to allow for remote configuration of operational settings and assessment of operational data and error codes. If this software is not provided by an alternate manufacturer, the contractor shall configure the settings manually for each individual outdoor unit and keep detailed records for future maintenance purposes.
6. START-UP AND WARRANTY
 - a. The system must be installed by a DXS trained and certified contractor. The bidders shall be required to submit training certification proof with bid documents. Untrained contractors who wish to bid this project may contact DXS New England (978-977-9911) to arrange training prior to bid day.

- b. The manufacturer shall provide a factory trained service technician to start-up each unit. Manufacturer shall provide instruction to the owners' personnel on proper unit operation and maintenance.
- c. The warranty period on all parts and compressors shall commence on the date of initial start-up and shall continue for a period of Ten (10) years not to exceed one hundred and twenty six (126) months from date of shipment. Proper maintenance of the equipment, performed by approved technicians as per the manufacturer or manufacturer's representative, shall be conducted. Maintenance logs shall be supplied by the owner upon request.

7. REFRIGERANT PIPING

- i. Code Compliance
 - 1. Installation shall conform with ASME B31.5 Mechanical Refrigeration Code.
 - 2. Welding materials and procedures shall conform to ASME SEC 9 and applicable provincial labor regulations.
 - 3. Safety pressure relief valves shall be field supplied and installed in the piping as per
 - 4. Pressure relief valves shall be 600 PSI rated and installed in pairs (two valve per refrigeration circuit), and shall be supplied and installed for both the liquid and suction line as per drawing details. Pressure relief valves shall be individually isolated to allow for maintenance and required replacement.
- ii. All systems shall display appropriate Ozone Depletion Prevention (ODP) tags prior to commissioning. VRV manufacturer shall not commission any system not displaying proper ODP tag.
- iii. Materials
 - 1. All copper piping shall be air conditioning and refrigerant grade ASTM B280 ACR.
 - 2. Copper piping shall be type K copper hard drawn.
- iv. Brazing rods for all joints shall be 15% silfoss.
- v. Approved R-32 flaring block, and approved torque wrenches, both available from VRV manufacturer, shall be used for all flare connections.
- vi. Y style piping joints and headers provided by the manufacturer shall be used to ensure proper refrigerant balance and flow for optimum system capacity and performance.
- vii. T style joints and/or joints provided by the installing contractor, or Y joints not purchased from the manufacturer shall not be acceptable.
- viii. Isolation valves shall be installed where shown on the schematics or where required to support service of each branch box and terminal unit. Isolation valves shall be bi-flow self seating valves rated for R-32 with operating pressures up to 650 PSI. Valves shall be complete with brass schrader connections located on the valve body only.
- ix. Quality Assurance
- x. Nitrogen purging shall be used on all brazed joints to minimize oxidization.

- xi. Filter dryers, sight glasses, expansion valves, solenoid valves or any other 3rd party components shall NOT be installed in the field piping.
- xii. Contractor shall provide VRV manufacturer with all actual pipe lengths installed for calculation of refrigerant charge. Refrigerant piping contractor shall supply and charge VRV system with required quantity of R-32 prior to VRV manufacturer commissioning. Refrigerant charging shall be done in the liquid state.
- xiii. High/low pressure gas line, liquid and suction lines shall be individually insulated between the condensing units, branch selector units and indoor units.
 - 1. All indoor refrigerant lines shall be insulated with minimum ½" wall diameter Armaflex.
 - 2. All outdoor refrigerant lines shall be insulated with minimum ¾" wall diameter Armaflex and suitable for outdoor service. Exposed insulation shall be protected by aluminum, sheet metal, painted canvas, plastic cover, or painted with an approved UV coating that is water resistant and provides shielding from solar radiation.
 - 3. Pipe clamps shall fasten around the piping insulation. Pipe clamps that compress the copper directly shall be installed a minimum of 36" away from RefNet joints and shall be loosely tightened to allow for copper expansion.
 - 4. Pipe supports shall be a maximum of 6' apart.

8. FAN COILS

- i. Fan coils shall monitor and maintain the unit superheat (cooling mode) or subcooling (heating mode) using a computerized PID control. Internal unit components shall be factory wired and piped, and complete with electronic proportional expansion valve, flare connections, condensate drain pan, self-diagnostics, and auto-restart function.
- ii. Daikin units shall be designed for R-32 refrigerant and be equipped with an electronic expansion valve.
- iii. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while inhibiting changes in room temperature when used with Daikin remote control BRC1E73.
- iv. Indoor units shall be completely factory assembled and tested. Internal unit components shall be factory wired and piped, and complete with electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, integral condensate pump for horizontal ducted and ceiling suspended and cassette style units, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
- v. FXZQ – 4 WAY CEILING CASSETTE UNIT
 - 1. Daikin indoor unit model FXZQ shall be a ceiling cassette fan coil unit for installation into the ceiling cavity equipped with an air panel grill. It shall be a four-way air distribution type, white, impact resistant with a washable decoration panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°.
 - 2. The indoor unit's sound pressure shall range from 25.5 dB(A) to 33 dB(A) at low speed measured at 5 feet below the unit.

3. The 4-way supply air flow shall be capable of field modification to 2-way or 3-way airflow to accommodate various installation configurations including corner installations.
4. The decoration panel shall be a low-profile design, extending only 5/16" below the ceiling without any overlap with neighboring ceiling tiles, allowing for installation directly adjacent to other ceiling components such as lights, diffusers, and sprinklers, etc.
5. Return air shall be through the concentric panel, which includes a resin net mold resistant filter. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump shall provide up to 21" of lift and have a built-in safety shutoff and alarm.
6. Three auto-swing positions shall be available to choose from, which include standard, draft prevention and ceiling stain prevention. The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.
7. Fresh air intake (where shown on plans) shall be possible by way of direct duct installation to the side of the indoor unit cabinet.
8. A branch duct knockout (where shown on plans) shall exist for branch ducting supply air.
9. The fan shall have a variable speed direct drive DC motor with a statically and dynamically balanced impeller with 3 user-selectable fan speeds. The automatic fan speed mode shall allow the fan to vary between 5 speeds based on space load.

vi. FXSQ_10" – CONCEALED CEILING DUCTED UNIT

1. Daikin indoor unit FXSQ shall be a built-in ceiling concealed fan coil unit with direct-drive DC (ECM) type fan with auto CFM adjustment at commissioning for installation into the ceiling cavity. Casing shall be constructed of galvanized steel. Configuration shall be horizontal discharge air with horizontal return air, with a maximum height of 9-5/8" and be designed to fit in tight ceiling plenums.
2. The indoor unit's sound pressure shall range from 28 dB(A) to 36 dB(A) at low speed measured 5 feet below the ducted unit.
3. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump shall provide up to 25" of lift from the center of the drain outlet and have a built-in safety shutoff and alarm.
4. The fan shall have a variable speed direct drive DC motor with statically and dynamically balanced impeller with 3 user-selectable fan speeds. The automatic fan speed mode shall allow the fan to vary between 5 speeds based on space load. The unit shall have logic for automatically adjusting external static pressure settings of the fan motor (selectable during commissioning).
5. Field installed filters and filter kits with 2" filter depth option of side or bottom access.
6. Pleated MERV 13 filters with 3 spare sets of filters in addition to the ones supplied with the unit (4 sets total).

9. CONDENSING UNIT

- i. The condensing unit shall be factory assembled in North America and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of Daikin inverter scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports, liquid receiver and suction accumulator.
- ii. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.
- iii. The unit shall incorporate an auto-charging feature and a refrigerant charge check function to ensure proper refrigerant charge.
- iv. The following safety devices shall be included on the condensing unit: high pressure sensor and switch, low pressure sensor, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter, and anti-recycling timers.
- v. To ensure the liquid refrigerant does not flash when supplying to the various indoor units, the circuit shall be provided with a sub-cooling feature.
- vi. Oil recovery cycle shall automatically occur 2 hours after start of operation and then every 8 hours of operation.
- vii. The Daikin inverter scroll compressors shall be high efficiency reluctance DC (digitally commutating), hermetically sealed, variable speed type. Temperatures and pressures shall be read every 20 seconds and calculated. With each reading, the compressor capacity (INV frequency) shall be controlled to eliminate deviation from target value. Non inverter-driven compressors shall not be accepted.
- viii. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. Upon complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.
- ix. Non inverter-driven compressors, shall not be allowed.
- x. The compressors' motors shall have a cooling system using discharge gas, to avoid sudden changes in temperature resulting in significant stresses on winding and bearings.
- xi. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
- xii. The compressor shall be internally isolated to avoid the transmission of vibration, eliminating the need for external spring insulation.
- xiii. Inverter board shall be refrigerant-cooled to prevent inefficient and unstable operation that can result from air-cooled inverter boards due to varying ambient conditions.
- xiv. In the event of compressor failure, for condensing units with multiple compressors, the remaining compressors shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity. The microprocessor and associated controls shall be designed to specifically address this condition.
- xv. In the case of multiple condenser modules, conjoined operation hours of the compressors shall be balanced by means of the Duty Cycling Function, ensuring sequential starting of each module at each: start/stop cycle, completion of oil return, completion of defrost, or every 8 hours of operation, extending the operating life of

the system. When connected to a central control system, sequential start is activated for all systems on each DIII network.

- xvi. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish. The unit shall be modular in design and shall allow for side-by-side installation with minimum spacing requirements.

- xvii. Condensing Unit Stand:

Provide 18" high seismic rated snow stand similar to Quick-Sling VRF/VRV Super Stand product or equal securely fastened to the anchored roof sleepers and the unit. Provide neoprene seismic rated vibration isolators.

- xviii. Air Cooled

1. The fan motor shall have inherent protection and permanently lubricated bearings. The motor shall be provided with a fan guard to prevent contact with moving parts. The condensing unit shall consist of one or more propeller type, direct-drive 350 or 750 W fan motors that have multiple speed operation via a DC (digitally commutating) inverter. Motors shall be capable of delivering design air at high external static pressures up to 0.32 in WG (factory set as standard at 0.12 in. WG) to accommodate field applied duct for indoor mounting of condensing units.
2. Night setback control of the fan motor for low noise operation by way of automatically limiting the maximum speed shall be a standard feature.
3. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.
4. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tubes with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design. The fins are to be covered with an anti-corrosion acrylic resin and type E1 hydrophilic film.
5. The fins are to be covered with an anti-corrosion hydrophilic blue coating as standard with a salt spray test rating of 1000hr (ASTM B117 & Blister Rating:10), Acetic acid salt spray test of 500hr (ASTM G85 & Blister Rating:10).
6. The pipe plates shall be treated with powdered polyester resin for corrosion prevention. The thickness of the coating must be between 2.0 to 3.0 microns.
7. Provide wind baffles on all intake sides and a top hood for snow and cold weather operation.
8. System shall be able to enlarge from single to dual module without the need for installed main pipe size changes. The manufacturer shall provide predefined pipe sizes and design rules ensuring reliable system operation and offering design flexibility in phased installation applications.
9. The outdoor coil shall have three-circuit heat exchanger design. The lower part of the coil shall be used for inverter cooling and be on or off during heating operation, enhancing the defrost operation.

10. Each condensing unit shall have a three-segment removable panel design which allows for direct separate access to outdoor fans, critical mechanical and electrical components for ease of installation and service, and shall have separate knock-outs for refrigerant piping and wiring on the bottom panel.
11. Each system shall include a built-in data recorder that can store up to 45 minutes of operational data which can help identify the issue in case of a product failure.

xix. Heat Pump (not applicable to the Mercy Center)

1. The outdoor unit shall be capable of heating operation at -4°F ambient temperature. Tested factory data on heating capacity and efficiency shall be available.
2. The outdoor unit shall be capable of cooling operation down to +23°F without any additional low ambient controls.
3. The outdoor unit shall be complete with low ambient controls and low ambient wind baffles for cooling operation down to -4°F

xx. Heat Recovery

1. The outdoor unit shall be capable of heating operation at -13°F ambient temperature. Tested factory data on heating capacity and efficiency shall be available. For multiple module systems, the system shall continue to provide heat to the indoor units in heating operation while in the defrost mode.
2. The outdoor unit shall be capable of cooling operation down to 23°F without any additional low ambient controls.

10. BRANCH SELECTOR BOX

- i. Branch selector boxes shall be located as shown on the drawing. Selector box cabinets shall have a galvanized steel plate casing and shall house multiple electronic expansion valve and a sub-cooling loop. The unit shall contain sound absorption thermal insulating material made of flame and heat resistant foamed polyethylene.
- ii. Branch selector boxes shall not require drain pan and drain connections. Manufacturers with branch selector boxes requiring drain connections shall bid as an alternate and carry allowances to compensate for the added costs of the drain connections.
- iii. Manufacturers with branch selector box sizes, arrangements, or locations that differ from what is specified shall make the necessary arrangements to ensure their alternative branch selector boxes both fit in the space and comply with ASHRAE 15.
- IV. Branch boxes shall be provided with factory installed safety shutoff valves to each fan coil for interlock with refrigerant detectors at downstream indoor units, and will close upon detection of a leak. Maximum releasable charge to be calculated by the equipment manufacturer for each branch box port for ASHRAE 15 compliance

11. REFRIGERANT SAFETY

- a. For all systems over 2-tons in capacity, provide factory installed R32 refrigerant leak detector with onboard sequence to alert with a visual light on room controller, engage the indoor unit fan and close branch selector valve (where branch selector applicable) upon a leak in compliance with section 7.6.1.1 of ASHRAE 15 2022.

- b. Alternate manufacturers to provide releasable charge values and calculations for ASHRAE 15 2022 compliance.
- c. Provide factory installed safety shutoff valves in all branch boxes and Mrel calculations for ASHRAE 15 2022 compliance.
- d. All indoor units shall have a factory installed refrigerant leak sensors built in. If a leak is detected, the unit shall go into circulation mode and provide full airflow. The unit shall have a signal output in event of a leak to close branch selector valve zone and signal to BMS for alarming and other action as specified.
- e. Branch boxes shall be provided with factory installed safety shutoff valves for interlock with refrigerant detectors at downstream indoor units, and will close upon detection of a leak. Maximum releasable charge to be calculated by the equipment manufacturer for each branch box port for ASHRAE 15 compliance.

12. CONTROLS

- i. Fan coil units shall be supplied with Individual Zone Controllers, similar to Daikin model BRC1E73
 - 1. Remote controllers shall be hard wired by installing contractor.
 - 2. Controllers shall be able to function as follows:
 - 1. The controller shall have dual or single Cool and Heat setpoints for occupied periods, and independent setback setpoints for unoccupied periods.
 - 2. The controller shall have the ability to digitally prohibit individual buttons and functions.
 - 3. The controller shall have a self-diagnosis function that constantly monitors the system for malfunctions (total of 80 components).
 - 4. An LCD digital display will allow the temperature to be set in 1°F units.
 - 5. The controller shall be equipped with a thermostat sensor.
 - 6. The controller shall have the ability to automatically changeover the mode of operation with dual or single setpoints.
 - 7. Controller shall have built-in 7-day, weekday plus Saturday Sunday (5+1+1), weekday plus weekend (5+2) and everyday (1) scheduler.
 - 8. Controller shall have a simple display mode, displaying only the operation mode, the setpoint(s), and the room temperature.
 - 3. Provide an advanced multi-zone controller for installation in a common area as shown on the plans, equal to Daikin iTouch Manager. The controller shall have a 10" LCD touch screen display with the following screen views and functionalities:
 - 1. Central control of set points, schedules, airflow rates, heat/cool mode, and of setback (override) temperature settings during unoccupied periods.
 - 2. Adjustable temperature limits to restrict local wall mounted thermostat set point ranges.
 - 3. Visible and audible alarm indication of any system malfunctions with descriptive error code.
 - 4. External Digital and / or Analog input/output and display of external input values.
 - 5. Tiered hierarchy allowing for control of fan coil units independently or as a group.

6. Remotely disable individual functions of the wall mounted controllers.
7. Web enabled for remote access from PC, tablet or portable device and automatic alert and error emails.
8. Automatic changeover shall be accomplished using one of the following two algorithms:
 - a) Averaging method – the central controller shall sum up the difference between room temperatures and set points for all indoor units in the system. Once this delta reaches the primary changeover deadband of $\pm 2^{\circ}\text{F}$ (adjustable), the central controller shall change over the system automatically.
 - b) Voting Method – the averaging method shall be used for the first stage of changeover. However, if any fan coil in the system reaches the primary changeover deadband of 3°F away from set point (adjustable), the voting algorithm shall take over and changeover the system to satisfy the diverting fan coil. The voting method limits the maximum amount that a zone can deviate from set point. This maximum amount shall be adjustable.
 - For both automatic change over options, a weight (0-3) can be added to each indoor unit. The automatic changeover algorithm shall use this weighting to prioritize changeover for the more heavily weighted fan coils.
 - Upon any changeover, a guard timer shall prevent another changeover for a period of 15, 30, or 60 (default) minutes.
 - The guard timer shall be ignored by a change of setpoint manually from either the central controller or the remote controller, by schedule, or if the secondary deadband is reached with either of the automatic changeover algorithms. The secondary changeover deadband shall be the sum of the primary changeover deadband (adjustable) $\pm 1^{\circ}\text{F}$ (adjustable)
9. “3D” Floor plan graphic layout
 - The central controller shall have the capability for site floor plan to be uploaded as a background to create a graphics interface. Background shall be specific project building floor plan rendered in “2D” or “3D”.
 - Floor plan layout shall be displayed on building control display as well as accessible from the web.
 - Floor plan will include capability to control indoor unit, and auxiliary inputs / outputs, such as designated lighting control, as follows:
 - i. Up to 4 status points to be assigned to the control point icon (room name, room temperature, set point, and mode).
 - ii. Status and control points to display on corresponding location of zone served on floor plan.
 - iii. Digital input and output icons will display On/Off status.
 - iv. Analog input icons will display analog value.
 - Up to 60 floor layout sections shall be possible depending on project scope.
10. Centralized controller shall be complete with power distribution software with the ability to generate .csv files with power consumption data for each fan coil in the system. With proper tenant agreement via a lease or purchase agreement, the distributed power consumption data can be used by the

owner or by the billing company to assess how the power consumption of the condensing units shall be distributed to each fan coils. The energy consumption files shall be accessible from the web via a restricted security access.

11. VRV manufacturer shall provide all necessary power meters required for the power distribution software of the centralized controller. Power meters shall be Measurement Canada approved. Power meters shall be installed and wired back to the centralized controller by division 16.
12. Installing contractor shall provide a 24VAC power connection to the central controller.
 - a. Power Proportional Distribution (PPD) (not applicable to Mercy Center project but future capability shall exist to add such feature)
 - i. The tenant billing option shall be capable of calculating VRV Controls Network equipment energy usage in kWh based on the energy consumption of the outdoor unit(s) divided among the associated indoor units. This software is used in conjunction with the intelligent Touch Manager and a Watt Hour Meter (WHM). A maximum of 3 Watt Hour Meters can be connected to the intelligent Touch Manager. Up to 4 additional Watt Hour Meters can be connected to each iTM Plus Adapter, and up to 7 iTM Plus Adapters can be connected to the intelligent Touch Manager. The Power Proportional Distribution results data can be saved to a USB flash drive, or on a PC with the use of the web access. Data is saved in the CSV format. Results can be stored up to 13 months in the intelligent Touch Manager.
 - ii. Provide a control module to allow full integration with a BACnet IP compatible with project BMS.
 1. BACnet module shall be wired, installed and powered (24VAC) by installing contractor. IP connection shall be by BMS contractor.
 2. VRV manufacturer shall commission the BACnet panel. BMS contractor shall provide VRV manufacturer with static IP address and instance number for commissioning.
 3. All programming for monitoring and control of VRV system via the BACnet panel shall be by BMS contractor, as per the Sequence of Operation.
 4. Programmability:
 - a. The BACnet building management system shall support weekly schedule settings through its programming.
 - i. The schedule shall support the indoor unit:
 1. On/Off
 2. Each scheduled event shall specify time and target group
 3. Each scheduled event shall include On/Off, Operation Mode, Occupied Cooling Setpoint, Occupied Heating Setpoint, Setup (Cooling) setback setpoint, Setback (Heating) setback setpoint, Remote Controller On/Off Permit/Prohibit, Remote Controller Mode Permit/Prohibit,

Remote Controller Setpoint Permit/Prohibit, and Timed
Override Enable

4. Setup (Cooling) and Setback (Heating) setpoints when unit is Off (unoccupied) by Group
 5. An override shall be provided for use enabling indoor unit operation during the unoccupied period by the BACnet building management system programming.
- b. The BACnet building management system shall support auto-changeover through its programming.
- i. Auto-change shall provide changeover for both Heat Pump and Heat Recovery systBMS based upon the group configurations. This will allow for the optimal room temperature to be maintained by automatically switching the indoor unit's mode between Cool and Heat in accordance with the room temperature and setpoint temperature.
 - ii. Changeover shall change the operation mode of the indoor unit that is set as the Changeover Master. The Changeover Master indoor unit shall then change the operation mode of all indoor unit groups daisy chained on the same DIII-Net communication bus to the same outdoor unit in the Heat Pump system or the same branch selector box in the Heat Recovery system.
 - iii. Changeover to cooling mode shall occur when the room temperature is great than or equal to the cooling setpoint
 - iv. Differential to be determined by BACnet building management system programming
 - v. Changeover to heating mode shall occur when room temperature is less than or equal to the heating setpoint.
 - vi. Differential to be determined by BACnet building management system programming
 - vii. Guard timer- Upon changeover, guard timer will prevent another changeover during this period. Guard timer should be ignored by a change of setpoint manually from the BMS, Intelligent Touch Controller, Remote Controller, or by schedule. Guard timer to be configured by BACnet building management system programming (30 minute minimum recommended)
- c. The Interface for use in BACnet shall support force shutdown of associated indoor unit groups.
- d. Provide BACnet interface to send and receive occupied, unoccupied and setpoint commands to EMS.

13. ELECTRICAL

- i. The power supply to the condensing unit shall be as scheduled.

- ii. Independent electrical power for fan coils and branch selector boxes shall be 208/230 volts, 1 phase, 60 hertz. The unit shall be capable of operating within the limits of 187 volts to 253 volts.
- iii. Unless limited by local electrical codes and standards, multiple fan coils and branch selector boxes can be connected to the same breaker. Individual disconnect switches for each fan coil are required, and are to be provided and installed by division 16.
- iv. Electrical power for condensing units shall be 460 volts, 3 phase, 60 hertz.
- v. The control voltage between the indoor and outdoor unit shall be 16VDC non-shielded 2 conductor cable.
- vi. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one outdoor unit with one 2-cable wire, thus simplifying the wiring operation.
- vii. Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit then to the branch selector box and outdoor unit. Control wiring shall run from the indoor unit terminal block to the specific controller for that unit.

14. EXECUTION

a. DELIVERY, STORAGE AND HANDLING

- 1. Units shall be stored and handled according to the manufacturer's recommendations. Units shall be kept clean and isolated from dust and debris.

ii. INSTALLATION

- 1. Install condensing units on a flat surface level within 1/8 inch, and elevated a minimum of 18" from ground or roof surface. Provide intermediate supports as recommended by the equipment manufacturer.
- 2. Provide all necessary control wiring as recommended by the manufacturer.
- 3. High/low pressure gas line, liquid, and suction lines must be individually insulated between the outdoor and indoor units.
- 4. Contact DXS (978-977-9911) prior to installation to review and confirm piping layout and lengths.
- 5. Use refrigeration best practice to allow pipes to expand and contract freely. Review manufacturer installation instructions to ensure expansion joints are properly designed.
- 6. Pressure test ALL systBMS to 550 PSI after system was vacuumed and held to below 500 microns for at least one hour. Review manufacturer installation instructions for proper pressure test procedures.
- 7. Design and install all piping as per local code and regulations.

2.20 DUCTLESS SPLIT AIR CONDITIONING SYSTEM (non VRF)

- A. Furnish and install a ductless split commercial ceiling mounted fan coil (surface mounted below ceiling) as scheduled matched with a roof mounted air cooled condensing unit. Indoor

unit shall be wall hung as scheduled. The matched system shall be rated per ARI Standard 210/240 and certified by UL and CSA. The system shall be as manufactured by Daikin, Mitsubishi, Sanyo or equal. A non-CFC or HCFC refrigerant must be used such as R-32 or approved equal. Minimum EER=15

- B. The combination of the outdoor unit and the indoor-fan coil unit shall have a total net cooling capacity as scheduled on drawings or greater at conditions of entering-air temperature at the evaporator coil of 80 degrees F. dry bulb and 67 degrees F. wet bulb. Outdoor ambient temperature of air entering the condenser of 95 degrees F. The system shall have a minimum listed SEER (seasonal energy efficiency ratio) of 15 at ARI conditions.
- C. Indoor Fan Coil Unit:
1. Indoor, direct-expansion, low-profile (11-3/4 in. high) in-ceiling fan coil or wall hung as scheduled. Unit shall come complete with cooling coil, fan, fan motor, piping connectors, electrical controls, condensate pump, and hanging brackets.
 2. Cabinet shall be constructed of zinc-coated steel. Fully insulated discharge and inlet grilles shall be attractively styled, high-impact polystyrene. Cabinet shall have filter tracks and cleanable filters which shall be accessible from below with a 1/4-turn fastener. Adjacent room cooling to be provided by a simple knockout in the cabinet side panel, and cabinet shall have provisions to accommodate a limited amount of ductwork, if desired.
 3. Fan shall be a centrifugal, direct-drive blower type with air intake in center of the unit and discharge on the perimeter. Air louvers shall be adjustable.
 4. Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins will be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a factory-installed condensate pump and drain connection for hose attachment to remove condensate. External pump shall be provided for wall units as required.
 5. Motor shall be totally enclosed and permanently lubricated with inherent protection. Fan motor shall be 3-speed. Unit shall operate on single phase 60- cycle 208 V power.
 6. Controls shall be 24 Volt, and shall be easily operated by the user from a wall-mounted control unit. Float control shall be in the condensate sump to shut unit down in case of pump malfunction. A wall-mounted programmable thermostat with three (3) fan speed selections, and an auto/manual switch shall be supplied for field installation. The refrigerant is controlled with a piston-type refrigerant metering device, and evaporator coil freeze protection shall be provided.
- D. Outdoor Air Cooled Condensing Unit: Furnish and install matching condensing unit. Condensing unit shall have low ambient control for operation down to 0°F, hard start assist kit, winter start package and crankcase heater.
- E. Condensing Unit Stand: Provide 18" high seismic rated snow stand similar to Quick-Sling VRF/VRV Super Stand product or equal securely fastened to the anchored roof sleepers and the unit. Provide neoprene seismic rated vibration isolators.
- F. For all systems over 2-tons in capacity, provide factory installed R32 refrigerant leak detector with onboard sequence to alert with a visual light on room controller, engage the indoor unit fan and close branch selector valve (where branch selector applicable) upon a leak in compliance with section 7.6.1.1 of ASHRAE 15 2022

2.21 PACKAGED ENERGY RECOVERY HVAC UNITS: DOAS-1 & DOAS-2

- A. Unit Certifications: Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration. Unit Energy Efficiency Ratio (EER) and heating COP shall be equal to or greater than prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings and IECC 2021. Unit shall be safety certified by ETL and be ETL US and ETL Canada listed. Unit nameplate shall include the ETL/ETL Canada label. Unit and components shall be designed, manufactured, and independently analyzed, rated, and certified to meet with the seismic compliance standards of the International Building Code, 2015 edition. If requested, unit shall be provided with Certificate of Compliance from an independent certifying Professional Engineer clearly indicating that the unit and components meet seismic design requirements.
- B. Submittals: Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, fan performance, filter information, factory supplied accessories, electrical characteristics and connection requirements. Installation, Operation and Maintenance manual with startup requirements shall be provided. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, construction details, clearances, and connection details. Computer generated fan curves for each fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.
- C. Warranty: Manufacturer shall provide a "parts only" warranty for a period of 12 months from the date of equipment startup or 18 months from the date of shipment, whichever is less. Contractor shall provide full parts and labor warranty during this time period but no less than 12 months from the point of project substantial completion as determined by the project Architect. Factory warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer's written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and air filters.
- D. Products shall be provided by the following manufacturers:
 - 1. Valent or approved equal by Daikin or Aeon.
 - 2. Substitute equipment may be considered for approval that includes at a minimum:
 - 1. R-32 refrigerant (or approved alternate refrigerant).
 - 2. Direct drive supply fans
 - 3. Double wall cabinet construction
 - 4. Insulation with a minimum R-value of 13
 - 5. Stainless steel drain pans

6. Hinged access doors with lockable handles
 7. Variable capacity inverter duty scroll compressor with 10-100% capacity for heat pump service.
 8. Hot gas reheat dehumidification coil.
 9. Energy recovery wheel as specified.
 10. Modulating electric heat.
 11. Airflow measuring stations on the exhaust fan, supply fan and outdoor air intake.
 12. All other provisions of the specifications must be satisfactorily addressed.
 13. Vibration isolating spring roof curb.
 14. Full programmable refrigeration only controller capable of controlling all aspects of the units operation compatible with the building EMS (as applicable). Controller must be capable of performing the sequences specified within the sequence of operation with capability for EMS read and write data interface.
- E. Packaged rooftop unit shall include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser and heat pump coils, condenser fans, reheat coil, exhaust fans, energy recovery wheels, gas furnaces and unit controls. Unit shall be factory assembled and tested including leak testing of the coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the controls compartment's literature pocket. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel. Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
- F. Installation, Operation and Maintenance manual shall be supplied within the unit. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's access door. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's access door.
- G. General Construction:
1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610°F. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break with no metal path from inside to outside the cabinet. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.

2. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Refrigerant piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
3. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
4. Access to filters, dampers, cooling coils, reheat coil, heaters, supply fans, exhaust fans, return fans, energy recovery wheels, compressors, water-cooled condensers, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
5. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure. Provide custom color as selected by Architect on entire exterior of unit.
6. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
7. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.
8. Roof curb shall be seismically restrained vibration isolating type with 2" static deflection springs. Curbs shall have an overall height of 24" or less if possible to reduce overall unit height.

H. Electrical

1. Unit shall be provided with standard power block for connecting power to the unit.
2. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
3. Unit shall be provided with factory installed and factory wired 115V, 13 amp GFI outlet with outlet disconnect switch in the unit control panel.
4. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more that 10% out of balance on voltage, the voltage is more that 10% under design voltage, or on phase reversal.
5. Unit shall be provided with manual reset low temperature limit controls which shut off the unit when the discharge temperature reaches a field adjustable setpoint.

6. Unit shall be provided with blower auxiliary contacts on the low voltage terminal block which close when the supply fans are energized.
7. Unit shall be provided with remote stop/start terminals which require contact closure for unit operation. When these contacts are open the low voltage circuit is broken and the unit will not operate.
8. For all RTU'S with a scheduled capacity of 2,000 CFM or greater, duct smoke detectors shall be furnished by the Electrical Subcontractor and given to the Mechanical Subcontractor for installation within the ductwork. The duct smoke detectors shall be wired by the Electrical Subcontractor with fan interlock wired by the HVAC contractor.

I. Supply Fans

1. Unit shall include direct drive, unhooded, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balanced and mounted on rubber isolators.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

J. Exhaust Fans

1. Exhaust dampers shall be sized for 100% relief.
2. Fans and motors shall be dynamically balanced.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Access to exhaust fans shall be through double wall, hinged access doors with quarter turn handles.
5. Unit shall include belt driven, unhooded, backward curved, plenum exhaust fans.
6. Unit shall include belt driven forward curved exhaust fans.
7. Unit shall include direct drive, axial flow exhaust fans. Blades shall be adjustable pitch.
8. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

K. Cooling/Heat Pump Coils

1. Evaporator & heat pump Coils

- a. Coils shall be designed for use with R-32 (or other approved alternate) refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
- b. Coils shall have interlaced circuitry and shall be standard (6 row high) capacity.
- c. Coils shall be helium leak tested.
- d. Coils shall be furnished with factory installed electronic thermostatic expansion valves (reversible for heat pump service).

L. Refrigeration System

- 1. Unit shall be factory charged with R-32 refrigerant or other approved alternate refrigerant.
- 2. Compressors shall be inverter scroll (at least 1st stage) type with thermal overload protection, independently circuited, and carry a 5-year non-prorated warranty.
- 3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam insulated panels to prevent the transmission of noise outside the cabinet.
- 4. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
- 5. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.
- 6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low-pressure sides, and factory installed liquid line filter driers.
- 7. Unit shall include a variable capacity inverter scroll compressor on the lead refrigeration circuit(s) which shall be capable of modulation from 10-100% of its capacity.
- 8. Lead refrigeration circuit(s) shall be provided with modulating valves, electronic controller, supply air temperature sensor and a dehumidification control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.
- 9. Lag refrigeration circuit(s) shall be provided with factory installed controls to protect against evaporator frosting and to prevent excessive compressor cycling.
- 10. First capacity stage shall be provided with variable speed condenser fan and adjustable compressor lockout to allow cooling operation down to 35°F.
- 11. Unit shall have reversing valve(s) for heat pump cycle mode where scheduled.

M. Condensers

1. Air-Cooled Condenser

- a. Condenser fans shall be vertical discharge, axial flow, direct drive fans.
- b. Coils shall be designed for use with R-32 refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.
- c. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
- d. Coils shall be helium leak tested.

N. Filters

1. Unit shall include 4 inch thick, pleated panel filters with an ASHRAE efficiency MERV rating of 13, upstream of the cooling coil and upstream of the energy recovery wheel. Furnish three (3) spare sets for each unit in addition to those required and used during building flush out.

O. Outside Air/Economizer

1. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to meet smoke damper Class-1 leakage specifications in accordance with U.L. 555S at 4 inches w.g. air pressure differential across the damper. Damper assembly shall be controlled by spring return enthalpy activated fully modulating actuator. Unit shall include outside air opening bird screen, outside air hood with rain lip and barometric relief dampers. Provide cleanable and removable moisture eliminators on intake air hoods.

P. Energy Recovery – Refer to schedules for wheel info. however, all DOAS units shall have energy recovery wheels

1. Unit shall contain a factory mounted and tested energy recovery wheel(s). The energy recovery wheel(s) shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings. Frame shall slide out for service and removal from the cabinet. Wheel shall have a minimum total energy transfer effectiveness in both winter and summer mode of no less than 70%.
2. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, ECM drive motor and drive belt.
3. Wheels shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow and minimum pressure drop-to-efficiency ratios. The layers shall be effectively captured in stainless steel wheel frames or aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix.
4. Wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or

coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.

5. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.
 6. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the ARI Certified Product. Wheel effectiveness must meet the conditions specified in the schedules but in no case shall sensible effectiveness and total energy effectiveness be less than 70%.
 7. Energy recovery wheel cassette shall carry a 5-year non-prorated warranty.
 8. Unit shall include 2" MERV 8 pre-filters and 4 inch thick, pleated panel outside air filters with an ASHRAE efficiency of MERV rating of 13, upstream of the wheels. Unit shall include 2 inch thick, pleated panel exhaust air filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the wheels. Provide 3 spare sets in addition to those required during building flush-out period.
 9. Hinged service access door shall allow access to the wheel(s).
 10. Total energy recovery wheels shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.
 11. Unit shall include a variable speed wheel to support both economizer and energy recovery wheel defrost control which includes an adjustable temperature sensor and wheel pressured sensor which, when frost is detected, slows allowing warm exhaust air to defrost the wheel. Wheel bypass dampers shall also be provided to support economizer cooling once the wheel has fully stopped.
 12. Unit shall include energy recovery wheel rotation detection sensors and a set of normally open and normally closed contacts for field indication of wheel rotation.
 13. Section shall include bypass recirculation damper as well as wheel OA and EA bypass dampers.
- Q. Manufacturer must provide grommetted and sealed test ports for temperature and pressure readings between each unit section element, such as filters, coils, energy recovery wheels, dampers and fans

R. Controls

1. Factory Installed and Factory Provided Controller

- a. It is the intent of this project that the HVAC equipment shall come with full factory controls, actuators, sensors and devices. .
- b. Factory controller shall include all components within the unit as well as the condensing section of the unit (i.e. compressors and condenser fans). Unit controller must be capable of controlling all features with external information provided by EMS system such as supply air temperature reset, fan static, etc... Controller shall be factory installed in the unit controls compartment and factory tested. Controller must be capable of flushing hot gas reheat coil to prevent oil migration into hot gas coil. Refer to ATC article for points which must come with the units from the factory.
- c. Controller shall include non-volatile memory to retain all programmed values, without the use of an external battery, in the event of a power failure.
- d. Suction pressure sensors shall be factory installed. Supply air temperature and space humidity setpoints, for the dehumidification mode of operation, shall be adjustable.
- e. Units shall be provided with the following minimum control devices or components installed from the factory (or field installed as noted):
 - Unitary controller with BACnet (or LON if EMS requires) interface for full control of unit. Controller shall accept, scheduling, supply air reset, supply and exhaust static reset (where specified) and dehum. demand from EMS.
 - Condenser section controller for full control of the refrigeration side of the unit inclusive but not limited to control of compressors, condenser fans, hot gas reheat valve, reheat coil flush, suction pressure sensors, low and high refrigerant and temperature limits, time on and off delays and voltage and phase protection.
 - Fully modulating outdoor air, return air and recirculation damper actuators. Normally closed outdoor air damper.
 - 2-position normally close energy wheel OA and EA bypass dampers.
 - Supply and exhaust fan(s) ECM or VFD drives.
 - Energy recovery wheel drive ECM or VFD drive
 - Energy wheel rotation sensor.
 - Fan mounted supply and exhaust airflow stations. Airflow stations which require probes to cross the inlet cone of the fan shall not be allowed as they impact the performance of the fan. Airflow station shall be similar to Greenheck Sure-Aire or approved equal by unit fan manufacturer and shall monitor the pressure difference between the fan inlet and the smallest diameter of the fan cone. Low pressure sensor orifices shall be equal spaced at the inlet cone venture and extend to termination plate on fan

housing. High pressure flow probe(s) shall be mounted in the low velocity zone near the fan inlet and shall also extend to a termination plate on the fan housing. Flow station shall measure pressure differential to within +/-3%. Furnish field installed electronics package which shall be mounted and wired by EMS and shall include controller in NEMA 4 enclosure with 4 digit 0.6" LCD display configured to read CFM. Unit shall have a 4-20 mA DC analog output signal.

- Provide factory furnished supply air flow and exhaust air flow stations. Construction type shall vary by manufacturer but in general shall consist of a multi-point pitot or hot wire array calibrated to the free area of unit intake and capable of reading with 5% +/- accuracy down to 25% of the schedule minimum outside air volume.
- Cooling coil leaving air temperature sensor wired to unit condenser controller. This is in addition to any device require to be furnished and installed by the EMS.
- Outdoor air temperature sensor wired to unit condenser controller. This is in addition to any device require to be furnished and installed by the EMS.

2. Field Installed Controls: Refer to control drawings and sequence of operation points list contained with this specification section.

S. Start-Up, Commissioning & Training

1. Provide factory service/start-up technician to check, test and start equipment. Technician shall coordinate mapping of all control points with EMS contractor and commissioning of unit. Technician shall work with project commissioning agent to verify proper operation of unit. In coordination with the mechanical contractor and control contractor the factory technician shall provide Owner training of unit controls, maintenance, etc...

2.22 ACCESS PANELS

- A. Furnish and install access panels for access to all parts of the HVAC systems that require accessibility for the proper operation and maintenance of the system.
- B. Size shall be sufficient for the purpose, but no less than 12 inches by 18 inches. Particular attention shall be exercised in the selection of doors for masonry walls in order that frame sizes used will match the courses of brick or block. Refer to section 08 31 00 for products.
- C. Access doors shall be prime coated of rust inhibitive paint, continuous hinge and manufactured by Inland Steel Products Company "Milcor", Acudor, Mifab, Miami-Carey or Walsh-Hannon-Galdwin, Incorporated "Way Lector". Type shall be based upon "Milcor" as follows:
 1. Suspended Drywall Ceilings: Style ATR with 16 gauge frame, 18 gauge panel and flush screwdriver operated cam locks.
 2. Plastered Walls and Ceilings: Style K with 16 gauge frame, 14 gauge panel and flush screwdriver operated cam locks.

3. Masonry Non-Rated Walls: Style M with 16 gauge frame, 14 gauge panel and flush screwdriver operated cam locks.
4. Masonry Non-Rated Wall: Fire rated with UL 1-1/2 hour "B" rating, 16 gauge frame, 20 gauge sandwich type insulated panel, self-latching lock having interior release mechanism, and key operated cylinder lock keyed as required to suit requirements of the Architect.
5. Non-Rated Dry Walls: Style DW with 16 gauge frame, 14 gauge panel screwdriver operated cam locks.

2.23 THERMOMETERS AND PRESSURE GAUGES

A. Straight Thermometers:

1. Where indicated on the Drawings, furnish and install 7 in. long die-cast aluminum case, "Adjustable Angle" red appearing mercury tubing thermometers, H.O. Trerice Co., Cat. A001 complete with separable stainless steel Type 304 socket, 30 degrees to 240 degrees F. range, and lagging extensions when installed in insulated pipe.
2. Thermometers to be adjusted to a position for maximum readability from normal operator's position.
3. Thermometers shall be H.O. Trerice Co., Weksler Instruments Corp., Weiss Instruments, or approved equal.

B. Pressure Gauges: Pressure gauges shall be as manufactured by Trerice, or approved equal, Series 600, 4-1/2 in. diameter, range 0 to 100 PSI (or other range as required by application), aluminum case, white face with black figures, with petcocks. Provide fluid filled gauges at pumps.

C. Provide separable stainless steel wells for each thermometer and pressure gauge. Wells for thermometers shall be filled with heat conductive gel prior to installation of thermometer.

2.24 ELECTRICAL WORK

- A. The Heating, Ventilating and Air Conditioning Contractor shall provide all wiring for the Automatic Temperature Controls, air handlers, duct smoke detectors (fan interlock and control loop power), condensers, etc.. except as otherwise specified herein.
- B. The HVAC contractor shall hire a licensed electrician to perform all control wiring as required by code. Minimum gauge of all control wiring is 18 AWG and shall be plenum rated.
- C. The Electrical Contractor shall install and do all power wiring for all motor starters and unmounted motors, furnished to him at the job site by other trades.
- D. For all low voltage motors, temperature control wiring and motor control wiring, including wiring for interlocking, shall be provided by the Section providing the motors, including the installation of all control devices.

- E. Furnish all starters and all other motor control devices for motor driven equipment required for the work. The Electrical Contractor shall provide all code required disconnect switches for all motors, except where otherwise noted. The setting of all motors required for mechanical equipment shall be included as part of the mechanical work.
- F. Equipment which includes a number of correlated electrical control devices mounted in a single enclosure or on a common base with equipment, shall be supplied for installation completely wired as a unit with terminal boxes and ample leads ready for external wiring.
- G. All electrical items called for as part of the mechanical work shall conform to NEMA Standards, to the requirements of the National Fire Protection Association and to the requirements of any local electrical code authority having jurisdiction, any field modifications required to ensure such conformance shall be included as part of the mechanical work.

2.25 ELECTRIC MOTORS

- A. This Contractor shall provide all electric motors necessary for driving all motor driven equipment required to be furnished under this section of the Specifications.
- B. All motors shall be designed for 3 phase, 60 cycle alternating current operation with 460 volts across the motor terminals, except that, unless otherwise specified herein, all motors 1/3 HP and smaller shall be designed for single phase, 60 cycle alternating current at 120 volts across the terminals.
- C. The speed, horsepower, type and other essential data for each motor, if not given under paragraphs describing the various motor driven apparatus, or in schedules on the drawings shall be submitted to the Engineer for his review. All two speed motors shall be single winding type.
- D. Contractor shall furnish premium efficient motors eligible for rebate by the local electric utility, when applicable.

2.26 SCAFFOLDS AND STAGING

- A. General: Sub-Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 – TEMPORARY FACILITIES and herein.
 - 1. Scaffolding and staging required for use by this Sub-Contractor pursuant to requirements of Section 01 50 00 – TEMPORARY FACILITIES shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Contract requiring such scaffolding.
 - 2. Each Sub-Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 – TEMPORARY FACILITIES and as additionally required for dust control).
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Sub-Contractor.

2.27 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Sub-Contractor shall be furnished, installed, operated and maintained in safe conditions by this Sub-Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES.

2.28 AUTOMATIC TEMPERATURE CONTROLS

- A. Furnish and install all control components necessary to obtain a fully functional control system as described herein. The contractor is responsible for providing all controls, relays, etc. necessary to accomplish the Sequence of Operations and performance specified, whether or not the items are specifically identified herein. This shall include all the points shown in the control diagrams and on the drawings. Wherever a setpoint is referred to, this implies that the setting is adjustable by the user. Contractor shall hire the project electrician to provide additional power supplies to support the control devices as required.
- B. All controls operating equipment and systems configured to run off emergency stand-by power must be wired to the emergency stand-by power circuit. Any controls supporting life safety components as well as minimal building heating shall be wired to life safety emergency power circuit. As indicated in section 01.60.00 Product Requirements, 1.6 Owner's Proprietary Products, the Automated Logic system is a proprietary product for existing control modifications and Automated Building Systems is a proprietary product for new control. No alternates shall be allowed.
- B. The specified DDC system is based on the most recent generation of Niagara based products from Alerton, as provided by Automated Building Systems, Inc. the Owners current energy management system provider. Approved equals will be allowed. In addition, the existing building has an Automated Logic system which shall remain and be used to control the existing welding area make-up air unit with interface to the fume extraction fans. Owner's front-end graphics must be updated to include changes to exiting systems as well as new systems. The control system shall operate on a central network bus and shall web-based access via password protection to any remote computer. This control system shall be referred to as the DDC, BMS, EMS or ATC system throughout this specification. EMS system must be BACnet and Open Protocol compatibility for direct communication with DOAS and VRF systems to obtain operation status of systems. Besides various HVAC systems the EMS shall communicate to other building systems via ModBus RS-485 connection to monitor and report on status. The systems shall be as follows:
- Lighting system (BACNet) – for occupancy/vacancy status of each room if noted within the SOO herein.

It is the intent of this project that the VRF heat pumps and rooftop units shall come with factory controls to operate many of the respective units operations with BACnet interface to the building EMS vendor. Although equipment may come with many local devices and sensors provided by the equipment manufacturer the EMS contractor must still provide external sensors and devices (i.e. duct smoke detector and damper connections, duct static and space static sensors, return and/or space CO2 sensors, etc...) as required to achieve the sequence of operation and comply with the bid documents. Controls subcontractor must review specifications and clarify with respective mechanical sub-bidders to verify mechanical contractor is proposing to provide the equipment specified with communication interface specified

- C. The BMS contractor shall be regularly engaged in the installation and maintenance of BMS systems and shall meet the following qualifications:
- i. A minimum of ten (10) years of demonstrated technical expertise and experience in the installation and maintenance of BMS systems similar in size and complexity to this project.
 - ii. A minimum of ten (10) years' experience installing the control system of the manufacturer that is to be proposed.
 - iii. Shall be a certified-to-install, direct representative of a control system manufacturer that has a minimum of ten (10) years experience producing control systems similar to that which is to be proposed.
 - iv. A maintained service organization consisting of at least eight (8) competent servicemen, within 60 miles of the project site, for a period of not less than ten years.
 - v. Tech support available 24 hrs / per 365 day's per year.
 - vi. The Bidder shall not be considered qualified to bid this project unless they can provide a list of 10 projects, similar in size and scope to this project, completed within the last four years.
 - vii. The system manufacturer/installer shall provide an experienced project manager for this work from beginning of control installation until final completion. The project manager is responsible for direct supervision of the design, installation, start-up and commissioning of the BMS as well as attending of project meetings whenever directed by the owner, construction manager, and/or mechanical contractor. It shall not be acceptable to change the project manager after the project has begun and before final completion. If the BMS manufacturer wishes to change the project manager, the construction manager and/or owner's representative must be notified immediately and both the new project manager and the previous project manager shall spend 3 consecutive business days together on-site performing a project management switchover. Exceptions may be allowed for small projects as determined by the construction manager and/or owner's representative.
- D. The entire system, materials & devices as well as installing contractor and associated work shall comply with all current governing codes, ordinances and regulations including UL, NFPA, NEC, IBC, IMC, local AHJ, etc...
- E. The system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability for any existing control system component including but not limited to Primary Control Panels, Secondary Control Panels, personal operator workstations, and portable operator's terminals, to be connected and directly communicate with any new BMS system equipment without bridges, routers or protocol converters.
- F. All control wiring shall be shielded plenum rated minimum 18 AWG (unless lighter gauge or heavier gauge is required due to impedance or current demands) and shall be run concealed above ceilings or within walls. When the wiring must run exposed it shall be run in EMT conduit in unfinished service spaces and in Wiremold® or equal conduit system product in finished occupiable spaces.
- G. It shall be division 23 00 00 responsibility to provide all personnel as required to fully coordinate with the commissioning agent. The hours of training and instruction outlined in division 23 00 00 and the Testing and Balancing requirements shall be in addition to those tests and requirements outlined in section 01 91 13 and required to fulfill section 01 91 13 commissioning obligations.

H. General

1. The automatic temperature control system shall include, but not be limited to, the following components:
 - Updated front-end computer with graphic software showing all new building HVAC systems and changes to existing system made as part of this project. Real-time interface with controlled components.
 - Several stand-alone DDC control unit(s) networked together on a local LAN to control the environment in the entire building
 - Expansion modules for the controllers, if required, shall provide for the capability of additional DDC points.
 - End devices such as sensors, actuators, dampers and valves.
 - Control transformers and relays.
 - Control wiring between duct smoke detectors and the respective fan starters.
2. The failure of any single component shall not interrupt the control strategies of other operational devices.

I. OPERATOR INTERFACE / STATION

1. Existing front-end computer and network graphics software shall be updated to reflect all new building HVAC systems and changes to existing system made as part of this project.

J. INPUT/OUTPUT INTERFACE

1. Digital Inputs (DI) shall allow the monitoring of on/off signals from remote devices. The digital inputs shall provide a wetting current of 12mA at 12 vdc to be compatible with commonly available control devices.
2. Analog Inputs (AI) shall allow the monitoring of low voltage current or resistance signals and shall have a minimum resolution of 0.1% of the sensing range. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.
3. Digital Outputs (DO) shall provide a continuous low voltage signal for on/off control of remote devices. Where specified in the sequences of operations or indicated on the points list, digital outputs shall have 3-position (on/off/auto) override switches, status lights, and shall be selectable for either normally open or normally closed positions.
4. Analog Outputs (AO) shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10vdc or a 4 to 20 mA signal as required to provide proper control of the output device.

K. AUXILIARY CONTROL DEVICES

1. Control Valves
 - a. Valve bodies shall be 2-way or 3-way mixing as shown on the drawings and as specified herein. Valve bodies 2" and under shall be bronze, screwed type, rated for 125 psig. Valve bodies 2-1/2" and over shall be iron, flanged and rated at 125 psig, except where otherwise noted. Valves shall have stainless steel stems and allow for servicing including packing, stem and disk replacement. Valve shall be sized for a pressure drop equal to 2 psig.

2. Valve Actuators

- a. Valve actuators shall be electronic, spring return, low voltage (24v) and properly selected for the valve body and service. Actuators shall be fully proportioning. All heating valves including radiation shall be fail open style to open fully upon power loss however during summer months when the heating plant is off, the ATC shall disable power to the valves.

3. Dampers and Actuators

- a. Dampers shall be opposed blade type except where installed in round ductwork where single blade type is acceptable. All damper blades shall be low leakage type with neoprene gasketed edge seals rated for no more than 3 CFM/SF leakage at 1" w.g.. Actuators shall be electronic, spring return, low voltage (24v) and properly selected for the required torque and speed. Actuators shall be fully proportioning with the exception of those dampers specified as being 2-position open & closed. All actuators shall include end switches. Dampers for the fire/smoke service shall include end switches for both full open and full closed positions.
- b. Dampers exposed to the area served shall be double wall insulated ultra-low leakage type.

4. Temperature Sensors

- a. Temperature sensors for VRF fan coils shall be furnished by the VRF unit manufacturer. Otherwise temperature sensors shall be Resistance Temperature Detector (RTD) type or thermistors, as dictated by the requirements of this specification. Final location of all space sensors shall be coordinated with the Owner and Engineer. Space sensors in all areas shall be wall mounted type with a user adjustable access allowing deviation of +/- 3 deg. of computer defined setpoint and push button occupied override. Space sensors in unsecured public areas such as in the lobbies and restrooms shall be non-adjustable type with push button occupied override.
- b. Duct sensors shall be rigid or averaging as specified in the sequence of operations. Averaging sensors shall be a minimum of 20 feet in length. Freeze protection sensor shall have a 20 foot sensor crossing back and forth across the air exit face of the water heating coil. Immersion sensors shall be provided with a separable stainless steel well
- c. Sensor accuracy's and operating ranges shall be as follows:
 - Space temp. +/- 1 deg. F, 0 to 130 deg. F range
 - Duct temp. +/- 1 deg. F, 30 to 160 deg. F range
 - O.A. Duct temp. +/- 1 deg. F, -30 to 160 deg. F range
 - Water +/- 1 deg. F, 0 to 200 deg. F range

5. Relative Humidity Sensors

- a. Relative humidity sensors shall be thin film capacitor type with an accuracy of +/- 2% with a range of 10% to 90%. For enthalpy calculations provide one on North wall for outdoor air sensing and one in each RTU and ERU main return air duct and elsewhere as shown on the control drawings or indicated herein. Final location of all

space sensors shall be coordinated with the Owner and Engineer. Space sensors shall be wall-mounted type.

6. CO2 sensors: Shall be self-calibrating duct or wall-mounting type as specified capable of measuring a CO2 range between 100 and 2000 PPM as manufactured by Mamac or approved equal.
7. Flow Switches
 - b. Differential pressure switches shall be provided at filters and fans. Current sensing run indicators shall be provided at each fan and pump. Sensor shall be able to differentiate between belt loss and motor failure and report to the workstation as such.
8. Air Flow Measuring Stations: Outdoor air intake, exhaust fan and supply air fan airflow stations shall be furnished by the DOAS equipment manufacturer. Airflow stations shall be similar in quality to multi-point cross grid wire device similar to Ebtron Gold series. .
9. Duct Smoke Detectors: HVAC contractor shall install duct smoke detectors in ductwork as well as interlock with respective fan circuits and EMS system. Electrical contractor shall furnish duct smoke detector, power wire and wire to fire alarm system.
10. Occupancy Sensors: Provide dual technology (PIR and Ultrasound) occupancy sensors for EMS monitoring and control of HVAC ventilation systems in the Surgery and Dental Areas. Sensors shall be as manufactured by Wattstopper or equal. Sensors shall be in a number and location to cover all occupiable spaces of the respective areas.

L. OPERATOR INTERFACE SOFTWARE

3. Alarms
 - a. The stand-alone DDC unit shall provide visual notification of equipment failures, program failures, hardware failures or sensor failures. In addition each sensor and point shall be individual alarmed for values in excess of their respective high/low limits or status. When an alarm is detected, it shall be automatically stored and the user notified by displaying a message on the front display panel. The front-end shall be located in the Maintenance Office.
 - b. In addition to visual notification, a dial out alarm via email or text to defined parties shall be sent during a high-level alarm condition as follows:
 - Duct smoke detector activated
 - Fan failure
 - Pump failure
 - VRF failure
 - DOAS failure
 - Freeze stat protection alarm
 - Low space temperature (lower than 50°F)
 - High space alarm (greater than 100°F)
 - c. Filter Alarms:

If filter differential static pressure sensor detects a filter pressure drop of greater than a setpoint of 0.7" a dirty filter maintenance alarm shall be reported by the front-end.
Typical for all system with filter monitoring as indicated on the control drawings.

4. Scheduling

- a. The scheduling program in the stand-alone DDC unit shall provide daily, weekly and calendar scheduling capability. The master schedule shall be capable of being individually edited for each day of the week and holidays.

5. Communications

- a. The controller shall communicate on a network bus. In addition, the system shall communicate to the internet via a Ethernet connection. Coordinate with Owner for Ethernet interface port. Contractor shall program system to dial out and email alarms to predefined parties and send alarms to the Owner's security monitoring company.
 1. The electrical contractor shall provide wiring from the BMS system to the generator for the load bank "transfer of control" contact closure to initiate the load bank and time delay load application circuit.
 2. Coordinate exact requirements with the electrical vendor.

6. Fault Detection and Diagnostics:

The EMS shall include analytical software to support fault detection and diagnostics of the EMS system. Software shall be similar to Niagra WEBs-N4 Analytics, current version. Software shall include an algorithm library editable to match the current applications within the building and shall be set up to monitor, trend and report on operation issues.

M. SEQUENCE OF OPERATION – DOAS-1 & DOAS-2 (Dedicated Outdoor Air System)

1. General

- a. DOAS-1 & DOAS-2 are packaged rooftop units with energy recovery wheels units that are variable air volume (VAV) units which provide year-round dehumidification, cooling, heating and ventilation to many areas in the building.
- b. Many control sequences and points related to the DX condenser sections, electric heat and energy wheels shall be accomplished via the units factory controls which must be programmed and interfaced to the EMS. The EMS must control occupied/unoccupied modes, fan static setpoints, supply air discharge setpoints, etc... via hard wire or BACnet interface. EMS contractor must coordinate with RTU vendor to ensure all specified sequences and points are provided.

2. Supply & Exhaust Fan Control

- a. The EMS system shall compare the outdoor conditions, the space conditions and the buildings historical warm-up/cool-down profile to determine the optimum start time

required to achieve space setpoint conditions by the scheduled occupied start time. The fans shall run continuous during the occupied time period. During morning warm-up mode the outdoor air dampers shall remain closed and the system shall supply air reset off the return air temperature to bring the spaces up to space heating setpoint (Refer to Heating Coil Control).

- b. The EMS shall index from the occupied mode to the unoccupied mode based on a time schedule furnished by the owner. This schedule may be temporary overridden for a predetermined time period by sensor mounted override switches.

3. Occupied Mode

- a. At the commencement of occupied mode, the outdoor air damper shall open 100% and the return/recirculation air dampers shall close. The supply fan and exhaust fan shall run continuously throughout the occupied time period (see exhaust fan enable herein). If discharge air duct static rises above a setpoint of 2.5" w.c. or if the exhaust air inlet static drops lower (more negative) than -2.5" the unit shall be disabled and an alarm shall be reported. The high limit duct static pressure sensor shall be located on the unit side of any smoke dampers.
- b. For DOAS-1, the supply fan variable frequency drive shall modulate to maintain supply air static pressure setpoint initially set for 0.75". Every 5 minutes, the system will check all the VAV damper positions and reset static pressure setpoint as follows: If all the VAV damper positions are below a setpoint of 90% open, then decrease the static pressure setpoint by 5% of the design range (initial range of 0.4" minimum and 0.75" maximum for an increment of 0.05"). Otherwise do not change setpoint. If any VAV damper is open greater than a setpoint of 98% then increase the static pressure setpoint by 5% of the design range. Static pressure setpoint shall never exceed the specified static setpoint.
- c. For DOAS-1, the exhaust fan variable frequency drive to maintain return/exhaust air static pressure setpoint initially set for -0.75". The exhaust air damper shall open (gravity style) when the fan is enabled. Refer to VAV Terminal Sequence for additional information. Every 5 minutes, the system will check all the VAV damper positions and reset static pressure setpoint as follows: If all the VAV damper positions are below a setpoint of 90% open, then decrease the static pressure setpoint by 5% of the design range (initial range of -0.4" minimum and -0.75" maximum for an increment of 0.05"). Otherwise do not change setpoint. If any VAV damper is open greater than a setpoint of 98% then increase the static pressure setpoint by 5% of the design range. Static pressure setpoint shall never exceed the specified static setpoint.
- d. For DOAS-2, the supply fan variable frequency drive shall modulate to maintain a constant supply airflow CFM as determined by the supply airflow station. Supply duct static pressure shall be monitored.
- e. For DOAS-2, the exhaust fan variable frequency drive to maintain a constant return/exhaust airflow CFM as determined by the exhaust airflow station. Exhaust duct static pressure shall be monitored.
- f. When enabled, minimum supply and exhaust fan speed shall not be allowed to fall below a setpoint of 10Hz or minimum speed as otherwise directed by the unit manufacturer.

- g. Outdoor air flow as determined by the supply airflow (as unit is 100% OA) shall be monitored.
- h. The energy reclaim wheel shall run continuously during occupied periods however, if outdoor air enthalpy is below return air enthalpy and cooling is required the wheel speed shall modulate to maintain supply air setpoint. Economizer shall be disabled if the OA dry bulb rises above a setpoint of 70F or the OA enthalpy rises above 26 BTU/lb. Once the wheel is fully stopped, the wheel bypass dampers shall open.
- i. Energy wheel speed shall modulate as frost protection for the wheel insuring that the minimum exhaust air temperature off the wheel does not fall below a setpoint as described below and reset as follows. The final accepted unit and wheel manuf. must be consulted to verify the below values are applicable for their wheel.

<u>RA Humidity</u>	<u>Defrost Enable Outdoor Air Temp</u>	<u>Vary Wheel to Wheel Exhaust Temp</u>
20% RH	-10 F	15 F
30% RH	0 F	20 F
40% RH	10 F	25 F

Pressure drop across wheel in excess of a predefined limit (confirm with factory) shall also indicate a potential frost condition and shall enable defrost mode.

- j. If wheel run indicator detects a loss of wheel rotation either due to loss of current or reduced current indicating belt loss an alarm shall be reported by the EMS.
- k. Main return air carbon dioxide levels shall be monitored and if levels exceed a maximum CO2 setpoint level of 800 ppm (adj.) or greater a low-level alarm shall be reported by the EMS.

4. Unoccupied Mode

- a. At the commencement of unoccupied mode the outdoor air dampers shall close and the recirculation damper shall open and fans shall cycle off. If required, the fans shall cycle on to maintain unoccupied space cooling and heating setpoints initially set for 88°F and 60°F respectively for DOAS-1 system. ON DOAS-2, unoccupied setpoints must be set at least 2F higher for cooling or lower for heating than the lowest space temperature setpoint of the associated VRF system.

5. Cooling/Dehumidification Control

- a. The total enthalpy of the return air and outdoor air streams shall be compared and, if advantageous, outdoor air economizer cycle shall be enabled either partially in conjunction with mechanical cooling or exclusively to maintain supply air temperature setpoint. Economizer shall be disabled if the OA dry bulb rises above a setpoint of 70F or the OA enthalpy rises above 26 BTU/lb. In economizer mode, the outdoor air and return air dampers shall modulate as a first stage to satisfy supply air setpoint unless unit is in 100% OA mode. The energy reclaim wheel shall run continuously during occupied periods however, if outdoor air enthalpy is below return air enthalpy and cooling is required the wheel speed shall modulate so as to allow the system to reach supply air setpoint as indicated above and herein. If the wheel is fully stopped the bypass dampers shall open to full bypass.

- b. If there is a call for space dehumidification as determined by the return air dewpoint or central space humidistat detecting a dewpoint above a setpoint of 55°F the DX compressor stages shall modulate (inverter compressor) to maintain a cooling coil temperature (as measured via refrigerant gas pressure sensor) setpoint of 45 degrees. If suction temp is not monitored than the leaving air temp. of the cooling coil shall be set to 53°F. Stages shall increase as the distance and time from setpoint increase with a minimum of 5-minute delay between compressor stages (not inverter modulation). Coordinate with delays built into condenser controller. Hot gas reheat shall be modulated as required to maintain supply air setpoint.
 - c. Hot Gas Reheat Valve (HGRV) Purge Cycle: When the hot gas reheat valve has not been open for at least 2 consecutive minutes within the last hour and a compressor is running in the reheat circuit, the hot gas reheat purge cycle shall be enabled and the HGRV shall be forced 100% open for an adjustable purge duration of 2 minutes. The purge cycle may occur once every 60 minutes (adj.).
 - d. For DOAS-1, when building hot water is not available, the supply air discharge setpoint shall be reset between 58°F and 75°F based on an average of the cooling demand from spaces. If more than 2 zones on the system are above cooling setpoint by greater than a setpoint of 3°F, the supply air reset schedule shall reset down towards the minimum overriding the average demand.
 - e. For DOAS-1, when building hot water is available, the supply air discharge setpoint shall be reset between 58°F and 70°F based on an average of the cooling demand from spaces. If more than 2 zones on the system are above cooling setpoint by greater than a setpoint of 3°F, the supply air reset schedule shall reset down towards the minimum overriding the average demand.
 - f. For DOAS-2, the supply air discharge setpoint shall be reset between 65°F and 75°F based on an average of the cooling demand from spaces.
 - g. Morning Cool-Down: For DOAS-1: If the average space temperature is above cooling setpoint and it is within 2-hours (adj.) of a scheduled occupied period the EMS shall calculate an optimized start-time to achieve space setpoint and enable the unit into morning cool-down mode. The supply air temperature shall be reset down to 58°F until the average space temperature reaches cooling setpoint or the return air temperature reaches 75°F whichever comes first at which time the unit shall drop out of morning cool-down mode and enter normal occupied operation at the schedule time. Unit shall also operate to ensure the space dewpoint drops below 54F before allowing associated chilled beam and sensible only chilled water coil valves from opening.
 - h. If airflow is not proven via a pressure sensor an adjustable differential pressure sensor across the DX coil, the compressors circuits shall be deactivated without regard for minimum compressor run times (coordinate with compressor controller).
6. Heating Control
- a. The units heat pump compressors shall modulate heat pump heating as first stage followed by electric resistance heat if required to maintain the supply air reset schedule as identified in the cooling sequence initially 58°F to 75°F for DOAS-1 and 65°F to 75°F for DOAS-2. Electric heat shall be disabled if DX cooling or dehumidification mode is operational. EMS shall monitor units defrost cycle via

BACnet interface and when unit is in defrost mode, the electric heat shall become the 1st stage heat to maintain supply air reset setpoint. If outdoor air temperatures are below a setpoint of 10°F or if the supply air volume is below the minimum allowed for heat pump operation (verify with heat pump manuf.) the heat pump cycle shall be disabled and the gas furnace shall become primary heat. Heat pump as primary heat shall be reenabled when OA temperatures rise above 15F.

- b. During morning warm-up or cool down the supply air reset schedule shall be overridden and the heat pump compressors as first stage followed by gas furnace shall modulate to satisfy the reset schedule indicated herein.
- c. Morning Warm-up: For DOAS-1, if the average space temperature is below heating setpoint and it is within 2-hours (adj.) of a scheduled occupied period the units the EMS shall calculate an optimized start-time to achieve space setpoint and enable the unit into morning warm-up mode. The supply air temperature shall be reset up 80°F until the average space temperature reaches heating setpoint or the return air temperature reaches 70°F whichever comes first at which time the unit shall drop out of morning warm-up mode and enter normal occupied operation at the schedule time
- d. During morning warm-up or anytime heat is needed when outdoor air temperatures are above a setpoint of 15°F, the RTU heat pump cycle shall be the first stage of heat followed by the electric heater.

7. System Safeties & Misc.:

- a. While the unit is operating, if the system discharge air temperature drops below 40°F for longer than 30 seconds, the ATC shall report a freeze condition to the EMS and the following shall occur:
Disable unit including supply air and exhaust air fans.
Close the outdoor and exhaust air dampers and open the return air damper.
Disable DX and electric heat sections
Report a high level alarm
- b. Normal damper positions are as follows:
O.A. damper – normally closed
R.A. damper – normally open
E.A. damper – normally closed (barometric gravity type)
- c. Smoke Alarm – Upon a smoke detector activation or if any smoke damper in the system is in a position other than fully open, the unit and fans shall shutdown and the dampers shall go to their normal position (i.e. O.A.-Closed). An alarm shall be reported to the EMS system and the building fire alarm system.
- d. If the any of the VRF FC units detects a refrigerant alarm, the respective DOAS unit and VAV terminal (as applicable) shall be commanded on to occupied mode and an alarm shall be reported by EMS. Alarm mode shall be manually reset at the front-end.
- e. The factory condensing unit controller shall perform hot gas reheat coil flush cycles as needed to insure no refrigerant oil is tied up in the coils.

- f. Coordinate with factory for minimum on & off times, time delays and such for compressors.

8. DDC Point List – DOAS-1 & DOAS-2

- a. Refer to the plans and these sequences of operation and provide all points required and inferred to make for a fully functional and operation system. Being that the units shall have BacNet communication, many points may be extracted from the interface however this contractor must provide any points and all points needed to achieve the operation and monitoring level specified. As a minimum the following points being monitored and controlled for each unit:

<u>Inputs</u>	<u>Outputs</u>
Filter Diff. Pressure AI (2)	Unit enable/disable DO
Exhaust duct static AI	Supply fan S/S DO
Freezestat AI	Exhaust fan S/S DO
Mixed air temp. AI	Supply fan VFD AO
Supply duct static AI	O.A. damper AO
Supply fan status	Return Air damper AO
amp. AI	Supply Air setpoint AO
Exhaust fan status/	Exhaust Fan VFD AO
amp. AI	Wheel Bypass Dampers DO (2)
Duct Smoke Det. DI (mult)	Supply duct static setpoint AO
Discharge air temperature AI	Exhaust duct static setpoint AO
R.A. temperature AI	Wheel Enable and Speed DO & AO
DX Coil Press./Temp AI (mult)	Duct Smoke Damper DO (mult) coord. with EC
R.A. humidity AI	Bacnet Interface
R.A. CO2 AI	
Space CO2 AI (multiple)	
Wheel discharge air temp AI	
Wheel rotation DI	
Wheel Pressure Drop AI	
Supply Duct Static Pressure AI	
Return/Exhaust Duct Static Pressure AI	
Low Limit Duct Static Pressure AI	
High Limit Duct Static DI	
Wheel Supply Leaving Temp AI	
DX Coil Air DP AI	
Duct Smoke Damper DI (mult)	
Outdoor air volume (monitoring)	
Supply Air Volume AI	
Exhaust Air Volume AI	
Factory Discharge Air sensor	
Factory OA Temp sensor AI	
O.A. temperature AI (global) also integral to unit	
O.A. humidity AI (global) also integral to unit	
Bacnet Interface	
VRF Refrigerant alarm DI	

N. SEQUENCE OF OPERATION FOR VARIABLE REFRIGERANT FLOW ZONING SYSTEM - VRF (ACHP-1, ACHP-2 & FC-#):

1. The fan coil zones shall cycle their fans and heat pump unit for cooling or heating as required to maintain scheduled space temperature setpoint initially set for 70°F occupied & 62°F unoccupied for heating and 75°F occupied and 82°F unoccupied for cooling. If the areas are in a scheduled occupied period the fan coil shall operate continuously, and a signal shall be sent to the respective DOAS-1 or DOAS-2 to enable (see DOAS-1 & 2 sequence herein).
2. Upon start of an occupied period the fan coil fan shall operate on medium speed when room conditions have met setpoint and shall speed up as needed when space demand requires either cooling or heating. For ducted FC units the fan shall operate at the design supply CFM.
3. For FC-1 (Surgery) system, the SF-1 fan shall operate during all scheduled occupied periods or whenever the FC-1 fan is on such as to support a call for room heating or cooling. If the room is unoccupied, based on room occupancy sensor, for longer than 10 minutes, the VAV terminal serving the space shall be commanded closed. Once room occupancy sensor detects occupancy the VAV terminal shall open to design CFM (see VAV SOO).
4. For FC-2 (Dental), the fan shall operate at full design CFM during all scheduled occupied periods or whenever the FC-1 fan is on such as to support a call for room heating or cooling. If the room is unoccupied, based on room occupancy sensor, for longer than 10 minutes, the VAV terminal serving the space shall be commanded closed. Once room occupancy sensor detects occupancy the VAV terminal shall open to design CFM (see VAV SOO).
5. If a fan coil unit with integral condensate drain pump detects an overflow condition in the condensate pump well, the fan coil cooling cycle shall be disabled and an alarm shall be reported by the VRF controller iTouch panel.
6. The VRF controller shall enable branch selector valves and control respective exterior heat pump condensers as required. Upon activation of the FC unit refrigerant alarm, the respective branch isolation valve shall close and the fan FC fan shall operate at full airflow and an alarm shall be reported by the VRF system and the EMS (see DOAS for occupied override initiation).
7. The VRF iTouch controller shall monitor status and space temperatures and establish schedule and control of the system. System shall also BACNet interface to the DOAS factory controllers.
8. DDC Point List VRF Heat Pumps:
As a minimum the following points shall be monitored and controlled for each VRF fan coil heat pump system

Inputs

Space Temperature AI
Occupancy Sensors DI (multiple)
SF-1 Fan Status AI
SF-1 Filter DP AI

Outputs

Controls part of VRF package
SF-1 Fan start/stop DO

Refrigerant Alarm DI
VRF BACnet interface

O. SEQUENCE OF OPERATION - ELECTRIC CABINET HEATERS

1. For Electric Cabinet Heaters: Integral adjustable thermostat shall enable and disable heaters and fan to maintain space temperature setpoint initially set for 60°F for utility and entry vestibule areas. For lounges and normally occupied areas, the EMS shall enable and disable units to maintain space setpoints initially set for 60°F during unoccupied periods and 70°F during occupied periods. ECH heating setpoint shall be set at least 1°F below VRF heating setpoint to ensure VRF heat pump is first stage of heat for space.
2. DDC Point List Electric Cabinet Heaters:
As a minimum the following points shall be monitored and controlled for each electric cabinet heater:

Inputs

Space Temperature – AI
Space temp. adj AI
Push button override DI

Outputs

Heater Enable/Disable DO

P. SEQUENCE OF OPERATION DUCTLESS SPLIT UNIT, HP-1 & FC-17

1. The thermostat upon sensing a change in space temperature from setpoint shall stage cooling or heating to maintain setpoint. Indoor fan shall cycle with cooling demand as required. Initially setpoints shall be 70°F for heating and 75°F for cooling.
2. If condensate auxiliary switch goes into alarm, the unit shall be disabled and an alarm shall be reported at the VRF controller.
3. DDC Point List Ductless Split AC
:
As a minimum the following points shall be monitored and controlled for each electric cabinet heater:

Inputs

Space Temperature – AI
Condensate Alarm - DI

Outputs

Factory controller

Q. SEQUENCE OF OPERATION – VAV & EVAV TERMINALS:

- a. General: The VAV units provide tempered dehumidified ventilation air to the respective building areas.
- b. During scheduled occupied periods, dampers shall modulate open to their design maximum CFM as required to maintain space design outdoor airflow for all other areas (animal related and such).

- c. Exhaust VAV boxes shall operate in unison with their respective VAV's to match the supply air VAV airflow equal to the supply airflow subject to offsets where shown on the plans.
- d. Hot water coil valves on boxes with such shall modulate to prevent overcooling of the serviced areas and maintain space heating setpoint.
- e. If hot water plant is not active, the VAV dampers shall be temporarily allowed to reduce to no less than 50% of design maximum air to limit space overcooling below space heating setpoint.
- f. During morning warm-up all VAV boxes shall go to their maximum design airflow position to allow warm air to bring the space up to occupied heating setpoint (initially 70 deg. F.). If respective space is at heating setpoint while in morning warm-up mode the VAV box shall close to its minimum position.
- g. During morning cool down all VAV boxes shall go to their maximum design airflow position to allow cool air to bring the space down to occupied cooling setpoint (initially 75 deg. F.). If respective space is at cooling setpoint while in morning warm-up mode the VAV box shall close to its minimum position. For exhaust VAV's serving the animal related areas, Janitors closet, etc... the VAV shall open to schedule maximum airflow during all occupied periods.
- h. For FC-1 (Surgery) and FC-2 (Dental), if the room is unoccupied, based on room occupancy sensor, for longer than 10 minutes, the VAV terminal serving the space shall be commanded closed. Once room occupancy sensor detects occupancy, the VAV damper shall go to its design maximum position.
- i. If any FC unit goes into refrigerant alarm, the respective DOAS unit and VAV terminal (as applicable) shall be commanded on to 100% ventilation mode and an alarm shall be reported by EMS.
- j. Points List
 - a. As a minimum, the following points will be monitored and controlled for each VAV Unit. See also points indicated on drawings:

Inputs

Velocity Sensor AI
Space temp. AI
Space temp. adj AI
Push button override DI
Supply Temp AI
Space CO2 AI
Room Occupancy Sensors DI (multiple)
Refrigerant Alarm (from VRF)

Outputs

Damper AO
Hot water Coil AO

R. SEQUENCE OF OPERATION – GENERAL EXHAUST FANS

- 1. Local bathroom exhaust fans (CEX) shall be controlled via integral fan mounted occupancy sensors.

2. For all fans (excluding CEX fans), the EMS shall monitor the fans and report and alarm condition when the fan is commanded on and the electrical current status from the fan drops below setpoint or when the DP across the fan(s) detects a failed condition
3. For exhaust fans (ILF-#) serving the welding area, a local switch with green "ON" pilot light located in the area shall enable the two (2) fume extraction fans and associated HV unit to operate per the existing sequence of operation in place. Switch shall have an engraved laminated nameplate placed above it which indicates "Welding Fume Exhaust". When the switch is placed in the on position, the exhaust air dampers shall open and the fans shall be enabled along with the HV unit serving the space.
4. Existing exhaust fans shown as serving heat producing non occupied rooms shall cycle and open respective exhaust dampers, as applicable, to maintain a cooling setpoint, initially 85°F. Coordinate with E.C. for fans controlled by line voltage thermostats where scheduled.
5. For fans scheduled with ECM motors or variable speed drives reflected on the control drawings with a VFD, the EMS shall send a 0 to 10 VDC signal to start and stop the fan and modulate its speed. For fans scheduled with ECM motors reflected on the control drawings with a HS or HOA, the EMS shall send a 0 to 10 VDC signal to start and stop the fan and the final running control voltage signal shall be coordinated with the balancer. For fans scheduled with ECM motors reflected on the control drawings with a HS or HOA and also scheduled to have a potentiometer dial, the EMS shall send a start and stop signal to the fan.
6. DDC Point List – General Exhaust Fans

As a minimum the following points shall be monitored and controlled for each fan:

Inputs

Space Temperature – AI
Run Indicator AI
Fan DP – DI (adj.)
Fan On Switch DI

Outputs

Start/Stop - DO
Damper – DO
Green Pilot Light DO

ECM HS/HOA (no potentiometer) Start/Stop AO
ECM HS/HOA (with potentiometer) Start/Stop DO

S. SEQUENCE OF OPERATION – SYSTEM OCCUPIED OVERRIDE

1. A master system occupied override switch shall be provided in the Reception area with increments of 2 hours, 4 hours, 6 hours and 8-hours. When depressed the entire suite HVAC systems shall be placed in a temporary occupied mode condition for the defined time period regardless of scheduled time period.
2. DDC Point List – System Occupied

As a minimum the following points shall be monitored and controlled for each fan:

Inputs

Timer – DI

Outputs

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of heating, ventilating and air conditioning system will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Install equipment ductwork, piping and controls where shown with recognized industry standards and practices, to ensure that installation complies with requirements and serves intended purposes.
- B. Coordinate with other work as necessary to interface installation of ductwork, piping and equipment with other components of systems.
- C. Installation of Ductwork
1. Installation of ductwork shall be coordinated with other work as necessary to interface installation or ductwork with other components of systems. Duct sizes shown on the drawings at connection to fans or other equipment may vary in actual installation. Contractor shall provide transition pieces as required. Ducts, casings and hangers shall be installed straight and level and shall be free of vibration and noise when fans are operating. All ducts shall be protected and sealed during construction to prevent moisture and dust entry. After installation duct segments and systems shall be pressure tested per SMACNA standards.
 2. Provide fire safing to close all floor and wall (where fire rated) openings around ductwork - pack annular space with rockwool and 18 gauge sheet metal safing.
 3. Seal the ductwork at joists and seams with water based duct sealer DuctMate® EZ-Seal or approved equal.
 4. When ductwork penetrates an insulated joist bay in the attic area, maintain insulation integrity. Support ductwork to prevent movement and secure insulation and fill all gaps.
 5. 1/8" thick galvanized steel angle irons shall be used to support ductwork mounted on the roof. Angles shall be securely fastened to the ductwork and the roof before installation of the roofing membrane. Roofer shall flash in angle supports.
 6. This contractor is responsible for sleeving all duct penetrations before pouring of slab. If additional holes are required this contractor shall have pay for the coring of such holes in coordination with the general contractor and with prior consent of the Architect.
 7. Fabrication, installation, sealing, protecting and testing of all ductwork and duct liner shall comply with the most recent publications from the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) including but not limited to the following. All smoke control ductwork must be pressure tested as well as all other ductwork required by code and/or otherwise required by SMACNA standards described herein:
 - SMACNA IAQ Guidelines for Occupied Buildings under Construction with special emphasis placed on the section regarding Duct Cleanliness and Protection for New Construction.
 - SMACNA Duct Cleanliness for New Construction Guideline.
 - This project must comply with SMACNA Duct Cleanliness Guidelines Advanced Level.
 - SMACNA HVAC Duct Construction Standards – Metal and Flexible

- SMACNA Air Duct Leakage Test Manual

8. Duct pressure tests shall take place after all takeoffs and wall penetrations are in place and before applying exterior insulation. Correct any leaks found. Pressure test all high-pressure ductwork and 25% of all medium and low pressure ductwork on the project at 100% of its duct construction class pressure in accordance with SMACNA standards.
9. Duct leakage testing shall be per SMACNA HVAC Air Duct Leakage Test Manual. Provide orifice assembly including straightening vanes, orifice plate mounted in straight tube with properly located pressure taps, and U-tube manometer or other device as specified by SMACNA. Submit leak test report in SMACNA format along with ductwork drawings for designer review.
10. All ductwork shall be shipped to the site with protective film on all open connections to prevent dust from entering. Film shall be reapplied to all open ends as the duct is installed until such time as building is clean and system is ready for start-up

D. Installation of Piping

1. Contractor shall examine location where the piping is to be installed and determine space conditions. Provide and erect in a workmanlike manner, according to the best practices of the trade, all piping shown on the Drawings or required to complete the installation intended by these Specifications.
2. All drain piping from condensate drain pans shall be properly trapped in accordance with the static pressures involved. Condensate drain piping sizes shall be not less than 3/4 inch.
3. This contractor is responsible for coring of all holes related to his/her work in coordination with the general contractor and with prior consent of the Architect.
4. Provide fire safing to seal all floor and wall (where fire rated) openings around piping.
5. Provide 24 hour duration pressure test for all piping systems. Test pipes with clear water (propylene glycol mix if freezing could occur) at 1.5 times the system design pressure unless a more stringent or lengthy test is required by the local AHJ or under other Divisions. Any products or materials not rated for this pressure or the relief pressure must be isolated from the test. Provide a temporary 100 psi relief device on the tested system(s) to avoid damage due to thermal expansion during the test. Record ambient and system water pressure and temperature at start and end of test and report to Engineer. Inspect piping for leaks and if any are found repair and repeat test.
6. All systems shall be thoroughly flush with clear water and then filled with clear water and circulated for a period no less than 8 hours. Drain water, clean all strainers and then refill the hot water system with clean water and chemically treat.

E. Installation of Equipment

1. Contractor shall examine location where equipment is to be installed and determine space conditions and notify Architect, in writing, of conditions detrimental to proper and timely completion of work.
2. Install equipment where shown in accordance with manufacturer's written instructions.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of installation of the automatic temperature control system and after motors have been energized with normal power source, test system to demonstrate compliance with requirements. When possible, field correct malfunctioning controls then retest to demonstrate compliance. Replace controls, which cannot be satisfactorily corrected. Refer to Section - Test and Balancing. Fully coordinate all testing with the commissioning agent. In addition, to the commissioning agents reports, the balancing contractor (TAB) and the controls contractor shall submit written reports of testing procedures and findings.

3.04 SERVICE

1. After completion of the control system installation, the controls contractor shall regulate and adjust all thermostats, control valves, damper motors, etc., and place in complete operating condition, subject to the approval of the Owner. Complete instructions shall be given to the operating personnel. There shall be 40 hours of instruction given on the operation of the entire system at a training schedule determined by the Owner.

2. Start-Up and Commissioning

For all rooftop DOAS units and VRF systems provide factory service/start-up technician to check, test and start equipment. Technician shall coordinate mapping of all control points with EMS contractor and commissioning of unit. Technician shall work with project commissioning agent to verify proper operation of unit. In coordination with the mechanical contractor and control contractor the factory technician shall provide Owner training of unit controls, maintenance, etc...

3.05 TESTING, ADJUSTING AND BALANCING (TAB)

A. General

1. Section Includes
 - a. Testing, adjusting, and balancing of Air Systems.
 - b. Testing, adjusting, and balancing of Hydronic Systems.
 - c. Measurement of final operating conditions of HVAC Systems.
2. Related Documents
 - a. Drawings and General Provisions of Contract, including General and Supplementary Conditions, apply to work of this section.
3. References
 - a. ASHRAE - Standard 111 - 1988 Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air Conditioning, and Refrigeration Systems.
 - b. ASHRAE - 2007 HVAC Applications Handbook: Chapter 37, Testing, Adjusting and Balancing.
 - c. AABC- National Standards for Total System Balance.
 - d. NEBB - Procedural Standards for Testing, Balancing and Adjusting of Environmental System.
 - e. SMACNA - HVAC System Testing, Adjusting and Balancing.

- f. Sheet Metal Industry - Certification of Testing, Adjusting and Balancing Technicians.
- 4. Quality Assurance
 - a. Agency shall be a firm specializing in the adjusting and balancing of systems specified in this Section with minimum three years documented experience, acceptable to the Designer.
 - b. Perform the work under the supervision of one of the following:
 - 1) AABC Certified Test and Balancing Engineer.
 - 2) NEBB Certified Testing, Balancing, and Adjusting Supervisor.
 - 3) TABIC Certified Contractor.
 - c. Work shall be performed only by a Balancing Sub-Sub Contractor which employs Certified Testing, Adjusting and balancing Technicians as listed by the Sheet Metal Industry National Certification Board for TAB Technicians.
 - d. The work must be performed by a Certified Testing, Adjusting and Balancing Technician who may be assisted by other TAB Technicians. The Certified Testing, Adjusting and Balancing Technician is responsible for :
 - 1) Procedures to follow.
 - 2) Accuracy of all testing.
 - 3) Integrity of recorded data
 - 4) Entering all data and any abnormal or notable conditions in report forms.
 - 5) Initialing and dating each sheet.
 - e. The General Section of the Balance Report shall include the names, signatures, and registration numbers of the Technicians who were assigned to the project.
- 5. Submittals
 - a. Submit name of the Balancing Sub-Sub Contractor for approval within 30 days after award of contract.
 - b. Submit for review, prior to commencement of work, a list of equipment and procedures to be used in balancing the systems.
 - c. Submit reports of preconstruction plan check and periodic mechanical construction review.
 - d. Submit draft copies of report for review prior to final acceptance of project. Provide final copies to the Designer and for inclusion in operating and maintenance manuals.
- 6. Procedures, General
 - a. All Air and Hydronic Systems shall be balanced using a procedure which results in minimum restrictions being imposed.
 - 1) At Completion of balancing:
 - a) At least one damper for an outlet/inlet shall be fully open on every branch duct.
 - b) At least one branch duct balancing damper shall be fully open on every trunk duct.
 - c) At least on trunk (zone) balancing damper shall be fully open in each Air System.
 - d) Supply/exhaust fan RPM shall be set so the static pressure at the terminal which is most difficult to supply/exhaust is adequate, but not excessive.
 - e) At least one hydronic terminal unit balancing valve in each piping branch shall be fully open.
 - f) At least one branch line balancing valve in each Hydronic System shall be fully open.

7. Final Reports
 - a. Submit reports on previously approved Test Data Forms
 - b. Forms shall include the following information:
 - 1) Title Page:
 - a) Company name
 - b) Company address
 - c) Company telephone number
 - d) Name, signature, and registration number of each technician
 - e) Project name
 - f) Project location
 - g) Project Architect
 - h) Project Engineer
 - i) Project Contractor
 - j) Project altitude
 - k) Date of report
 - 2) Instrument List:
 - a) Instrument
 - b) Manufacturer
 - c) Model
 - d) Serial number
 - e) Range
 - f) Calibration date
 - 3) Air Moving Equipment
 - a) Designation
 - b) Location
 - c) Manufacturer
 - d) Model
 - e) Airflow, specified and actual
 - f) Return airflow, specified and actual
 - g) Outside airflow, specified and actual
 - h) Total static pressure (total external), specified and actual
 - i) Inlet pressure
 - j) Discharge pressure
 - k. Fan RPM
 - 4) Return\ Exhaust Fan Data:
 - a) Designation
 - b) Location
 - c) Manufacturer
 - d) Model
 - e) Airflow, specified and actual
 - f) Total static pressure (total external), specified and actual
 - g) Inlet pressure
 - h) Discharge pressure
 - i) Fan RPM, initial and final
 - 5) Electric Motor:
 - a) Manufacturer
 - b) HP
 - c) Frame
 - d) Phase, voltage, amperage; nameplate and actual
 - e) RPM
 - f) Service factor
 - g) Starter size, rating, heater elements

- 6) V-Belt Drive:
 - a) Identification
 - b) Driven sheave, diameter
 - c) Belt, size and quantity
 - d) Motor sheave, diameter
 - e) Center to center distance, maximum, minimum, and actual
 - f) Final components
- 7) Duct Traverse:
 - a) System zone/branch
 - b) Duct size
 - c) Area
 - d) Design velocity
 - e) Design airflow
 - f) Test velocity
 - g) Test airflow
 - h) Duct static pressure
 - i) Air temperature
 - j) Air correction factor
- 8) Air Monitoring Station Data:
 - a) Identification/location
 - b) System
 - c) Size
 - d) Area
 - e) Design velocity
 - f) Design airflow
 - g) Test velocity
 - h) Test airflow
- 9) Air Distribution Test sheet:
 - a) Air terminal number
 - b) Room number/location
 - c) Terminal type
 - d) Terminal Size
 - e) Area factor
 - f) Design velocity
 - g) Design airflow
 - h) Test velocity, initial and final
 - i) Test airflow, final
 - j) Percent of design airflow, initial and final
- 10) Cooling Coil Data:
 - a) Designation
 - b) Location
 - c) Service
 - d) Manufacturer
 - e) Size, face area, and fins/inch
 - f) Airflow, design and actual
 - g) Entering Air DB temperature, design and actual
 - h) Entering air WB temperature, design and actual
 - i) Leaving air DB temperature, design and actual
 - j) Leaving air DB temperature, design and actual
 - k) Air pressure drop, design and actual
- 11) Heating Coil Data:
 - a) Designation
 - b) Location

- c) Service
 - d) Manufacturer
 - e) Size, face area, and fins/inch
 - f) Airflow, design and actual
 - g) Water flow, design and actual
 - h) Water pressure drop, design and actual
 - i) Entering water temperature, design and actual
 - j) Leaving water temperature, design and actual
 - k) Entering air temperature, design and actual
 - l) Leaving air temperature, design and actual
 - m) Air pressure drop, design and actual.
 - c. Report is to include a listing of any abnormal or notable conditions not contained in the above.
 - d. Provide four copies of reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
8. HVAC Sub-Contractor Responsibilities
- a. Prepare each system for testing and balancing
 - b. Cooperate with Balancing Sub-Sub Contractor, provide access to equipment and systems. Operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.
 - c. Notify Balancing Sub-Sub Contractor seven days prior to time system will be ready for testing, adjusting, and balancing.
 - d. Where fans (air handling units, supply fans, return fans, exhaust fans, etc.) are provided with variable pitch sheaves, HVAC Sub-Contractor shall adjust sheaves, as required, at no additional cost to the Owner, until desired Design Points (CFM and/or Static Pressure) are reached. If adjustment of the variable pitch sheaves is beyond the range of the sheaves, HVAC Sub-Contractor shall replace sheaves, as required, at no additional cost to the Owner, until the desired Design Points (CFM and/or Static Pressure) are reached. Where fans (air handling, supply, return, exhaust, etc.) are specified with fixed ratio sheaves, HVAC Sub-Contractor shall replace sheaves with new sheaves, at no additional cost to the Owner until desired Design Points (CFM and/or Static Pressure) are reached.
9. Sequencing and Scheduling
- a. Sequencing work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.
10. Drawing and Construction Review
- a. Perform a pre-construction review of the following documents:
 - 1) Contract drawings.
 - 2) Contract specifications.
 - 3) Addenda.
 - 4) Submittal data.
 - 5) Shop drawings.
 - 6) Automatic Control drawings.
 - b. Prepare a report of the preconstruction review list of recommended changes to allow most effective balancing.
 - c. Perform two construction reviews of the mechanical installation during the progress of the project. Purpose of the reviews to be:
 - 1) Identify potential problems for performing balancing.

- 2) Identify modifications which will aid balancing.
- 3) Schedule and coordinate balancing with other work.
- d. Prepare a report of each construction review.

11. Equipment

- a. Provide all necessary tools, scaffolding and ladders.
- b. Provide all necessary instruments. Instruments shall be used and applied which are best suited to the system function being tested. Instruments shall be in first class state of repair and have been calibrated within a period of six months prior to starting the job. Calibration history of each instrument shall be available for examination. Instruments shall be re-calibrated upon completion of the job if required by the Designer to prove reliability.

12. Examination

- a. Before commencing work, verify that systems are complete and operable. Ensure the following:
 - 1) Equipment is operable and in safe and normal condition.
 - 2) Temperature control systems are installed complete and operable.
 - 3) Proper thermal overload protection is in place for electrical equipment.
 - 4) Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5) Duct systems are clean of debris.
 - 6) Correct fan rotation.
 - 7) Fire and volume dampers are in place and open.
 - 8) Coil fins have been cleaned and combed.
 - 9) Access doors are closed and duct end caps are in place.
 - 10) Air outlets are installed and connected.
 - 11) Duct system leakage has been minimized.
 - 12) Proper strainer baskets are clean and in place.
 - 13) Correct pump rotation.
 - 14) Hydronic systems have been flushed, filled, and vented.
 - 15) Service and balance valves are open.
- b. Report to the Designer any defects or deficiencies noted during performance of services.
- c. Promptly report abnormal conditions in mechanical systems or conditions which prevent system balance.
- d. If, for design reasons, system cannot be properly balanced, report as observed.
- e. Beginning of work means acceptance of existing conditions.

13. Preparation

- a. Provide instruments required for testing adjusting and balancing operations. Make instruments available to the Designer to facilitate spot checks during testing.

14. Installation Tolerances

- a. Adjust Air Handling Systems to the following tolerances:
 - 1) Supply systems shall be balanced so that:
 - a) The total quantity to each space is within -5% to +10% of design values.
 - b) If two outlets in space, each outlet is within -10% to +10% of design value.
 - c) If three or more outlets in space, each outlet is within -15% to +15% of design value.

- 2) Exhaust and return systems shall be balanced so the total quantity from each space is -10% to +10% of design values.
 - b. Adjust Hydronic Systems to the following tolerances:
 - 1) Heating System:
 - a) Supply water temperature above 160°F: -10% to +10% of design value.
15. Adjusting
 - a. Recorded data shall represent actually measured or observed condition.
 - b. Permanently marked settings of valves, dampers, and other adjustment devices, allowing settings to be restored. Set and lock memory stops.
 - c. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
 - d. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
16. Air System Procedure
 - a. Measure and balance air quantities at air inlets and outlets.
 - b. Adjust Air Handling and Distribution Systems to provide design supply, return and exhaust air quantities at site altitude.
 - c. Make air quantity measurements in ducts by pitot tube traverse of entire cross sectional area duct.
 - d. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
 - e. Effect volume control at outlets by use of dampers installed in the ductwork. Do not use volume dampers that are integral with the outlets.
 - f. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
 - g. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
 - h. Measure temperature conditions across outside air, return air, and exhaust air dampers to check leakage.
 - i. Where modulating dampers are provided, take measurements and balance at extreme conditions. Set variable volume terminals at maximum airflow rate, full cooling with design diversity; read volumes at minimum airflow rate and full heating.
 - j. Measure building static pressure and adjustable supply, return and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.
17. Water System Procedure
 - a. Adjust water systems to provide design quantities.
 - b. Use calibrated flow meters and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
 - c. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
 - d. Effect system balance with automatic control valves fully open to heat transfer elements.

- e. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- 18. Field Verification
 - a. The Designer may request verification of the data contained in the Balancing Report. If so, the TAB Technician who originally initialed the data sheets shall read outlets selected at random by the Designer who will compare the values with those in the report.
 - b. It is understood that the verification process shall take place within one week after delivery of the report. The operating mode of the system shall be the same for verification as it was during the balancing procedure.
 - c. The number of readings to be verified shall not exceed 10% of the total contained in the report.
 - d. If the field verification is not satisfactory, the firm doing the TAB work shall completely rebalance the system and a new report shall be prepared. The Designer may notify the Sheet Metal Industry Certification Board for TAB Technicians so that appropriate action can be taken.
- B. It shall be division 23.00.00 responsibility to provide all personnel as required to fully coordinate with the commissioning agent as applicable. The hours of training and instruction outlined in division 23.00.00 and the Testing and Balancing requirements shall be in addition to those tests and requirements outlined in the commissioning section as applicable.
- C. Certified Reports
 - 1. For the reports required to be submitted within this section, provide certification by an independent balancing and testing contractor who is versed in the field of air balancing and who is not affiliated with any firm involved in the design or construction phases of this work.
 - 2. Identify in the reports each item not complying with the Contract requirements, or obvious misoperation or design deficiencies of equipment or controls.
- D. Additional Commissioning Coordination & Requirements
 - 1. The Testing, Adjusting, & Balancing (TAB) Balancing Contractor shall submit their TAB procedures as part of the SUBMITTAL criteria in Division 1 of this specification. Integral with this submittal shall be the TAB strategy/plan for water system, which shall include the following
 - a. Furnish one-line, schematic system drawings for the Commissioning Agent review of the Hot Water Piping System.
 - 2. Each hydronic system drawing will be 1-line schematic representation of the system to be they are installed, indicating all coils, balancing valves, strainers, automatic control valves, pressure regulating valves, meters, etc.
 - 3. Each hydronic system flow diagram shall indicate all pressure drops (design conditions and actual conditions) of each component, as well as associated flows and temperatures (design and actual).
 - 4. Furnish one-line, schematic system drawings for the Commissioning Agent review of the Duct System for the follows:

- a. Central HVAC system(s)
- b. General exhaust system(s)
- 5. Each air system drawing will be 1-line schematic representation of the system to be they are installed, indicating all louvers, dampers, filters, coils, fans, dampers, balancing valves, volume terminal devices, etc.
- 6. Each air system flow diagram shall indicate all pressure drops (design conditions and actual conditions) of each component, as well as associated flows, velocity, and temperatures (design and actual)

3.06 LABELING

- A. Provide pipe markers of either pressure sensitive tape or laminated plastic, color coded and indicating the type and direction of flow of the piping service. Duct labels shall be stenciled and painted on the ductwork. All new refrigerant piping, heating supply and return water and condensate drain piping throughout the building shall be labeled. All supply, return and exhaust ductwork mains shall be labeled with flow direction, service and associated air moving unit. Ducts and piping excluded from the labeling requirement are any of the following: 1) Ducts exposed within finished spaces, 2) branch ducts serving individual diffuser, register or grille. Labels shall be at the inlet and outlet to each piece of equipment, at the entrance and exit of each room and at intervals along the duct and pipe of a minimum of every 20 feet.
- B. All equipment, starters and VFD's shall be labeled with engraved laminated nametags.
- C. 1-1/2" Brass valve tags with recessed stamped black lettering indicating service and valve number shall be provided at every shut-off, bypass and control valve in the building. Shut-off valves at individual VAV's, cabinet heaters and baseboard heaters located within 5 feet of the serviced terminal need not be tagged. A typed valve chart shall be made and inserted in each copy of the operation and maintenance. In addition the valve chart shall be mounted in a glass frame affixed to a wall in the boiler room. Chart shall show valve number, valve type and valve service. Directions for system seasonal drain down or isolation of components shall be included on this chart.

3.07 PAINTING

- A. Equipment installed under this Section shall have shop coat of factory applied non-lead paint, unless otherwise specified. Touch-up any scratches with matching paint. Hangers and supports shall have one coat of non-lead primer.

3.08 SPARE STOCK

A. Air Filters:

It is the intent of this specification that all equipment requiring or specified with air filters be furnished with four (4) spare sets of filters for each piece of equipment in addition to those supplied with the unit. Presuming the unit has not been operated during construction (operation during construction only allowed with written approval from Architect) the set of filters initially installed in the unit shall be utilized during testing and balancing. After testing,

a new set of air filters shall be installed leaving the Owner with three (3) full spare sets. All filters shall have minimum efficiency of MERV 13.

B. Belts:

It is the intent of this specification that all equipment requiring or specified with belt drives (i.e. fans, energy recovery wheels in DOAS units, etc...) be furnished with two (2) spare sets of belts for each piece of equipment in addition to those supplied with the unit.

C. Consumables and Other Spare Stock:

Any items considered consumable or required for routine maintenance and service replacement within the first 12 months of an equipment's operation shall be supplied of adequate quantity to operate the equipment for a period of 18 months. This shall include items required for routine maintenance/replacement in equipment with the first 18 months of operation.

END OF SECTION 23 00 00

Section 26 00 01
ELECTRICAL
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 TIME, MANNER AND REQUIREMENTS FOR SUBMITTING FILED SUB-BID CONTRACT BIDS:

- A. The work of this section is work of a Publicly Bid Filed sub-bid Contractor and includes the following requirements.

1. Specification requirements for the Filed sub-bid Contract "Electrical include all the following listed Specification Sections, in their entirety:

a.	26 00 01	Electrical
b.	26 05 00	Common Work Results for Electrical
c.	26 05 19	Electrical Power Conductors and Cables
d.	26 05 26	Grounding and Bonding for Electrical Systems
e.	26 05 29	Hangers and Supports for Electrical Systems
f.	26 05 33	Raceway and Boxes for Electrical Systems
g.	26 05 48	Vibration and Seismic Controls for Electrical Systems
h.	26 05 53	Identification for Electrical Systems
i.	26 05 73	Overcurrent Protective Device Coordination Study
j.	26 09 43	Network Lighting Controls
k.	26 24 16	Panelboards
l.	26 24 19	Motor Controls
m.	26 27 26	Wiring Devices
n.	26 28 13	Fuses
o.	26 28 16	Enclosed Switches and Circuit Breakers
p.	26 51 00	Interior Lighting
q.	27 05 00	Common Work Results for Communications
r.	27 10 00	Structured Cabling
s.	27 17 20	Testing Category 6A Twist Pair Infrastructure
t.	28 10 00	Unified Security System
u.	28 31 11	Addressable Fire-Alarm System

- B. Filed sub-bid contract bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the City of Worcester Purchasing Division, City Hall, 455 Main Street, Worcester, MA 01608 at the time and place stipulated in the "Invitation to Bid/Notice to Contractors." Along with the time of the bid opening, the following shall appear on the upper left hand of the envelope:

Name of Filed Sub-Bidder: Print Name of Filed Sub-Bidder

Project: WTHS TUFTS VET TECH CLINIC RENOVATION

Subcontract Bid for Section: 26 00 00 – ELECTRICAL

- C. Each filed Sub-bid contract bid submitted for work under this Section shall be on forms furnished by the City of Worcester as required by Section 44F of Chapter 149 of the General Laws, as amended. Filed Sub-bid contract bid forms may be obtained at the Department of Public Facilities in person, or by written request.
- D. Filed Sub-bid contract bids filed with the City of Worcester shall be accompanied by a BID BOND or CASH or CERTIFIED CHECK or a TREASURER'S or CASHIER'S CHECK issued by a responsible bank or trust company payable to the City of Worcester in the amount of five (5) percent of the bid. A filed Sub-bid accompanied by any other form of bid deposit than those specified will be rejected.
- E. Additional Requirements:
1. Filed Sub-bidder's attention is directed to Massachusetts G.L. Chapter 149 §44H, as amended, which provides in part as follows:
 2. Each filed Sub-bidder shall list in Paragraph E of the "Form for Sub-Bid" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that sub-subtrade requires such listing, provided that, in the absence of a contrary provision in the Specifications, any sub-bidder may, without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the Awarding Authority that he does customarily perform such class of work with persons on his own payroll and is qualified to do so. This Section of the Specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.

Class of Work	Description	Sections
Security	Unified Security System	28 10 00
Fire Alarm	Addressable Fire-Alarm System	28 31 11

- F. The work to be completed by the Filed Sub-Contractor for the work of this Section is shown on the following listed Drawings:
1. The Work of this Trade Contract is shown on the following Drawings:
 - a. E0.1 - Electrical Legend
 - b. E0.2 - Electrical Notes
 - c. ED1.1 - Electrical Demolition Ground Floor Ceiling Plan
 - d. ED1.2 - Electrical Demolition Third Floor Ceiling Plan
 - e. ED1.3 - Electrical Demolition Third Floor Plan
 - f. EH1.1 - New HVAC Power Plan
 - g. EH1.2 - New HVAC Power Roof Plan
 - h. EH1.3 - Electrical Equipment Schedule
 - i. EL1.1 - New Lighting Ceiling Plan
 - j. EL2.1 - Lighting Control System Details
 - k. EL2.3 - Lighting Control System Details
 - l. EL2.4 - Lighting Control System Details

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- m. EL2.5 - Lighting Control System Details
 - n. EP1.1 - New Floor Power Plan
 - o. EP2.1 - Electrical Distribution Riser
 - p. EP3.1 - Electrical Panel Schedules
 - q. EP3.2 - Electrical Panel Schedules
 - r. EP4.1 - Electrical Details
 - s. EP4.2 - Electrical Details
 - t. EP4.3 - Electrical Details
 - u. EP4.4 - Electrical Details
 - v. EP4.5 - Electrical Details
 - w. EP4.6 - Electrical Details
 - x. FA0.1 - Fire Alarm Legend
 - y. FA1.1 - New Fire Alarm Ceiling Plan
 - z. FA2.1 - Fire Alarm Riser
 - aa. FA3.1 - Fire Alarm Details
 - bb. FA3.2 - Fire Alarm Details
 - cc. SC0.1 - Security Legend
 - dd. SC1.1 - New Security Plan
 - ee. SC1.2 - Tufts Security Plan
 - ff. SC2.1 - Access Control Details
 - gg. TC0.1 - Telecommunications Legend
 - hh. TC1.1 - New Technology Plan
 - ii. TC1.2 - Tufts Technology Plan
2. Related items which may require coordination or impact work of this trade are shown on the following Drawings:
- a. AD3.1, AD3.2, AD3.3, A1.0, A2.1, A2.2, A3.0, A3.1, A3.2, A4.1, A4.2, A5.0, A5.1, A6.1, A6.2, A6.11, A6.12, A6.13, A6.14, A8.0, A8.1, A8.2, A8.3, A8.4, A8.5, A8.6, A8.7, A8.8, A9.1, A9.2, A9.3, A10.1, A10.2, A11.1, A11.2, A11.3, A12.1, A12.2, DH3.1, DH4.1, FP1.1, FP3.1, H3.1, H3.2, H4.1, H4.2, H5.1, H5.2, H5.3, H5.4, P1.1, P3.1, P3.2, P3.3, S1.1, S1.2, S3.1, S3.2, S4.1, S4.2
3. The complete List of Drawings for the Project is provided in Section 00 01 15.
4. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Filed Sub-Contractor's responsibility to determine full extent of work of this Section by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.
- G. Items to Be Installed Only: Install the following items as furnished by the designated Sections:
- 1. Division 8 – OPENINGS:
 - a. Section 083323 OVERHEAD COILING DOORS
 - 1) Controllers, wiring and power connections for overhead coiling doors.
 - b. Section 083326 OVERHEAD COILING GRILLES
 - 1) Controllers, wiring and power connections for overhead coiling grilles.
 - 2. Division 21 – FIRE SUPPRESSION:
 - a. Connections to duct smoke detectors.
 - 3. Division 22 – PLUMBING:
 - a. Power connections for:
 - 1) Water heaters.
-

4. Division 23 – HEATING, VENTILATING AND AIR CONDITIONING:
 - a. Power connections for equipment, control panels, pumps, fans, heaters, and boilers.
- H. Items to Be Furnished Only: Furnish the following items for installation by the designated Sections:
 1. Division 3 – CONCRETE:
 - a. Lintels, sleeves, anchors, inserts, plates and similar items for electrical systems.
 2. Division 4 – MASONRY:
 - a. Access doors in masonry openings.
 3. Division 9 – FINISHES:
 - a. Access doors in gypsum board assemblies.
 - b. Access doors in tile.
 - c. Access doors in acoustical tile
 4. Division 23 – HEATING, VENTILATING AND AIR CONDITIONING:
 - a. Duct smoke detectors and sampling tubes.
- I. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 1. Section 016000 – PRODUCT REQUIREMENTS: Owner's proprietary products and requirements for the same.
 2. Division 3 – CONCRETE for interior concrete equipment pads and installation of backboxes and conduit for electrical devices and light fixtures.
 3. Division 5 – METALS for structural supports necessary to distribute loading from equipment to roof or floor.
 4. Division 6 – WOOD, PLASTICS, AND COMPOSITES for plywood backing panels.
 5. Division 7 – THERMAL AND MOISTURE PROTECTION for coordination of floor and wall penetrations.
 6. Division 8 – OPENINGS for coordination with electrified door hardware.
 7. Division 9 – FINISHES for coordination with gypsum ceilings.
 8. Division 9 – FINISHES for coordination with acoustical ceilings.
 9. Division 22 – PLUMBING for coordination with sensors located at plumbing fixtures.
 10. Division 23 – HEATING, VENTILATING AND AIR CONDITIONING for coordination with HVAC piping and ductwork, motors, and control wiring except 120 VAC power to control panels as indicated on the Drawings.
 11. Division 31 – EARTHWORK for excavation and backfilling for underground work.
- J. The Electrical Subcontractor shall be responsible for filing all documents, payment of all fees, and securing of all inspections and approvals necessary for the electrical work.
- K. The Owner shall be responsible for all Utility Company and Municipal back charges for all materials furnished and work performed by them in conjunction with this Contract and pay same to the respective agency upon demand.
- L. The Electrical Subcontractor shall comply with the adopted version of NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations. The Electrical Subcontractor shall prepare and submit all documentation required to comply with NFPA 241.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Sub-Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.4 REFERENCES

- A. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any electrical item in the drawings or specifications for electrical work carries with it the instruction to furnish, install and connect the item as part of the electrical work, regardless of whether or not this instruction is explicitly stated.
- B. It shall be understood that the specifications and drawings for electrical work are complimentary and are to be taken together for a complete interpretation of the electrical work. Where the specifications and drawings for electrical work conflict with each other the costlier item will take precedence over the less costly unless the Designer rules otherwise.

1.5 REGULATORY REQUIREMENTS

- A. Comply with all applicable federal and state laws, and all local codes, by-laws, and ordinances.
- B. Where provisions of the Contract Documents conflict with any codes, rules or regulations, the latter shall govern. Where the contract requirements are in excess of applicable codes, rules or regulations, the contract provisions shall govern unless the Designer rules otherwise.
- C. Request inspections from authorities having jurisdiction, obtain all permits and pay for all fees and inspection certificates as applicable and/or required. All permits and certificates shall be turned over to the Owner at the completion of the work. Copies of permits shall be given to the Owner prior to the start of work.
- D. Unless otherwise specified or indicated, materials and workmanship and equipment performance shall conform with the latest edition of the following standards, codes, specifications, requirements, and regulations:
 - 1. State Building Code
 - 2. State Electrical Code
 - 3. National Fire Protection Association (NFPA)
 - 4. Local City Regulations and By-laws
 - 5. Underwriter's Laboratories, Inc. (UL)
 - 6. National Electrical Manufacturer's Association (NEMA)

7. American National Standards Institute (ANSI)

- E. All electrical work shall meet or exceed any other state and local codes and/or authorities having jurisdiction including all other standards indicated herein.

1.6 QUALITY ASSURANCE

- A. Company specializing in work described in the above listed individual specification sections with minimum 5 years documented experience.
- B. The requirements of the State Building Code and local regulations establish the minimum acceptable quality of workmanship and materials, and all work shall conform thereto unless more stringent requirements are indicated or specified herein.
- C. All work shall comply with the latest editions of the codes as referenced herein.
- D. Follow manufacturer's directions for articles furnished, in addition to directions shown on drawings or specified herein.
- E. Protect all work, materials, and equipment from damage during process of work. Replace all damaged or defective work, materials, and equipment without additional cost to the Owner.
- F. All equipment and materials for permanent installation shall be the products of recognized manufacturers and shall be new.
- G. Equipment and materials shall:
1. Where normally subject to Underwriters Laboratory Inc. listing or labeling services, be so listed or labeled.
 2. Be without blemish or defect.
 3. Not be used for temporary light and power purposes.
 4. Be in accordance with the latest applicable NEMA standards.
 5. Be products which will meet with the acceptance of all authorities having jurisdiction over the work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be so examined, tested and certified.
- H. Except for conduit, conduit fittings, outlet boxes, wire and cable, all items of equipment or material of one generic type shall be the product of one manufacturer throughout.
- I. For items which are to be installed but not purchased as part of the electrical work, the electrical work shall include:
1. The coordination of their delivery.
 2. Their unloading from delivery trucks driven into any point on the property line at grade level.
 3. Their safe handling and field storage up to the time of permanent placement in the project.
 4. The correction of any damage, defacement, or corrosion to which they may have been subjected. Replacement if necessary, shall be coordinated with Contractor who originally purchased the item.

5. Their field make-up and internal wiring as may be necessary for their proper operation.
 6. Their mounting in place including the purchase and installation of all dunnage, supporting members, and fastenings necessary to adapt them to architectural and structural conditions.
 7. Their connection to building wiring including the purchase and installation of all termination junction boxes necessary to adapt and connect them to this wiring. Included also shall be the purchase and installation of any substitute lugs or other wiring terminations as may be necessary to adapt their terminals to the building wiring as called for and to the connection methods set forth in these specifications.
- J. Items which are to be installed but not purchased as part of the electric work shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the electric work will be considered only if presented in writing within one week of the date of delivery to the project of the items in question. The electric work includes all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

1.7 SUBMITTALS

- A. Comply with requirements specified in Division 01.
- B. Material and equipment requiring Shop Drawing Submittals shall include but not be limited to:
 1. Electrical Work
 2. Common Work Results for Electrical
 3. Electrical Power Conductors and Cables
 4. Grounding and Bonding for Electrical Systems
 5. Hangers and Supports for Electrical Systems
 6. Raceway and Boxes for Electrical Systems
 7. Vibration and Seismic Controls for Electrical Systems
 8. Identification for Electrical Systems
 9. Network Lighting Controls
 10. Panelboards
 11. Motor Controls
 12. Wiring Devices
 13. Fuses
 14. Enclosed Switches and Circuit Breakers
 15. Interior Lighting
 16. Structured Cabling
 17. Testing Category 6A Twist Pair Infrastructure
 18. Unified Security System
 19. Addressable Fire-Alarm System

1.8 CONTRACT DRAWINGS AND SPECIFICATIONS

- A. Drawings are diagrammatic and indicate the general arrangement of the various systems and approximate and relative locations of the materials and equipment defined by the specifications. Coordinate with and obtain the approval of the owner, architect, and

engineer for the exact locations of all materials and equipment. Check the drawings, specifications, and all fabrication and shop drawings (including fabrication and shop drawings of other trades) to verify space conditions, headroom requirements, characteristics, and for coordination. Where space conditions and headroom requirements appear inadequate, notify the engineer before submitting a bid. No consideration or allowance will be granted for failure to notify the engineer, or for any alleged misunderstanding of the requirements above. Completely furnish, install, connect, and interconnect all components of all systems in accordance with contract requirements, manufacturer's instructions, applicable codes and standards, and best practices of the trade.

- B. Minor deviations, variations, changes, and connections from layouts shown on the drawings (based on coordination, conditions, manufacturer's instructions, codes and standards, shop drawings, and verification of measurements and conditions) are permitted to facilitate construction provided the changes do not represent potential changes in scope of work (see the section of these specifications "Changes to the Scope of Work") and provided the changes are acceptable to the owner, architect, and engineer.
- C. Before submitting bid, examine and check all drawings and specifications relating to all work, including electrical, mechanical, plumbing, general construction, fire protection, and any other trades' drawings and specifications (as well as Division 1 General Requirements) and become fully informed as to the extent and character of work required and its relation to the work of other trades. No consideration, claims, charges, or compensation will be granted for any alleged misunderstanding of the work to be performed, or the force and intent of these specifications.
- D. Fully coordinate (prior to releasing doors and hardware) with the General Contractor to ensure that all doors to rooms housing new large electrical equipment swing open in the direction of egress and are equipped with proper "panic" hardware as per the NEC where applicable.

1.9 VISIT TO SITE

- A. Before estimating work, visit the project site and verify all measurements and field conditions affecting the work. The contractor is fully responsible for the correctness of all measurements. Submission of bid is considered evidence that this contractor has visited and examined the site. No consideration, claims, charges, or compensation will be granted for extra work as a result of the contractor's failure to visit the site or verify conditions and measurements.

1.10 SURVEYS AND MEASUREMENTS

- A. Base all required measurements, both horizontal and vertical, on reference points established by the General Contractor and be responsible for the correct laying out of the electrical work. In the event of a discrepancy between actual measurements and those indicated, notify the General Contractor in writing, and do not proceed with the work required until written instructions have been issued by the General Contractor.
- B. The Electrical Contractor is solely responsible for verifying field measurements, conditions, and drawing and specifications information (for all trades) before ordering materials and equipment and before commencing work. The Electrical Contractor is solely responsible for verifying shop drawings (including shop drawings of other trades) before releasing related materials and equipment and before rough in. No consideration, claims, charges, or

compensation will be granted due to any differences between the actual dimensions and any dimensions indicated on the drawings.

- C. Report any apparent discrepancies or conflicts found at once to the engineer for consideration and wait for a decision before proceeding with any work in the affected area.
- D. The engineer's decisions in cases of discrepancies, conflicts, and related to verification of measurements and conditions are final and binding upon the Electrical Contractor, make all installation accordingly.

1.11 EXISTING CONDITIONS AND UTILITIES

A. Existing Conditions

- 1. Information and data indicated on the drawings regarding existing conditions (including underground utilities) is from the best available sources. However, no assurance is made as to completeness and/or accuracy.
- 2. Contact all utility companies operating in the project vicinity (water, gas, sewage, electric, telephone, cable television, etc.) and the owner's maintenance department (where applicable) and verify all existing underground systems before any excavation commences.
- 3. Relocate any existing underground electrical feeders and wiring in areas of construction and around proposed foundations. Include all costs in bid. If any third-party owned wiring or equipment interferes with construction, notify the engineer.

B. Demolition of Utilities

- 1. The electrical contractor shall be responsible for coordinating with utility company for disconnecting and making safe power to the existing building to facilitate demolition by the general contractor.

1.12 ITEMS NOT SHOWN OR SPECIFIED

- A. Provide any items of material not indicated on the drawings and/or not specified, but which are required for the complete and proper installation and/or operation of any part of the work, as if indicated and specified.
- B. Provide any work not indicated on the drawings and/or not specified, but which is required for compliance with applicable codes and regulations, as if indicated and specified.
- C. No consideration, claims, charges, or compensation will be granted for performing work required for complete and proper installation/operation or required for compliance with applicable codes and regulations.

1.13 COORDINATION

- A. Electrical Drawings are diagrammatic. They indicate general arrangements of electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet Architectural requirements.

- B. Work shall be performed in cooperation with other trades on the project and so scheduled as to allow speedy and efficient completion of the work.
- C. Furnish to other trades advance information on locations and sizes of all frames, boxes, sleeves and openings needed for their work, and also furnish information and shop drawings necessary to permit trades affected by the work to install same properly and without delay.
- D. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Designer. Where the electrical work shall interfere with the work of other trades, assist in working out the space conditions to make satisfactory adjustments before installation. Without extra cost to the Owner, make reasonable modifications to the work as necessitated by normal structural interferences. Pay the General Contractor for additional openings or relocating and/or enlarging existing openings through concrete floors, walls, beams, and roof required for any work which was not properly coordinated. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside of structure as possible.
- E. If any electrical work has been installed before coordination with other trades so as to cause interference with the work of such trades, all necessary adjustments and corrections shall be made by the electrical trades involved without extra cost to the Owner.
- F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Designer for review and approval.
- G. Protect all materials and work of other trades from damage which may be caused by the electrical work and repair all damages without extra cost to the Owner.

1.14 MECHANICAL AND ELECTRICAL COORDINATION

- A. HVAC Subcontractor shall furnish and install various electrical items relating to the HVAC equipment and control apparatus. The Electrical Subcontractor shall be required to connect power wiring to this equipment unless noted otherwise.
- B. The HVAC and Electrical Subcontractors shall coordinate their respective portions of the work, as well as the electrical characteristics of the heating and ventilating equipment.
- C. All power wiring and local disconnect switches will be provided by the Electrical Subcontractor for the line voltage power. All control and interlocking wiring shall be the responsibility of the HVAC Subcontractor.
- D. 120V and above power wiring sources extended and connected to heating and ventilating control panels, transformers and switches shall be the responsibility of the Electrical Subcontractor. All low voltage thermostat, zone valve and any switch wiring shall be the responsibility of the HVAC Subcontractor.
- E. Temperature control and equipment wiring shall be installed by the HVAC Subcontractor.
- F. Pipe Tracing shall be furnished and installed by the specified subcontractor. Power connections shall be by the Electrical Subcontractor.

- G. The Electrical Subcontractor will provide all magnetic starters and disconnect switches except those furnished as an integral part of packaged equipment.
 - H. The Electrical Contractor shall be responsible for reviewing submittals (provided by the General Contractor) of other trades prior to submitting electrical submittals, ordering, or installing any electrical equipment, conduit, wire, materials, etc. Review:
 - 1. Mechanical equipment submittals.
 - 2. Plumbing equipment submittals.
 - 3. Fire protection equipment submittals.
 - 4. Theatrical dimming and audio-video equipment submittals.
 - 5. Kitchen equipment submittals.
 - 6. Elevator submittals.
 - 7. Media distribution and audio-video equipment submittals.
 - 8. Intrusion detection and access control equipment submittals.
 - 9. Video surveillance equipment submittals.
 - 10. Public address/clock equipment submittals.
 - 11. Owner supplied equipment submittals.
 - I. The Electrical Contractor must review and incorporate all the electrical loads and characteristics from all the shop drawings submittals of other trades as part of their submittals.
 - J. Where conflicts or potential conflicts exist, immediately refer the conflicts to the Architect and the engineer in writing for decision to prevent delay in installation of work.
- 1.15 MECHANICAL AND ELECTRICAL COORDINATION DRAWINGS
- A. Refer to Section 013100 PROJECT MANAGEMENT AND COORDINATION for coordination drawing requirements.
- 1.16 INSTALLATION REQUIREMENTS
- A. The arrangement of all electrical work shown on the drawings is diagrammatic only and indicates the minimum requirements of the work. Conditions at the building including actual measurements shall determine the details of the installation. All work shall be laid out and installed so as to require the least amount of cutting and patching.
 - B. Check the Architectural plans and specifications before ordering any material and equipment. Any discrepancies shall be brought to the attention of the Designer for his determination prior to proceeding with the work.
- 1.17 TYPICAL DETAILS
- A. Typical details where shown on the drawings shall apply to each and every item of the project where such items are applicable. They are not repeated in full on the drawings, which in many cases are diagrammatic only, but with the intention that such details shall be incorporated in full. Any alternate method proposed for use by the Electrical Subcontractor shall have the prior approval of the Designer.

1.18 SLEEVES, INSERTS

- A. Furnish and install all sleeves, inserts, anchor bolts and similar items to be set into masonry or concrete, as necessitated for mechanical and electrical work. Internal diameter of sleeve shall be 2" larger than the outside diameter of the pipe or insulation covered line passing through it.
- B. The Electrical Subcontractor is responsible for coring and sleeving (as applicable) all penetrations of the structure required of their respective work. All penetrations through the structure shall be sealed air and watertight.

1.19 FIRESTOPPING

- A. Comply with the requirements of Division 07. Refer to specification Section 078413 PENETRATION FIRESTOPPING.
- B. The Electrical Contractor shall be responsible for fire stopping all wall, floor and ceiling penetrations for the electrical work as necessitated for all conduit, wiring, cabinets, panels, etc. Fire stopping materials shall be coordinated with the Construction Manager.
- C. All conduit, wiring, cabinets, panels, etc. installed by the Electrical Subcontractor through acoustical partitions shall be sealed with an approved acoustical sealant, by the Electrical Subcontractor.

1.20 CORING, DRILLING

- A. Refer to the requirements of Division 1. Core, cut and/or drill all small holes 4 inches in diameter or less in walls and floors required for the installation of sleeves and supports for the electrical work. Penetration larger than 4 inches will be by the General Contractor.

1.21 CUTTING AND PATCHING

- A. Comply with Section 017329 CUTTING AND PATCHING.

1.22 ACCESSIBILITY

- A. Install all work such that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible.
- B. Furnish all access panels appropriate to particular conditions, to be installed by trades having responsibility for the construction of actual walls, floors, or ceilings at required locations.

1.23 SUPPLEMENTARY SUPPORTING STEEL

- A. Provide all supplementary steelwork required for mounting or supporting equipment and materials.
- B. Steelwork shall be firmly connected to building construction.

- C. Steelwork shall be of sufficient strength to allow only minimum deflection in conformity with manufacturer's published requirements.
- D. All supplementary steelwork shall be installed in a neat and workmanlike manner parallel to floor, wall, and ceiling construction; all turns shall be made at forty-five and ninety degrees, and/or as dictated by construction and installation conditions.
- E. All manufactured steel parts and fittings shall be galvanized.

1.24 TOOLS AND EQUIPMENT

- A. Provide all tools and equipment required for the fabrication and installation of the mechanical and electrical equipment at the site.

1.25 PORTABLE AND DETACHABLE PARTS

- A. The Electrical Contractor shall retain in their possession all portable and/or detachable parts and portions of materials, devices, equipment etc. necessary for the proper operation and maintenance of the electrical systems until final completion of the work, at which time they shall be handed over to the Owner.

1.26 RECORD DRAWINGS, PROJECT CLOSEOUT

- A. Comply with requirements specified in Section 017700 CLOSEOUT PROCEDURES.
- B. The Electrical Contractor shall submit the record set for approval by the fire and building departments in a form acceptable to the departments, when required by the jurisdiction.
- C. Drawings shall show record condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual manufacturer and make and model numbers of final equipment installation.

1.27 OPERATING, INSTRUCTION AND MAINTENANCE MANUALS

- A. Refer to Division 1 for submittal procedures pertaining to operating and maintenance manuals.
- B. Each copy of the approved operating and maintenance manual shall contain copies of approved shop drawings, equipment literature, cuts, bulletins, details, equipment and engineering data sheets and typewritten instructions relative to the care and maintenance for the operation of the equipment, all properly indexed. Each manual shall have the following minimum contents:
 - 1. TABLE OF CONTENTS
 - 2. Introduction
 - a. Explanation of manual and its purpose and use.
 - b. Description of the electrical systems.
 - c. Safety precautions necessary for equipment.
 - d. Illustrations, schematics, and diagrams.
 - e. Installation drawing.

3. Maintenance
 - a. Maintenance and lubricating instructions.
 - b. Replacement charts.
 - c. Trouble shooting charts for equipment components.
 - d. Testing instructions for each typical component.
 - e. Two typed sets of instructions for ordering spare parts. Each set shall include name, price, telephone number and address of where they may be obtained.
4. Manufacturer's Literature
 - a. The equipment for which shop drawings have been submitted and approved.

1.28 SERVICE CHARACTERISTICS

- A. Secondary Building Voltage - High Level: 480/277V
- B. Secondary Building Voltage - Low Level: 208/120V
- C. All equipment and wiring shall be suitable for the applied voltage.

1.29 DELIVERY, STORAGE AND HANDLING

- A. All materials for the work of this section shall be delivered, stored, and handled so as to preclude damage of any nature. Manufactured materials shall be delivered and stored in their original containers, plainly marked with the products' and manufacturer's name. Materials in broken containers or in packages showing watermarks or other evidence of damage, shall not be used, and shall be removed from the site.

1.30 TEMPORARY POWER AND LIGHTING

- A. The Electrical Subcontractor shall furnish and install feeders of sufficient size from the Utility Company's power transformer and meter for the electric light and power requirements for the building while under construction and until the permanent feeders and related equipment have been installed and are in operation. Temporary lighting shall be based on a minimum of one watt per square foot covering each and every square foot of floor area in the building. Sufficient wiring, lamps, and outlets shall be installed to insure proper lighting in all rooms, space, stairwells, and corridors. Minimum sized lamp used shall be 100 watt. Where higher lighting intensities are required by Federal or State Standards of Laws or otherwise specified, the above specified wattage shall be increased to provide these increased intensities.
- B. All necessary transformers, meters, cables, panelboards, switches, temporary lamp replacements and accessories required for the temporary light and power installation shall be provided by the Electrical Subcontractor.
- C. The Electrical Subcontractor shall provide and maintain on each floor of the building, a feeder or feeders of sufficient capacity for the requirements of the entire floor and he shall provide a sufficient number of outlets, located at convenient points, so that extension cords of not over 50 ft. in length will reach all work requiring temporary light or power.
- D. The Electrical Subcontractor shall provide temporary connection to the elevator. Refer to Section 142424 "Holeless Hydraulic Elevators".

- E. The Electrical Subcontractor shall install and maintain the wiring and accessories for the offices of the General Contractor and the Owner as specified in Section 015000 "Temporary Facilities and Controls".
- F. All temporary electrical work shall meet the requirements of the National Electrical Code, the Local Utility Company, and all Federal Standards and Laws.
- G. All temporary wiring and accessories thereto installed by the Electrical Subcontractor shall be removed after their purposes have been served.
- H. The General Contractor will pay for the cost of electric energy consumed by himself and by all of his Subcontractors, unless otherwise indicated.
- I. All lamps installed in permanent lighting fixtures and used for lighting during construction shall be replaced by the Electrical Subcontractor just prior to date of Use and Occupancy or Final Acceptance.
- J. Provide and maintain, to the satisfaction of the local authorities having jurisdiction, all temporary lighting and power that may be required for safety purposes. The Electrical Subcontractor will be compensated by the General Contractor for any additional standby time, materials or equipment required by the General Contractor or other Subcontractors beyond the normal working hours, as defined above.

1.31 TEMPORARY FIRE ALARM SYSTEM

- A. Furnish and install a temporary fire alarm system to provide temporary fire alarm detection and notification functions in construction areas.
- B. Submit a hard copy of a drawing of the proposed temporary system for review by the fire department.
- C. Temporary systems shall include detection devices such as heat detectors, notification devices and control devices to adequately serve the construction area.
- D. Manual alarm stations shall be installed at construction exits and at each stair tower on each floor.
- E. Where detection devices are located on the ceiling of the construction area, twenty-four inches of yellow caution tape will be affixed to the wiring serving a device within six inches of the device to provide a locator of the temporary detection device.
- F. Temporary protection devices shall be installed in mounting boxes and secured to building structure.
- G. All wiring connections of the temporary system shall be made in junction boxes. All junction boxes shall be covered and labeled.
- H. Temporary protection installations shall be fully tested and certified by the installing contractor.
- I. All fire alarm system devices providing protection to construction areas are to be maintained fully functional and compliant at all times. Junction boxes to remain closed at all times.

- J. Temporary protection shall be left in place until the new fire alarm equipment has been tested and certified compliant and operational by the installing contractor and accepted by the owner.
- K. The temporary fire alarm system including devices, raceways and wiring shall be removed by this contractor at the completion of the construction.

1.32 COMMISSIONING

- A. Comply with requirements specified in Division 1.

1.33 TRAINING AND SERVICE

- A. The Owner shall be thoroughly instructed in the use of for each type of system installed, as defined in the specifications by the system vendor.
- B. The Owner shall be thoroughly instructed in the use and upkeep of the system, the training shall include routine maintenance and operational adjustments.
- C. Final "as built" documentation must be available at the job site for all training sessions.
- D. The Electrical Subcontractor shall provide training materials free from any copyright restrictions, and upon request from the Owner, furnish a reproducible set of these materials.
- E. Instruction and training for the operation and routine maintenance of the system shall be provided at site, after final completion acceptance of the system, at a time mutually satisfactory to the Electrical Subcontractor and Owner.
- F. The training shall include system(s) functional description and the proper adjustment procedure for every adjustment in the system(s).
- G. The equipment will be made available by the Owner, after delivery and acceptance, for use in the instruction and training program. The Owner will provide space for the instruction and training. The Electrical Subcontractor shall provide the instructor(s) and all training materials.
- H. The Electrical Subcontractor shall engage a qualified videographer to record each training module separately on digital, window's compatible DVD media. Include instructions and demonstrations, diagrams, and other visual aids. At the beginning of each training module, record chart containing learning objective and lesson outline.

1.34 WARRANTY

- A. The Electrical Contractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.
- B. The warranty shall repair or replace defective materials, equipment, workmanship, and installation that develop within this period, promptly and to Owner's satisfaction and correct damage caused in making necessary repairs and replacements under warranty within Contract Price.

- C. In addition to warranty requirements of Division 1 and of Subparagraph A above, obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's name.
1. Upon receipt of notice from the Owner of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced by this Contractor without any reimbursement.
 2. Replace material and equipment that require excessive service during warranty period as defined and as directed by Designer.
 3. Provide 24-hour service beginning on the date the project is accepted by the Owner, whether or not fully occupied, and lasting until the termination of the warranty period. Service shall be at no cost to the Owner. Service can be provided by this contractor or a separate service organization. Choice of service organization shall be subject to the Owner's approval. Submit name and a phone number that will be answered on a 24-hour basis each day of the week, for the duration of the service.
 4. Submit copies of equipment and material warranties to the Owner before final payment.
 5. At end of warranty period, transfer manufacturers' equipment and material warranties still in force to the Owner.
 6. This Paragraph shall not be interpreted to limit the Owner's rights under applicable codes and laws and under this Contract.
 7. Parts of this Specification may specify warranty requirements that exceed those of this Paragraph. Those paragraphs will govern.
 8. Use of systems provided under this Section for temporary services and facilities shall not constitute Final Acceptance of work by the Owner and shall not initiate the warranty period.
 9. Non-durable items, such as electric lamps, shall be replaced up to the date of acceptance, such that they shall have had no more than 100 hours use prior to this date.
 10. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during warranty period immediately. If problems cannot be rectified immediately to the Owner's satisfaction, advise the Owner in writing, describe efforts to rectify situation, and provide analysis of cause of problem. Designer will direct course of action.

PART 2 - PRODUCTS

2.1 SEQUENCING

- A. Phasing: Refer to Section 01 10 00 - Summary, and Drawings for phasing and milestone completion requirements which affect the General Contractor's Work and the Work of this Filed Subcontract.
- B. Coordinate work of this Filed Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- C. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed Subcontract, have been received and approved by the Architect.
- D. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the

work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

2.2 SCAFFOLDS, STAGING, AND OTHER SIMILAR RAISED PLATFORMS

- A. General: Filed Subcontractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - Temporary Facilities and Controls and herein.
1. Scaffolding and staging required for use by this Filed Subcontractor pursuant to requirements of Section 01 50 00 - Temporary Facilities and Controls shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-Bid requiring such scaffolding.
 2. Each Filed Subcontractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - Temporary Facilities and Controls and as additionally required for dust control).
 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed Subcontractor.
 4. Enclose all exterior scaffolding outside of the construction fence with 8-foot high plywood enclosure at end of each workday to prohibit access to the scaffolding by unauthorized individuals.

PART 3 - EXECUTION

NOT USED

End of Section

Section 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceways and cables.
 - 2. Sleeve seals.
 - 3. Grout.
 - 4. Common electrical installation requirements.

1.3 SUBMITTALS

- A. Product Data: For sleeve seals.

1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Approved Manufacturers
 - a. Polywater
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Or approved equal.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Carbon steel Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.4 RACEWAY SEALS

- A. Where a raceway enters a building or structure from outside, it shall be sealed. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with cable insulation, conductor insulation, bare conductor, shield, or other components.
- B. Where a service raceway enters a building or structure from an underground distribution system, it shall be sealed in accordance with the NEC. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, shield, or other components.
- C. Conduits or raceways through which moisture may contact live parts shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.
- D. Where portions of a raceway or sleeve are known to be problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway or sleeve shall be filled with an approved material to prevent the circulation of warm air to a colder section of the raceway or sleeve.
- E. Cap empty conduits during construction to avoid water ingress into the building.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry.
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants".

- J. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- L. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.
- M. Sleeves shall be installed and properly secured at all points where pipes pass through masonry, concrete or wood. Do not cut the steel decking before the slab is poured. Provide core drilling after slab is poured and cured. Core openings shall have Link-Seal fire rated penetration closures.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

End of Section

Section 26 05 19

ELECTRICAL POWER CONDUCTORS AND CABLES
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 WARRANTY

- A. Comply with Section 260001.
- B. The Electrical Subcontractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Aluminum and Copper Conductors: Comply with NEMA WC 70.
 - 1. Feeders rated 100A and above may utilize Aluminum conductors.
 - 2. Feeders and branch circuits rated less than 100A shall be Copper conductors.

- B. Conductor Insulation: 90 degree rated; Comply with NEMA WC 70 for THHN, THWN-2 and XHHW-2.
- C. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire; health care facilities armored cable, Type HCF AC with ground wire; mineral-insulated, metal-sheathed cable, Type MI)

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 METAL CLAD (MC) CABLE ASSEMBLY

- A. Description
 - 1. Metal clad cable assemblies shall consist of 2 or more insulated, current carrying copper conductors. The Metal-Clad Cable shall be UL Classified as a Through-Penetrating Product (XHLY) for use in One, Two or Three-Hour Through-Penetration Firestop Systems {XHEZ}. Assembly shall be suitable for use in cable trays in accordance with the NEC.
 - 2. Current-Carrying Conductors: Soft annealed copper in compliance with the latest edition of ASTM B3 and/or B8.
 - 3. Each separate circuit conductor shall have its own dedicated neutral conductor. The dedicated neutral conductor shall be white/grey with a continuous color stripe matching the color of its dedicated circuit conductor. Multi-wire branch circuits are not allowed.
 - 4. Grounding/Bonding Conductor: Full sized bare aluminum bonding/grounding conductor, sized in accordance with Table 6,1 of UL1569, working in combination with the armor to create a low resistance ground path. Aluminum bonding/grounding conductor shall be cabled with the current-carrying conductors and shall be in intimate contact with the metal armor.
 - 5. Insulated Equipment Grounding Conductor: The equipment ground shall be full-sized in accordance with Table 6.1 of UL 1569 and shall be soft-annealed copper in compliance with the latest edition of ASTM B3 and/or B8.
 - 6. Insulated Conductor: The insulated conductor shall be Type THHN 90°C DRY with an extruded polypropylene protective covering. The Type THHN Insulated Conductor with protective covering shall be manufactured and tested in accordance with UL 83 and UL 1569.
 - 7. Armor: A zinc coated galvanized steel armor shall be applied over the cabled wire assembly with an interlock in compliance with Section 13 of UL 1569.
- B. Fittings
 - 1. Fittings shall be UL listed and identified for use with metal clad interlocking armor ground.
 - 2. Connectors shall be of steel or malleable iron and shall have saddle clamp to insure a tight termination of MC Cable to box.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN-2, single conductors in raceway.
- C. Emergency System Feeders in non-corrosive copper or brass environments: Mineral-insulated, metal-sheathed cable, Type MI.
- D. Emergency System Feeders direct-buried: Mineral-insulated, metal-sheathed cable, Type MI with an extruded outer polyolefin jacket to provide additional protection.
- E. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN-2, single conductors in raceway.
- F. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN-2, single conductors in raceway.
- G. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN-2, single conductors in raceway.
- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN-2, single conductors in raceway; Metal-clad cable, Type MC.
- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN-2, single conductors in raceway.
- J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- K. Class 1 Control Circuits: Type THHN-THWN-2, in raceway.
- L. Class 2 Control Circuits: Type THHN-THWN-2, in raceway; Metal-clad cable, Type MC.
- M. Fire Alarm Circuits:
 - 1. Initiating and signaling circuits originating and serving an evacuation zone: manufacturer recommended MC type cabling.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- I. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- B. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- C. Cut sleeves to length for mounting flush with both wall surfaces.
- D. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- E. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
- F. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- G. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations.

- H. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- I. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- J. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
- C. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

End of Section

Section 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

1.5 WARRANTY

- A. Comply with Section 260001.
- B. The Electrical Subcontractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Approved Manufacturers
 - 1. Harger Lightning and Grounding.
 - 2. Burndy; Part of Hubbell Electrical Systems.
 - 3. ERICO International Corporation.
 - 4. Or approved equal.

B. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

C. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad; 3/4-inch by 10 feet (19 mm by 3 m) in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

F. Grounding for Lightning Protection System: Install 3/0 AWG copper grounding conductor, in conduit, to the building's main service ground busbar.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohms.

- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

End of Section

Section 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. Section includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

- A. Product Data: For steel slotted support systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
 2. Steel slotted channel systems. Include Product Data for components.
 3. Equipment supports.
- C. Welding certificates.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Approved Manufacturers
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. Thomas & Betts Corporation.
 - c. Unistrut; Tyco International, Ltd.
 - d. Or approved equal.
 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 5. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Approved Manufacturers
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Or approved equal.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Approved Manufacturers
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) Or approved equal.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

2.3 ACOUSTICAL DECK HANGERS

- A. Provide dovetail rib locking hangers to support all piping, ductwork and other mechanical and utility components from acoustical decks.
- B. The locking hangers shall be inserted parallel to the ribs and can be placed continuously, spaced every 6 inches or 8 inches across the width of the profile.
- C. Hangers shall be capable of being unlocked and relocated, inserted, or removed and reused.
- D. Components shall include Wedge Nut shaped for appropriate deck profile 3/8 in. x 12 in. All Thread, 3.8 in. Washer. 3/8 in. Locking Nut and 3/8 in. to 3/8 in. Coupler Nut.
- E. Hanger type shall be compatible with the proposed Architectural Acoustical deck.
- F. Acoustical deck hangers shall be manufactured by Epic Metals Corporation. Canam Group, Inc., Nucor Corp., or approved equal. Coordinate approved manufacturer with the General Contractor.

2.4 RACEWAY AND CABLE SUPPORTS HANGING FROM STRUCTURE

- A. This Subcontractor shall furnish and install all supplementary steel or Unistrut systems which shall be supported only by structural steel when hanger loads exceed limitations at composite slabs and roof deck.

- B. "Sammy" hanger attachments are not permitted under any conditions.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb. (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

- 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- F. The Electrical Subcontractor shall install all hangers and supports for electrical systems prior to fireproofing.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. The Electrical Subcontractor shall coordinate the anchor-bolt pattern for all light fixtures.
- B. The Electrical Subcontractor shall provide to the respective subcontractor the layout of conduit and other materials that penetrate the equipment pads.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

End of section

Section 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. See Division 26 for exterior duct banks and manholes, and underground handholes, boxes, and utility construction.

1.3 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.5 WARRANTY

- A. Comply with Section 260001.
- B. The Electrical Subcontractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. EMT: ANSI C80.3.
- C. FMC: Zinc-coated steel.
- D. LFMC: Flexible steel conduit with PVC jacket.
- E. Fittings for Conduit (Including all Types and Flexible and Liquid tight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT: Steel, set screw or compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- B. LFNC: UL 1660.
- C. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.
- D. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

- A. Approved Manufacturers
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman.
 - 3. Square D; Schneider Electric.
 - 4. Or approved equal.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 and Type 3R (exterior) unless otherwise indicated.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type.
- E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS

- A. Approved Manufacturers
 - 1. Hoffman.
 - 2. Lamson & Sessions.
 - 3. Carlon Electrical Products.
 - 4. Or approved equal.
- B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with Snap-On cover and mechanically coupled connections with plastic fasteners.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.5 SURFACE RACEWAYS

- A. Provide surface raceway systems and associated boxes for branch circuit and data network voice, video and other low-voltage wiring. Surface raceway system shall consist of raceway bases, covers, pre-divided raceway bases, appropriate fittings and device mounting plates necessary for a complete installation.
- B. Surface Metal Raceways: Galvanized steel with Snap-On covers. Manufacturer's standard enamel finish in color selected by Architect.
 - 1. Approved Manufacturers
 - a. Thomas & Betts Corporation.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Wiremold Company (The); Electrical Sales Division.
 - d. Or approved equal.
 - 2. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.
 - a. Basis of design Wiremold V700 series, 2400 Series, 4000 Series.
- C. Surface raceways and boxes shall be utilized in finish areas where it is not possible to fish cabling and/or install recessed devices.
- D. Coordinate installation of surface raceways with the Architect prior to installation.
- E. EMT conduit and sheet metal outlet boxes shall not be permissible in finished areas.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

- D. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.
- E. Nonmetallic Floor Boxes: Nonadjustable, round.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- I. Cabinets:
 - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
- J. Air-vapor barrier electrical and communication boxes: Furnish and install air-vapor barrier boxes where there is no space (service cavity) between the airtight layer and the interior finish. Where air-sealed boxes are installed, they shall be marked in accordance with NEMA OS 4. Air-sealed boxes shall be installed in accordance with the manufacturer's instructions.
 - 1. Electrical and communication boxes that penetrate the air barrier of the building thermal envelope, and that do not comply with NEMA OS 4, shall be caulked, taped, gasketed, or otherwise sealed to the air barrier element being penetrated. All openings on the concealed portion of the box shall be sealed. Where present, insulation shall rest against all concealed portions of the box.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: Rigid steel conduit.
 - 2. Concealed Conduit, Above ground: Rigid steel conduit; EMT.
 - 3. Underground Conduit outside the foundation wall: RNC, Schedule 80 PVC, direct buried. Convert nonmetallic conduit to rigid steel conduit before rising through earth.
 - 4. Underground Conduit within building confines: RMC, direct buried or RNC, Schedule 80 PVC, direct buried. Convert nonmetallic conduit to rigid steel conduit before rising through earth.

5. Exposed or underground conduit to sewage ejector pump chamber: PVC coated rigid steel conduit.
 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 7. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Fire pump room.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: Rigid steel conduit.
 7. Raceways for Optical Fiber or Communications Cable: EMT or plenum rated inner duct.
 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
 9. Exposed or underground conduit to sewage ejector pump chamber: PVC coated rigid steel conduit.
 10. Exposed or underground conduit to acid neutralization chamber: PVC coated rigid steel conduit.
- C. Fire Pump Room:
1. All equipment shall be suitable for use in locations subject to a moderate degree of moisture.
 2. All equipment shall be minimally rated for NEMA Type 2, dripproof or with an ingress protection (IP) rating of IP31 or shall match the rating of the fire pump controller whichever provides greater protection.
 3. Comply with NFPA 20 for junction boxes located within the fire pump room and serving the fire pump controller (e.g., transition from 2-hour MI cable to standard cable) and raceway terminations into the fire pump controller. NFPA 20 prohibits the installation of such components in a manner which violates the integrity of the fire pump controller enclosure type rating.
 4. Comply with NEMA Standards Publication ICS 14-2015 Application Guide for Electric Fire Pump Controllers, which states that all "top-entry conduit fittings into the fire pump controller should be, as a minimum, watertight"; and side-entry conduit fittings into the fire pump controller "should be suitable for the environment and enclosure type".
 5. Comply with Article 695 of NFPA 70 National Electrical Code for fire pump installations.
 6. Where fire pump controller enclosures are listed for a greater level of protection than NEMA Type 2, the higher degree of protection against water infiltration shall

be extended to the associated and connected junction boxes, conduits and other connections located within the fire pump room.

- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
- E. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. All conduit and raceway locations and runs are to be coordinated with the architect prior to installation. All conduit runs must adhere to the historic building requirements.
- B. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- C. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- D. Complete raceway installation before starting conductor installation.
- E. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- G. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- H. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- I. Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project. Run conduits under floor slab as if exposed.
- J. Restrictions Applicable to EMT
 - 1. Do not use in areas subject to severe physical damage.
 - 2. Do not use in fire pump rooms.
- K. Restrictions Applicable to Nonmetallic Conduit
 - 1. PVC Schedule 40 and PVC Schedule 80
 - a. Do not use in areas where subject to severe physical damage, including but not limited to, mechanical equipment rooms, electrical equipment rooms, and other such areas.
 - b. Do not use in hazardous (classified) areas.
 - c. Do not use in fire pump rooms.
 - d. Do not use in penetrating fire-rated walls or partitions, or fire-rated floors.

- e. Do not use above grade.
- f. Convert nonmetallic conduit, to rigid steel conduit before rising through floor slab.

L. Restrictions Applicable to Flexible Conduit

- 1. Use only as specified in paragraph FLEXIBLE CONNECTIONS. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

M. Service Entrance Conduit, Underground

- 1. PVC, Type-EPC 40, galvanized rigid steel.
- 2. Convert nonmetallic conduit to rigid steel conduit before rising through floor slab.

N. Underground Conduit Other Than Service Entrance

- 1. Tape Wrapped rigid steel; PVC, Type EPC-40. Convert nonmetallic conduit to rigid steel conduit before rising through floor slab. Ten mil tape shall be 1/2 lapped and extend a minimum of 6 inches above floor.
- 2. Convert nonmetallic conduit to rigid steel conduit before rising through floor slab.

O. Conduit Installed Under Floor Slabs

- 1. Conduit run under floor slab shall be located a minimum of 12 inches below the vapor barrier. Seal around conduits at penetrations thru vapor barrier.
- 2. The Electrical Subcontractor will provide and pay for excavations and backfill for under grade slab conduit runs and coordinate the same with other utilities.
- 3. All structural fill/bedding material must be installed in accordance with the earthwork specifications, including compaction.

P. Conduit Through Floor Slabs

- 1. Where conduits rise through floor slabs, curved portion of bends shall not be visible above finished slab.
- 2. Convert nonmetallic conduit to rigid steel conduit before rising through floor slab.

Q. Conduit Installed in Concrete Floor Slabs

- 1. Rigid steel; PVC, Type EPC-40. Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits.
- 2. Space conduits horizontally not closer than three diameters, except at cabinet locations. Curved portions of bends shall not be visible above finish slab.
- 3. Increase slab thickness as necessary to provide minimum one inch cover over conduit.
- 4. Where embedded conduits cross building and/or expansion joints, provide suitable watertight expansion/deflection fittings and bonding jumpers. Expansion/deflection fittings shall allow horizontal and vertical movement of raceway.
- 5. Conduit larger than one inch trade size shall be parallel with or at right angles to main reinforcement; when at right angles to reinforcement, conduit shall be close to one of supports of slab.

6. Where nonmetallic conduit is used, raceway shall be converted to rigid steel before rising above floor, unless specifically indicated.

R. Stub-Ups

1. Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.
2. Convert nonmetallic conduit to rigid steel conduit before rising through floor slab.

S. Conduit Support

1. Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work.
2. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load.
3. Fasteners attached to concrete ceiling shall be vibration resistant and shock-resistant.
4. Holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints shall not cut main reinforcing bars. Fill unused holes.
5. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system.
6. Conduit and box systems shall be supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts.
7. Installation shall be coordinated with above-ceiling mechanical systems to assure maximum accessibility to all systems.
8. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Support exposed risers in wire shafts of multistory buildings by U-clamp hangers at each floor level and at 10 foot maximum intervals.
9. Where conduit crosses building expansion joints, provide suitable watertight expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means.
10. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

T. Directional Changes in Conduit Runs

1. Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

U. Locknuts and Bushings

1. Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

V. Flexible Connections

1. Provide flexible steel conduit between 3 and 6 feet in length for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size shall be 1/2 inch diameter. Provide liquidtight flexible conduit in wet and damp locations and in fire pump rooms for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections.

W. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

X. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

Y. Raceways for Optical Fiber and Communications Cable: Install as follows:

1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

Z. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

AA. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

- a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- BB. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- CC. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- DD. Set metal floor boxes level and flush with finished floor surface.
- EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- 3.3 INSTALLATION OF UNDERGROUND CONDUIT
- A. Excavation, Backfill and Concrete by General Contractor:
1. The General Contractor shall provide excavation, backfill and concrete for all underground and under floor slab conduits shown on the drawings.
 2. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving."
 3. Install backfill as specified in Division 31 Section "Earth Moving."
- B. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
- C. Direct-Buried Conduit:

1. Slope: Pitch ducts a minimum slope of 1:300 down toward handholes and away from buildings and equipment. Slope ducts from a high point in runs between two handholes to drain in both directions.
2. Wall Penetrations: Make a transition from PVC to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26.
3. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
4. Pulling Cord: Install test Greenlee No. 430 Poly Pull Line nylon cord in conduits, including spares.
5. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
6. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
7. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
8. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
9. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and conduits. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

D. Concrete-Encased Ducts: Support ducts on duct separators.

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
3. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
4. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
5. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

6. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
7. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
8. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 12 inches between non-primary power and signal ducts. 18 inches between primary power and signal ducts.
9. Partitions: A foam or plywood duct partition shall be used to make discontinuous the concrete between primary power and signal ducts.
10. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated or as required by the utilities.
11. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
12. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
13. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
14. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
15. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and conduits. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.
16. Conduit Cleaning and Testing
17. After conduits and accessories have been installed and all concreting operations, if any, completed, carefully clean and clear all conduit runs of all obstructions and foreign matter to the satisfaction of the DESIGNER.
18. Test conduits in the presence of the DESIGNER by pulling through each conduit 20-foot lengths of single conductor, Type THHN-THWN cable of the size and number given in the following table, or where called for, a flexible cylindrical mandrel having an outside diameter 1/4-inch less than the inside diameter of the conduit. Only nylon cable (no rope) that will withstand a reasonable stress shall be used to pull the mandrel through the conduit system.

Conduit Size	Wire Size or Mandrel
2 inch	3 - 250 kcmil
3 inch and larger	Mandrel

End of Section

SECTION 26 05 48

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. Section includes:
1. Isolation pads.
 2. Spring isolators.
 3. Restrained spring isolators.
 4. Channel support systems.
 5. Restraint cables.
 6. Hanger rod stiffeners.
 7. Anchorage bushings and washers.

1.3 SUBMITTALS

- A. Product Data: For the following.
1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
 3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.
- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.

- a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other Division 26 Sections for equipment mounted outdoors.
 - 2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
 - 3. Field-fabricated supports.
 - 4. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
 - C. Welding certificates.
 - D. Field quality-control reports.
- 1.4 QUALITY ASSURANCE
- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
 - B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
 - D. Comply with NFPA 70.
- 1.5 PERFORMANCE REQUIREMENTS
- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the State Building Code.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the State Building Code.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Approved Manufacturers

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Or approved equal.

B. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 SEISMIC-RESTRAINT DEVICES

A. Approved Manufacturers

1. Hilti
 2. Amber/Booth Company, Inc.
 3. Cooper B-Line, Inc.; a division of Cooper Industries.
 4. Or approved equal.
- B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.
- F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
- G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
- H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
1. Basis of Design: Hilti KCM - MD cast-in anchors and KWIK HUS-EZ I post-installed screw anchor.
- J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.
1. Basis of Design: Hilti HIT-RE 500 V3, HIT-HY 200, and HVU2 Adhesive anchors.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
 - 1. Install restrained isolators on electrical equipment.
 - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 2. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 3. Test to 90 percent of rated proof load of device.
 4. Measure isolator restraint clearance.
 5. Measure isolator deflection.
 6. Verify snubber minimum clearances.
 7. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust isolators after isolated equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

End of Section

Section 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Identification for conductors and communication and control cable.
 - 2. Warning labels and signs.
 - 3. Equipment identification labels.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

PART 2 - PRODUCTS

2.1 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with recognized industry standards for color and design.

- C. Operational Tags: Where needed for proper and adequate information on operation and maintenance of electrical systems, provide tags of plasticized card stock, preprinted.
- D. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- E. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).
- F. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 10 by 14 inches (250 by 360 mm).
- G. Fasteners for Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.
- H. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 mm)."

2.2 ELECTRICAL SYSTEM IDENTIFICATION

- A. Approved Manufacturers
 - 1. T&B.
 - 2. 3M.
 - 3. EMED Co.
 - 4. Or approved equal.
- B. Identification of Equipment:
 - 1. All pieces of major electrical equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Care shall be taken not to obliterate this nameplate in any way.
 - 2. The Contractor shall make it possible for the personnel operating and maintaining the equipment and systems in this project to readily identify the various pieces of equipment, junction boxes, etc., by marking them. All items of equipment, pull boxes, junction boxes, etc., shall be clearly marked using engraved nameplates as hereinafter specified. The item of equipment shall indicate the same number as shown on the Drawings, where applicable.
 - 3. White background and black letters equipment nameplates shall be three ply laminated plastic, a minimum of 3/32" thick, black background, white letters for normal power, red background, white letters for emergency power, and blue-white-blue for UPS power. Letters shall be similar to Roman Gothic of a size that

is legible (1/2" minimum for main nameplates and 3/8" minimum for branch device nameplates) and appropriate to the application. Attachment of nameplates shall be by stainless steel screws. Rivets or adhesives are not acceptable.

- a. Electrical equipment to be identified includes: All switchgear, switchboards, unit substations, distribution panels, transformers, motor control centers, panelboards, automatic transfer switches, busway plugs, disconnect switches, motor controller/starters, lighting control panels, pull boxes, junction boxes, and similar equipment.
- b. Nameplates on switchgear, switchboards, unit substations, automatic transfer switches, transformers, distribution panels, motor control centers, disconnect switches, motor controller/starters, variable frequency drives and panelboards shall give voltage and current characteristics and the source feeding the panel. Current characteristics shall indicate the size of the overcurrent devices serving the equipment and not the equipment current rating.
 - 1) Provide panel and circuit designation on disconnect switches, motor controllers/starters, variable frequency drives, etc.

Example:

PANEL PP2
120/208V, 3PH, 4 W, 225 A
Fed from DPA-3
Room 1.102

- c. Individual overcurrent devices and pilot lights in switchgear, switchboards, unit substations, distribution panels, motor control centers, and similar equipment shall have nameplates showing the load served and its location, where remote. Nameplates on motor starters shall indicate variable speed, time delay operation, etc., where applicable.
 - d. Blank nameplates shall be mounted on each spare or bussed space in motor control centers, and on each spare or space in distribution panels.
 - e. Branch circuit panelboards shall have neatly typed circuit directories behind clear plastic. Identify circuits by room numbers. Room numbers shall be those finally selected by the Owner; not necessarily those given on contract Drawings. Spares and spaces shall be indicated with erasable pencil; not typed. Circuit numbers shall be provided in the directory and at each circuit breaker.
- C. Conduit Systems: Provide adequate marking of major conduit which is exposed or concealed in accessible spaces, to distinguish each run as either a normal power, emergency power, fire alarm, control wiring or voice/data conduit. Except as otherwise indicated, use white banding with black lettering except that emergency power orange and white, fire alarm conduit markers shall use red banding. Provide self-adhesive or snap-on type plastic markers. Indicate voltage ratings of conductors exceeding 250 volts. Locate markers at ends of conduit runs, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors, or enters non-accessible construction and at spacings of not more than 30' along each run of exposed conduit.
- D. Cable Tray Systems: Provide engraved nameplates identifying cable tray systems as to use, on maximum 50' centers on all tray systems and whenever a tray enters a room or concealed accessible location. Nameplate text shall be submitted to the Engineer for review.

- E. Underground Cable Identification: Bury a continuous, preprinted, red and silver metallic ribbon cable marker, Brady No. 91600 Series or an approved equal with each underground cable (or group of cables), regardless of whether conductors are in conduit or direct buried. Locate each directly over cables, 12" above cable below finished grade. Ribbons shall be detectable from above grade using a pipe or cable locator.
- F. Cable/Conductor Identification: Coordinate a uniform and consistent scheme of color identification of power wiring throughout the building system. Identification shall be by the permanent color of the selected covering. On large conductors, secure identification by means of painted color banding or plastic tape.

1. Color scheme shall be as follows, or as required to match the existing color coding in the building for 120/240 V systems with high leg provide Orange for phase B.

	208/120 Volt	480/277 Volt	5kV/15kV
Phase A	Black	Brown	Black
Phase B	Red	Purple	Red
Phase C	Blue	Yellow	Blue
Neutral	White	Gray	White
Ground	Green	Green	

2. Wiring for switches shall be same color as phase wire.
3. Colored insulation in sizes up through #4. Conductors #3 and larger may have black insulation, but color coded with 1/2" wide band of colored tape, at accessible locations. Rap conductor minimum 6" width.
4. Feeder cables shall be tagged in pull boxes, wireways, wiring gutters of panels, and at other accessible locations. Tags shall be fireproof, nonconductive material, approved by Architect.
5. Maintain same conductor color from service entrance to last device.
- G. Phase Rotation: Phase rotation shall be maintained throughout the project.
1. Phase rotation shall be clockwise or counterclockwise, per serving power company standards, A-B-C, and identified as such left-to-right, top-to-bottom, and front-to-back with color coding as specified above at switchboards, panelboards, substations, transformers, motor control centers, motor starters, and similar locations.
2. Motor phase reversal, if necessary, shall be made at motor controller.
- H. Branch Circuit and Control Wiring Tags: All branch circuit and control wiring conductors shall be tagged using self-sticking vinyl cloth or mylar cloth wire markers. Embossed pressure sensitive plastic or metal ribbon markers will not be accepted. Tags shall be installed at all wiring splice, tap and termination points and shall correspond to the designations shown on the control wiring diagrams or panel schedules.
- I. Branch Circuit Pull Boxes and Junction Boxes: Branch circuit pull boxes shall be neatly stenciled with a black permanent marker indicating the panel name and branch circuit number. Boxes on emergency power systems shall be painted orange prior to marking. Boxes on fire alarm power systems shall be painted red prior to marking.

- J. Miscellaneous Switch Plates or Device Plates: Adhesive Film Label with Clear Protective Overlay for interior use: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).
 - 1. Nomenclature shall include the panel and circuit of the outlet or switch, or the indication of the pilot, or the area of control, or equipment served.
 - 2. Switched and non-switched device plates shall be engraved. Engraving shall be 3/16" condensed Gothic and shall be filled with black enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

3.2 CLEANING AND PAINTING OF ELECTRICAL WORK

- A. Prime, protective and touch-up painting is included in the Work of this Division. Finish painting in equipment spaces, concealed locations, and other locations not exposed to the view of building occupants is included in the work of this Division. Finished painting in areas exposed to the view of building occupants is specified under Division 9.
- B. All equipment and materials furnished by the electrical subcontractor shall be delivered to the job with suitable factory protective finish.
- C. Electrical switchgear, disconnect switches, contactors, etc., with suitable factory-applied finishes shall not be repainted; except for aesthetic reasons where located in finished areas as directed by the Architect and in a color selected by the Architect. Where factory-applied finishes are damaged in transit, storage or installation, or before final acceptance, they shall be restored to factory-fresh condition by competent refinishers using the spray process.
- D. All equipment not finished at the factory shall be given a prime coat and then finish painted with two coats of enamel in a color as directed by the Architect/Engineer. No nameplates on equipment shall be painted, and suitable protection shall be afforded such plates to prevent their being rendered illegible during the painting operations.
- E. The surfaces to be finish-painted shall first be prepared as follows:
 - 1. Galvanized and black steel surfaces shall first be painted with one coat of galvanized metal primer.

2. Aluminum surfaces shall first be painted with one coat of zinc chromate primer.
- F. All ferrous metal surfaces without a protective finish and not galvanized in exposed and concealed areas including chases, under floor and above ceilings shall be painted with two coats of zinc chromate primer as the construction progresses to protect against deterioration.
- G. All junction and pull boxes and covers which are part of raceway systems distributing emergency power shall be painted orange. Where a multiple branch emergency power system is installed, the branch designation (LS, CB or EQ) shall be stenciled on the box cover in minimum one inch (1") high white letters.
- H. All junction and pull boxes and covers and terminal cabinets which are part of the raceway/wiring system for emergency alarm wiring shall be painted orange and fire alarm wiring shall be painted red. A system designation (FA) shall be stenciled on the box or cabinet cover in minimum one inch (1") high white letters.
- I. All conduit exposed to view shall be finish painted as directed by the Architect.
- J. Before painting, all surfaces to be painted shall be suitably prepared. This shall include removing all oil, rust, scale, dirt, and other foreign material. Surfaces shall be made smooth by grinding, filing, brushing, or other approved method. In the painting operations, the primer for metal surfaces shall be of the zinc dust type unless specified otherwise, and where finish painting is specified, it shall be painted using materials and colors selected and approved by the Architect. Refer to Division 9 for additional requirements.

End of Section

Section 26 05 73

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes requirements for computer-based fault-current, overcurrent protective device coordination and arc flash protection studies. Protective devices shall be set based on Engineer's review of submitted results of the protective device coordination study.

- 1. Coordination of series-rated devices is not permitted.

1.3 SUBMITTALS

- A. The release of electrical equipment submittals (panelboards, engine generators, switchgear, etc.) is dependent on the receipt of a complete and accurate overcurrent protective device coordination study. The following submittals shall be in digital form:
 - 1. Coordination-study input data, including completed computer program input data sheets. Provide editable electronic media including all files and breaker TCC's.
 - 2. Study and Equipment Evaluation Reports.
 - 3. Coordination-Study Report; signed, dated, and sealed by a qualified professional engineer.
 - 4. Arc-flash study input data, including completed computer program input data sheets.
 - 5. Arc Flash Hazard Analysis Report; signed, dated, and sealed by a qualified professional engineer.
- B. Product Data: For computer software program to be used for studies.
- C. Qualification Data: For Coordination Study Specialist and Arc-Flash Hazard Analysis Specialist.
- D. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399. For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.
- E. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

1.4 DEFINITIONS

- A. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- B. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- C. SCCR: Short-circuit current rating.
- D. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.5 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.
- B. Qualifications: Comprehensive engineering analysis by qualified Professional Engineer or personnel trained and employed by the equipment manufacturer in required calculation methodology.
 - 1. Analysis to be performed by Professional Engineer or personnel trained, employed, and supervised by a registered Professional Engineer.
 - 2. Registered professional engineer shall be a full-time employee of the electrical equipment manufacturer or a professional engineering firm.
 - 3. Report shall be signed and sealed by a Professional Engineer with current registration.
- C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
- D. Comply with IEEE 399 for general study procedures.
- E. Comply with IEEE 1584 for performing Arc Flash Hazard Calculations.

1.6 PERFORMANCE REQUIREMENTS

- A. Fault Current Study: Prepare computer-based, fault current study to calculate the maximum available short-circuit current in amperes RMS symmetrical at circuit-breaker positions of the electrical power distribution system based on proposed feeder routing.
- B. Overcurrent Protective Device Coordination: Prepare computer-based, selective coordination study such that all overcurrent protective devices proposed for inclusion in the Work shall be selected to be selectively coordinated for total selective coordination with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open.

1. Total selective coordination shall be carried through each level of distribution for all branches of emergency power system. Emergency power systems shall include life safety, legally required standby systems, critical operations power systems, and fire pumps.
 2. The normal power system and standby power system shall be coordinate to 0.01s.
- C. Arc Flash Hazard Analysis: Prepare computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved Manufacturers
1. SKM Systems Analysis, Inc.
 2. EasyPower, LLC.
 3. Power Analytics Corporation.
 4. Or approved equal.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

- A. Comply with IEEE 399 for fault-current and overcurrent protective device coordination studies.
- B. Comply with IEEE 1584 and NFPA 70E for arc-flash hazard analysis.
- C. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate coordination by computer-generated, time-current coordination plots.

2.3 POWER SYSTEM STUDIES

- A. The Electrical Subcontractor shall request information required to complete the power system studies from the Utility Company. This information shall be provided to the manufacturer upon request.
- B. The manufacturer shall make all necessary modifications to the circuit breaker types for a fully coordinate electrical system to comply with the specifications.
- C. Short Circuits Studies, Protective Device Evaluation Studies, and Protective Device Coordination Studies shall be provided by the Manufacturer. The studies shall be submitted to the Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacture. If formal completion of the studies may cause delay in equipment manufacture, approval may be obtained for a

preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.

2.4 POWER SYSTEM DATA

- A. The Design System Analyst performing the short-circuit, protective device coordination study, and arc flash hazard analysis shall furnish the Contractor with a list of required data immediately after award of the contract. Contractor shall expedite collection of the data to ensure completion of the study and analysis as required.
- B. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
- C. Source combination shall include present and future motors and generators indicated in the documents.
- D. If applicable, include fault contribution of existing motors in the study and analysis.
- E. Gather and tabulate the following input data to support coordination study:
 - 1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 - 2. Impedance of utility service entrance.
 - 3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
 - a. Circuit breakers and fuses ratings and types.
 - b. Relays and associated power and current transformer ratings and ratios.
 - c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, X/R ratios, taps measured in per cent, and phase shift.
 - d. Generator short-circuit current contribution data, including short-circuit reactance, rated kilovolt amperes, size, rated voltage, and X/R ratio.
 - e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
 - f. Busway ampacity, impedance, lengths, and conductor material.
 - g. Motor horsepower and code letter designation according to NEMA MG 1.
 - h. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
 - i. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.
 - 4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Generator thermal-damage curve.

- e. Ratings, types, and settings of utility company's overcurrent protective devices.
- f. Special overcurrent protective device settings or types stipulated by utility company.
- g. Time-current-characteristic curves of devices.
- h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
- i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
- j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

2.5 SHORT-CIRCUIT STUDY REPORT CONTENT

- A. Executive Summary
- B. Study descriptions, purpose, basis and scope of the study.
- C. One-line diagram, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Cable size and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center and panelboard designations.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Short-Circuit Study Output:
 - 1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
 - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.
- F. Incident Energy and Flash Protection Boundary:
 - 1. Calculations:
 - a. Arcing fault magnitude.
 - b. Protective device clearing time.
 - c. Duration of arc.
 - d. Arc-flash boundary.
 - e. Working distance.
 - f. Incident energy.

- g. Hazard risk category.
 - h. Recommendations for arc-flash energy reduction.
- 2. Circuit breakers rated 1200A and higher shall be provided with an Arc flash Reduction Maintenance System for accelerated instantaneous trip to reduce arc flash. The setting shall be determined by the arc flash study and set in the field by the manufacturer's representative.
 - a. The pickup setting is chosen using the following steps:
 - 1) Calculate the arcing fault current that could flow through the circuit breaker associated with the Arc flash Reduction Maintenance System. Formulas from IEEE STD 1584TM-2002 are used to calculate the arcing current.
 - 2) Determine the total transient load current that can flow to loads fed by the circuit breaker equipped with the Arc flash Reduction Maintenance System. These can include motor inrush and transformer inrush.
 - 3) Choose a pickup setting for the Arc flash Reduction Maintenance System that is:
 - a) Below 75% of calculated arcing current.
 - b) Above the total transient load current.
- G. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.
- H. Equipment specific Arc Flash Warning Labels.
- I. Recommendations for system improvements, where needed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance.
 - 1. Proceed with coordination study and arc-flash study only after relevant equipment submittals have been assembled, but prior to their submission to the Architect.
 - 2. Coordination study shall accompany submission of relevant equipment submittals.

3.2 FAULT-CURRENT STUDY

- A. A short-circuit current ratings indicated in the Contract Documents are based on Fault-Current study prepared by the Engineer during design and are based on available information and anticipated feeder lengths. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system based on proposed feeder routing. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
 - 1. Electric Utility's supply termination point.
 - 2. Switchgear and switchboard bus.
 - 3. Motor-control center.
 - 4. Distribution panelboard.

5. Branch circuit panelboard.
 6. Standby Generators and Transfer Switches.
 7. Enclosed Fused Switch.
 8. Enclosed Circuit Breaker.
- B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
- C. Calculate momentary and interrupting duties on the basis of maximum available fault current.
- D. Calculate short-circuit currents according to IEEE 551.
- E. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 241 and IEEE 242.
1. Transformers, as appropriate for transformers included in the Work:
 - a. ANSI C57.12.10.
 - b. ANSI C57.12.22.
 - c. ANSI C57.12.40.
 - d. IEEE C57.12.00.
 - e. IEEE C57.96.
 2. Medium-Voltage Circuit Breakers: IEEE C37.010.
 3. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
 4. Low-Voltage Fuses: IEEE C37.46.
- F. Study Report:
1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
- G. Equipment Evaluation Report:
1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
 3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 4. Notify Engineer, in writing, of any existing circuit protective devices improperly rated for the calculated available fault current.
- 3.3 COORDINATION STUDY
- A. Coordination (Selective): Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the selection and installation of overcurrent protective devices and their ratings or settings for the full range of available overcurrents, from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents.

1. Emergency system (Life Safety) overcurrent devices shall be fully selectively coordinated with all supply side overcurrent protective devices (emergency and normal).
- B. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.
 1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
 2. Calculate the maximum and minimum ground-fault currents.
- C. Comply with IEEE 241 and IEEE 242 recommendations for fault currents and time intervals.
- D. The studies shall include all portions of the electrical distribution system from the normal power source and emergency/standby power sources down to and including the 120/208V distribution system. Normal/emergency/standby system connections and those which result in maximum fault conditions shall be adequately covered in the study.
- E. All emergency system overcurrent devices shall be selectively coordinated with the overcurrent devices installed on their supply side per Section 700.27 of the National Electrical Code. The generator circuit breakers shall be of the same manufacturer as the switchboard. Provide a letter from the manufacturer stating that the overcurrent devices have been selectively coordinated.
- F. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.
 1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
 2. Calculate the maximum and minimum ground-fault currents.
- G. Comply with IEEE 241 and IEEE 242 recommendations for fault currents and time intervals.
- H. Transformer Primary Overcurrent Protective Devices:
 1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
- I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

- J. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
 - a. Device tag.
 - b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
 - c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
 - d. Fuse-current rating and type.
 - e. Ground-fault relay-pickup and time-delay settings.
 2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
 - a. Device tag.
 - b. Voltage and current ratio for curves.
 - c. Three-phase and single-phase damage points for each transformer.
 - d. No damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.
 - f. Transformer inrush points.
 - g. Maximum fault-current cutoff point.
 - h. Motor starting characteristics, damage points and overload relay.
 - i. Thermal damage curve for motors larger than 100 HP.
 - j. Generator short-circuit decrement curve and damage point, and thermal damage curve.
- K. Completed data sheets for setting of overcurrent protective devices.
- L. Complete Schedule of breaker settings to summarize information contained on data sheets. Sample schedule has been included at the end of this section for preferred format.
- 3.4 ARC FLASH HAZARD ANALYSIS
- A. Comply with IEEE 1584 for arc flash hazard analysis.
 - B. Comply with NFPA 70E and its Annex D for hazard analysis study.
 - C. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system where work could be performed on energized parts including, but not limited to, the following:
 1. Disconnect switches.
 2. Electrical substations.
 3. Electrical switchgear and switchboards.
 4. Emergency system boxes and enclosures.
 5. Enclosed circuit breakers.
 6. Meter Sockets and assemblies.
 7. Motor starter.
 8. Motor-control centers.

9. Panelboards.
 10. Power transfer equipment. (ATS)
 11. Transformers.
 12. Uninterruptible power supply equipment.
- D. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent protection relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.
- E. Calculate the arc-flash protection boundary and the corresponding incident energy calculations for multiple system scenarios to be compared and the greatest incident energy to be uniquely reported for each equipment location. Calculations to be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions.
1. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off).
 2. The maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.
- F. Incident energy calculations shall consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators to be decremented as follows:
1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
 2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible.
- G. For each equipment location with a separately enclosed main device, calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.
1. When performing incident energy calculations on the line side of a main breaker, the line side and load side contributions must be included in the fault calculation.
- H. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device to compute the incident energy for the corresponding location.
- I. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash even, a maximum clearing time based on the specific location shall be utilized.
- J. Complete Arc Flash report to be used for the preparation of Arc Flash Warning labels for electrical equipment. Refer to Division 26 Section "Identification for Electrical Systems" for requirements of Arc Flash Study and labels.

3.5 CORRECT DEFICIENCIES, RE-CALCULATE AND REPORT

- A. After Engineer's initial review, correct unsatisfactory conditions and recalculate to demonstrate compliance; resubmit overcurrent protective devices as required to bring system into compliance.
- B. Revise and Resubmit report multiple times as necessary to demonstrate compliance with requirements.

3.6 APPLICATION OF WARNING LABELS

- A. Install arc-flash warning labels as specified in Division 26 Section "Identification for Electrical Systems". Install labels under the direct supervision and control of the Arc-Flash Hazard Study Specialist.

3.7 ARC-FLASH WARNING LABELS

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems." Produce a 3.5-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester for each work location included in the analysis.
- B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
 - 1. Flash Hazard Boundary.
 - 2. Short Circuit Current Available and date the calculation was performed.
 - 3. Shock Hazard when Cover is Removed.
 - 4. Limited Approach Boundary.
 - 5. Restricted Approach Boundary.
 - 6. Prohibited Approach Boundary.
 - 7. PPE Requirements, including the following:
 - a. Hazard Risk Category
 - b. Required Minimum Arc Rating of PPE in cal/cm²
 - c. Clothing Description
 - 8. Engineering report number, revision number, and issue date.
- C. Labels shall be machine printed, with no field-applied markings.

End of Section

SECTION 26 09 43
NETWORK LIGHTING CONTROLS
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. All the Contract Documents, including Drawings, General Conditions, Supplementary Conditions, and all Sections of Division 01 - General Requirements, apply to the Work of this Section.

1.2 SUMMARY

- A. Section Includes wireless lighting control systems and associated components:
 - 1. Wireless occupancy/vacancy sensors.
 - 2. Wireless daylight sensors.
 - 3. Wired load control modules with wireless communication inputs.
 - a. Includes fixture control modules with wired occupancy/vacancy/daylight sensors.
 - 4. Wired receptacles with wireless communication inputs.
 - 5. Wireless fixture control components factory-installed in luminaires not specified in this section.
 - 6. Wired wall dimmers and switches with wireless communication inputs.
 - 7. Wired wallbox occupancy sensors with wireless communication inputs.
 - 8. Wireless control stations.
 - 9. Fluorescent electronic dimming ballasts.
 - 10. LED Drivers.
 - 11. Power interfaces.
 - 12. Digital dimming ballast modules.
- B. Wireless hub(s) for centralized control, monitoring, and system integration.
- C. Software data and analytics dashboard, including server requirements.

1.3 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices; current edition.
- B. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.
- C. ANSI/ESD S20.20 - Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices); 2014.
- D. ASTM D4674 - Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments; 2002a (Reapproved 2010).

- E. CAL TITLE 24 P6 – California Code of Regulations, Title 24, Part 6 (California Energy Code); 2013.
- F. CSA C22.2 No. 223 – Power Supplies with Extra-low-voltage Class 2 Outputs; 2015.
- G. IEC 60929 - AC and/or DC-Supplied Electronic Control Gear for Tubular Fluorescent Lamps - Performance Requirements; 2015.
- H. IEC 61000-4-2 - Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test; 2008.
- I. IEC 61347-2-3 - Lamp Control Gear - Part 2-3: Particular Requirements for A.C. and/or D.C. Supplied Electronic Control Gear for Fluorescent Lamps; 2011, with Amendments, 2016.
- J. IEEE 1789 - Recommended Practice for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers; 2015.
- K. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).
- L. ISO 9001 - Quality Management Systems-Requirements; 2008.
- M. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- N. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.
- O. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; National Electrical Manufacturers Association; 2015.
- P. NEMA SSL 7A – Phase Cut Dimming for Solid State Lighting: Basic Compatibility; National Electrical Manufacturers Association; 2015.
- Q. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2015).
- R. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- S. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- T. UL 508 - Industrial Control Equipment; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.
- U. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- V. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.
- W. UL 1310 – Class 2 Power Units; Current Edition, Including All Revisions.

- X. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.
- Y. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.
- Z. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.
- AA. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. Lighting Control Manufacturer to provide plans indicating occupancy/vacancy and/or daylight sensor locations.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
- C. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.
- D. Wall Dimmers: Include derating information for ganged multiple devices.
- E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. System Performance-Verification Documentation.

1.5 CLOSEOUT SUBMITTALS

- A. Sustainable design closeout documentation.
- B. Wireless lighting control system manufacturer to provide an operation and maintenance manual that details the start-up procedure being performed including a process to follow, details on tests performed and an area that documents any test results.

1.6 QUALITY ASSURANCE

- A. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- B. Manufacturer Qualifications:
 - 1. Company with not less than ten years of experience manufacturing lighting control products using wireless communication between devices.
 - 2. Registered to ISO 9001, including in-house engineering for product design activities.
 - 3. Provides factory direct technical support hotline available 24 hours per day, 7 days per week.

4. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.

1.7 PROGRAMMING

- A. Coordinate and obtain a written approval of system functionality from the Owner prior to programming.
- B. Perform a walk-through with the Owner and demonstrate the system functionality.
- C. Make any adjustments to system functionality after initial programming if necessary, to achieve the desired functionality requested by the Owner.
- D. Obtain a written final letter of acceptance from the Owner upon completion of system functionality programming and demonstration.

1.8 COORDINATION REQUIREMENTS

- A. Coordination:
 1. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.
 2. Coordinate the placement of wall controls with actual installed door swings.
 3. Coordinate the placement of daylight sensors with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
 4. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.
 5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.
- B. Pre-Wire Meeting: Lighting Control Manufacturer to conduct an on-site meeting prior to commencing work. Manufacturer to review with installer:
 1. Low voltage wiring requirements.
 2. Separation of power and low voltage/data wiring.
 3. Wire labeling.
 4. Wireless hub locations and installation.
 5. Sensor locations to be reviewed in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
 6. Control locations.
 7. Computer jack locations.
 8. Load circuit wiring.
 9. Network wiring requirements.
 10. Connections to other equipment.
 11. Installer responsibilities.
 12. Sequencing:
 - a. Do not install sensors and wall controls until final surface finishes and painting are complete.

1.9 QUALITY ASSURANCE

- A. Product shall confirm to requirements outlined in NFPA 70.
- B. Manufacturer: manufacturer shall have at least 10 years of experience in the manufacture of lighting control systems. Manufacturers that do not have at least 10 years of experience shall not be acceptable.
- C. System components:
 - 1. Listed by an OSHA Nationally Recognized Testing Laboratory specifically for the electronic ballast/driver loads. Provide evidence of compliance upon request.
 - 2. Listed by FCC specifically for the required wireless communication protocols. Provide evidence of compliance upon request.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.11 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.
 - 1. Unless Otherwise Indicated:
 - a. Ambient Temperature:
 - 1) Lighting Control System Components, between 32 and 104 degrees F (0 and 40 degrees C).
 - 2. Relative Humidity: Less than 90 percent, non-condensing.
 - 3. Protect lighting controls from dust.

1.12 CYBERSECURITY

- A. The network connectable products within the Wireless Lighting Control system must be UL2900-1 listed to the Standard for Software Cybersecurity for Network-Connectable Products. Wireless Lighting Control Systems that fail to meet this requirement will not be accepted.

1.13 WARRANTY

- A. Comply with Section 260001.
- B. The Electrical Contractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.
- C. Manufacturer's Standard Warranty, With Manufacturer Full-Scope Start-Up; Standard 2-Year Warranty;

D. Manufacturer Lighting Control System Components, Except Lighting Management System Computer, Ballasts/Drivers and Ballast Modules:

1. First Two Years:
 - a. 100 percent replacement parts coverage, 100 percent manufacturer labor coverage to troubleshoot and diagnose a lighting issue.
 - b. First-available on-site or remote response time.
 - c. Remote diagnostics for applicable systems.
 - d. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.
2. Lighting Management System Computer: One year 100 percent parts coverage, one year 100 percent manufacturer labor coverage.
3. Ballasts/Drivers and Ballast Modules:
 - a. With Remote Full-Scope Start-Up: Three years 100 percent parts coverage, no manufacturer labor coverage.
 - b. With On-Site Full-Scope Start-Up: Five years 100 percent parts coverage, no manufacturer labor coverage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturers

1. Lutron Vive
2. Cooper Lighting, WaveLinx Connected Lighting (WCL) system
3. Acuity Brands, nLight Air
4. Or approved equal

B. Basis of Design

1. Lutron Electronics Company, Inc; Vive; www.lutron.com.

C. Substitutions

1. By using pre-approved substitutions, Contractor accepts responsibility and associated costs for all required modifications to related equipment and wiring. Provide complete shop drawings (including power wiring) with deviations from the original design highlighted in an alternate color for review and approval by Architect prior to rough-in.

D. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.2 LIGHTING CONTROLS - GENERAL REQUIREMENTS

A. Sensor Layout and Tuning: include Lighting Control Manufacturer's Sensor Layout and Tuning service; Lutron LSC-SENS-LT:

1. Lighting Control Manufacturer to take full responsibility for wired or wireless occupancy/vacancy and daylight sensor layout and performance for sensors provided by Lighting Control Manufacturer.
 2. Lighting Control Manufacturer to analyze the reflected ceiling plans, via supplied electronic AutoCAD format, and design a detailed sensor layout that provides adequate occupancy sensor coverage and ensures occupancy and daylight sensor performance per agreed upon sequence of operations. Contractor to utilize the layouts for sensor placement.
 3. During startup, Lighting Control Manufacturer to direct Contractor regarding sensor relocation, as required, should conditions require a deviation from locations specified in the drawings.
 4. Lighting Control Manufacturer to provide up to two additional post-startup on-site service visits, within one calendar year from Date of Substantial Completion to fine-tune sensor calibration per the agreed upon sequence of operations.
- B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.
- C. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, programming, etc. as necessary for a complete operating system that provides the control intent indicated.
- D. Design lighting control equipment for 10-year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C) and 90 percent non-condensing relative humidity.
- E. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.
- F. Power Failure Recovery: When power is interrupted for periods up to 10 years; and subsequently restored, lights to automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
- G. Wireless Devices:
1. Wireless device family includes area or fixture level sensors, area or fixture level load controls for dimming or switching, and load controls that can be mounted in a wallbox, on a junction box, or at the fixture.
 2. Wireless devices including sensors, load controls, and wireless remotes or wall stations, can be set up using simple button press programming without needing any other equipment (e.g. central hub, processor, computer, or other smart device).
 3. Wireless hub adds the ability to set up the system using any smart device with a web browser (e.g. smartphone, tablet, PC, or laptop).
 4. System does not require a factory technician to set up or program the system.
 5. Capable of diagnosing system communications.
 6. Capable of having addresses automatically assigned to them.
 7. Receives signals from other wireless devices and provides feedback to user.
 8. Capable of determining which devices have been addressed.
 9. RF Range: 60 feet (18 m) line-of-sight or 30 feet (9 m) through typical construction materials between RF transmitting devices and compatible RF receiving devices.
 10. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 15, for Class B application.

H. Wireless Network:

1. RF Frequency: 434 MHz; operate in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.
 - a. Wireless sensors, wireless wall stations and wireless load control devices do not operate in the noisy 2.4 GHz frequency band where high potential for RF interference exists.
 - b. Wireless devices operate in an uncongested frequency band providing reliable operation.
 - c. Fixed network architecture ensures all associated lights and load controls respond in a simultaneous and coordinated fashion from a button press, sensor signal, or command from the wireless hub (i.e. no popcorning).
2. Distributed Architecture: Local room devices communicate directly with each other. If the wireless hub is removed or damaged, local control, sensing, and operation continues to function without interruption.
3. Local room devices communicate directly with each other (and not through a central hub or processor) to ensure:
 - a. Reliability of system performance.
 - b. Fast response time to events in the space (e.g. button presses or sensor signals).
 - c. Independent operation in the event of the wireless hub being removed or damaged.
4. Device Finishes:
 - a. Wall Controls: To be selected by Architect from the manufacturer's standard colors.

I. Interface with building automation system; Lutron System and Network Integration Consultation; LSC-INT-VISIT.

2.3 WIRELESS SENSORS

A. General Requirements:

1. Operational life of 10 years without the need to replace batteries when installed per manufacturer's instructions.
2. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.
3. Does not require external power packs, power wiring, or communication wiring.
4. Capable of being placed in test mode to verify correct operation from the face of the unit.
5. Provides a clearly visible method of indication to verify that motion is being detected during testing and that the unit is communicating to compatible RF receiving devices.
6. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
7. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions; Lutron XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
8. Provide optional, readily accessible, user-adjustable controls for timeout, automatic/manual-on, and sensitivity.

9. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
10. Capable of turning dimmer's lighting load on to an optional locked preset level selectable by the user. Locked preset range to be selectable on the dimmer from 1 percent to 100 percent.
11. Color: White.
12. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
13. Provide temporary mounting means for drop ceilings to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.
14. Sensor lens to illuminate during test mode when motion is detected to allow installer to place sensor in ideal location and to verify coverage prior to permanent mounting.
15. Ceiling-Mounted Sensors:
16. Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
17. Provide recessed mounting bracket compatible with drywall and compressed fiber ceilings.
18. Wall-Mounted Sensors: Provide wall or corner mounting brackets compatible with drywall and plaster walls.

B. Wireless Combination Occupancy/Vacancy Sensors:

1. Ceiling-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), an occupancy sensor with low light feature (automatic-on when less than one footcandle of ambient light available and automatic-off), or a vacancy sensor (manual-on and automatic-off).
2. Wall-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), or a vacancy sensor (manual-on and automatic-off).
3. Product(s):
 - a. Ceiling-Mounted Occupancy/Vacancy Sensor; <Lutron Radio Powr Savr Series, Model LFR2-OCR2B-P-WH; or Lutron Radio Powr Savr Series, Model ULFR2-OCR2B-P-WH (BAA-Buy American Act Compliant): Coverage from 324 square feet (30.2 sq m) to 676 square feet (62.4 sq m) depending on ceiling height from 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view.
 - b. Wall-Mounted Occupancy/Vacancy Sensor; Lutron Radio Powr Savr Series, Model LFR2-OWLB-P-WH; or Lutron Radio Powr Savr Series, Model ULFR2-OWLB-P-WH (BAA-Buy American Act Compliant): Minor motion coverage of 1500 square feet (139.4 sq m) and major motion coverage of 3000 square feet (278.7 sq m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); 180 degree field of view.
 - c. Corner-Mounted Occupancy/Vacancy Sensor; Lutron Radio Powr Savr Series, Model LFR2-OKLB-P-WH; or Lutron Radio Powr Savr Series, Model ULFR2-OKLB-P-WH (BAA-Buy American Act Compliant): Minor motion coverage of 1225 square feet (113.8 sq m) and major motion coverage of 2500 square feet (232.3 sq m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); 90 degree field of view.
 - d. Hallway Occupancy/Vacancy Sensor; Lutron Radio Powr Savr Series, Model LFR2-OHLB-P-WH; or Lutron Radio Powr Savr Series, Model

ULFR2-OHLB-P-WH (BAA-Buy American Act Compliant): Major motion coverage of up to 150 feet (45.7 m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); narrow field of view.

C. Wireless Daylight Sensors:

1. Product: Lutron Radio Powr Savr Series, Model LFR2-DCRB-WH.
2. Open-loop basis for daylight sensor control scheme.
3. Stable output over temperature from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C).
4. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.
5. Provide linear response from 2 to 150 footcandles.
6. Color: White.
7. Mounting:
 - a. Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
 - b. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
 - c. Provide temporary mounting means for drop ceilings to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.

2.4 LOAD CONTROL MODULES

A. Provide wireless load control modules as indicated or as required to control the loads as indicated.

B. Junction Box-Mounted Modules:

1. Plenum rated.
2. 0-10 V Dimming Modules:
 - a. Product(s):
 - 1) 8 A dimming module with 0-10V control, without emergency mode; Lutron PowPak Dimming Module Model RMJS-8T-DV-B; or Lutron PowPak Dimming Module Model URMJS-8T-DV-B (BAA-Buy American Act Compliant).
 - 2) 8 A dimming module with 0-10V control, with emergency mode; Lutron PowPak Dimming Module Model RMJS-8T-DV-B-EM.
 - b. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
 - c. Single low voltage dimming module with Class 1 or Class 2 isolated 0-10V output signal conforming to IEC 60929 Annex E.2; source or sink automatically configures.
 - d. Selectable minimum light level.
 - e. Configurable high- and low-end trim.
 - f. Relay: Rated for 0-10 V ballasts, LED drivers, or fixtures that conform with NEMA 410.
 - g. Dimming Modules with Emergency Mode:
 - 1) Operation With Lutron Vive Wireless Hub: Upon loss of power, dimming module enters and remains in emergency mode as long as

- wireless hub is de-energized; upon restoration of power to wireless hub, dimming module returns to normal mode and lights automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
 - 2) Operation Without Lutron Vive Wireless Hub: Upon loss of power, dimming module enters and remains in emergency mode for 90 minutes, during which time local unit buttons and wireless controls are disabled.
 - 3) Used with Lutron Model LUT-ELI-3PH emergency lighting interface to achieve total system UL 924 listing.
 - 3. Phase Selectable Dimming Modules:
 - a. Product(s):
 - 1) Phase selectable dimming module, without emergency mode; Lutron Vive Phase Select PowPak Model RMJS-PNE-DV.
 - 2) Phase selectable dimming module, with emergency mode; Lutron Vive Phase Select PowPak Model RMJS-PNE-DV-EM.
 - b. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
 - c. Dimming; Lutron PRO LED+:
 - 1) UL listed for LED control in forward or reverse phase modes. Provide published LED performance testing on both forward and reverse phase dimming.
 - 2) UL listed for fluorescent, electronic low voltage, and magnetic low voltage control.
 - d. Provides leading-edge or trailing-edge dimming; manual configuration.
 - e. Selectable minimum light level.
 - f. Configurable high- and low-end trim.
 - g. Provide cycle-by-cycle compensation for incoming variations, including changes in frequency, harmonics, and line noise; accommodate up to plus/minus two percent change in frequency per second.
 - h. Comply with NEMA SSL 7A.
 - i. Rated Load: Electronic low voltage (reverse phase, 450 W, 120/277 V), dimmable LED (reverse phase, 450 VA, 120/277 V; forward phase, 200 W, 120 V), incandescent/halogen (450 W, 120/277 V), magnetic low voltage (400 VA/320 W, 120/277 V), Lutron Hi-lume 1% 2-wire LED Driver (3 A, 120 V - maximum of 13 drivers), fluorescent (forward phase, 400 VA, 120/277 V).
 - j. Dimming Modules with Emergency Mode:
 - 1) Operation With Lutron Vive Wireless Hub: Upon loss of power, dimming module enters and remains in emergency mode as long as wireless hub is de-energized; upon restoration of power to wireless hub, dimming module returns to normal mode and lights automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
 - 2) Operation Without Lutron Vive Wireless Hub: Upon loss of power, dimming module enters and remains in emergency mode for 90 minutes, during which time local unit buttons and wireless controls are disabled.
 - 3) Used with Lutron Model LUT-ELI-3PH emergency lighting interface to achieve total system UL 924 listing.
- 4. Digital Ballast/LED Driver Dimming Modules:

- a. Product: Lutron PowPak Single Zone Control Module with EcoSystem; Model RMJS-ECO32-SZ.
 - b. Single dimming module with Class 1 or Class 2 isolated digital output signal conforming to IEC 60929; capable of direct control without interface.
 - c. Provides direct low-voltage control of up to 32 compatible Lutron EcoSystem and third party DALI digital ballasts/LED drivers as a single zone (multiple ballasts/LED drivers connected to same module will be at same light level).
 - 1) Electronically links a digital ballast/LED driver to a zone for both dimming and turning on/off.
 - 2) Electronically assigns occupancy/vacancy sensors for manual on/auto off and auto on/auto off control.
 - 3) Electronically assigns wireless control stations for manual local control.
 - 4) Electronically assigns daylight sensor for automatic daylight dimming.
 - d. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
 - e. Selectable minimum light level.
 - f. Configurable high- and low-end trim.
5. Relay Modules:
- a. Product(s):
 - 1) 16 A relay module, without emergency mode, without contact closure output; Lutron PowPak Relay Module Model RMJS-16R-DV-B; or Lutron PowPak Relay Module Model URMJS-16R-DV-B (BAA-Buy American Act Compliant).
 - 2) 16 A relay module, with emergency mode, without contact closure output; Lutron PowPak Relay Module Model RMJS-16R-DV-B-EM.
 - 3) 16 A relay module, without emergency mode, with contact closure output; Lutron PowPak Relay Module Model RMJS-16RCCO1-DV-B; or Lutron PowPak Relay Module Model URMJS-16RCCO1-DV-B (BAA-Buy American Act Compliant).
 - 4) 5 A relay module, without emergency mode, without contact closure output; Lutron PowPak Relay Module Model RMJS-5R-DV-B.
 - 5) 5 A relay module, without emergency mode, with contact closure output; Lutron PowPak Relay Module Model RMJS-5RCCO1-DV-B.
 - b. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
 - c. Relay:
 - 1) Rated Life of Relay: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
 - 2) Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
 - 3) Fully rated output continuous duty for inductive, capacitive, and resistive loads.
 - d. Contact Closure Output:
 - 1) Single contact closure output with normally open and normally closed dry maintained contacts suitable for connection to third party equipment (e.g. building management system, HVAC system, etc.).
 - 2) Contact Ratings: Resistive load; 1 A at 0-24 VDC, 0.5 A at 0-24 VAC.

- 3) Controlled by associated occupancy/vacancy sensors and wall controls.
 - e. Relay Modules With Emergency Mode:
 - 1) Operation With Lutron Vive Wireless Hub: Upon loss of power, relay module enters and remains in emergency mode as long as wireless hub is de-energized; upon restoration of power to wireless hub, relay module returns to normal mode and lights automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
 - 2) Operation Without Lutron Vive Wireless Hub: Upon loss of power, relay module enters and remains in emergency mode for 90 minutes, during which time local unit buttons and wireless controls are disabled.
 - 3) Used with Lutron Model LUT-ELI-3PH emergency lighting interface to achieve total system UL 924 listing.
- 6. 20 A Receptacle Modules:
 - a. Product(s):
 - 1) 20 A receptacle module, without contact closure output; Lutron PowPak 20 A Relay Module Model RMJS-20R-DV-B.
 - 2) 20 A receptacle module, with contact closure output; Lutron PowPak 20 A Relay Module Model RMJS-20RCCO1-DV-B.
 - b. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, and ten wireless control stations.
 - c. Relay:
 - 1) Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
 - 2) Motor rating of 1 HP at 120 V, 2 HP at 277 V.
 - d. Contact Closure Output:
 - 1) Single contact closure output with normally open and normally closed dry maintained contacts suitable for connection to third party equipment (e.g. building management system, HVAC system, etc.).
 - 2) Contact Ratings: Resistive load; 1 A at 0-24 VDC, 0.5 A at 0-24 VAC.
 - 3) Controlled by associated occupancy/vacancy sensors and wall controls.
- 7. Contact Closure Output Modules:
 - a. Product: Lutron PowPak CCO Module Model RMJS-CCO1-24-B; or Lutron PowPak CCO Module Model URMJS-CCO1-24-B (BAA-Buy American Act Compliant).
 - b. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
 - c. Contact Closure Output:
 - 1) Single contact closure output with normally open and normally closed dry maintained contacts suitable for connection to third party equipment (e.g. building management system, HVAC system, etc.).
 - 2) Contact Ratings: Resistive load; 1 A at 0-24 VDC, 0.5 A at 0-24 VAC.
 - 3) Operation affected by associated occupancy/vacancy sensors and wall controls.

C. Fixture Control Modules/Sensors:

1. Fixture Control Modules:
 - a. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
 - b. Communicates via wired input with one combination occupancy/daylight or vacancy/daylight fixture sensor.
 - c. Coordination between Wired and Wireless Sensors:
 - 1) Occupancy/Vacancy Sensing: Wired and wireless sensors work in conjunction (occupancy detected by either sensor turns lights on and vacancy detected by both sensors turns lights off).
 - 2) Daylight Sensing: Wireless sensor takes precedence over wired sensor.
 - d. Selectable minimum light level.
 - e. Configurable high- and low-end trim.
 - f. Plenum rated.
 - g. Mounts to fixture or junction box through ½ inch (16 mm) trade size knockout.
 - h. Digital Ballast/LED Driver Fixture Control Modules:
 - 1) Product(s):
 - a) Digital ballast/LED driver fixture control module, without emergency mode; Lutron PowPak Wireless Fixture Control for EcoSystem ballasts/drivers; Model FCJS-ECO.
 - b) Digital ballast/LED driver fixture control module, with emergency mode; Lutron PowPak Wireless Fixture Control for EcoSystem ballasts/drivers; Model FCJS-ECO-EM.
 - 2) Supports reporting of energy measurement to wireless hub at accuracy of plus/minus 2 percent or 0.5 W (whichever is higher).
 - 3) Single integral controller with Class 1 or Class 2 isolated digital output signal conforming to IEC 60929; capable of direct control without interface.
 - 4) Provides direct low-voltage control of up to 3 compatible digital ballasts/LED drivers.
 - a) Electronically links a digital ballast/LED driver to a zone for both dimming and turning on/off.
 - b) Electronically assigns occupancy/vacancy sensors for manual on/auto off and auto on/auto off control.
 - c) Electronically assigns wireless control stations for manual local control.
 - d) Electronically assigns daylight sensor for automatic daylight dimming.
 - 5) Fixture Control Modules With Emergency Mode:
 - a) Operation With Lutron Vive Wireless Hub: Upon loss of power, fixture control module enters and remains in emergency mode as long as wireless hub is de-energized; upon restoration of power to wireless hub, fixture control module returns to normal mode and lights automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
 - b) Operation Without Lutron Vive Wireless Hub: Upon loss of power, fixture control module enters and remains in emergency mode for 90 minutes, during which time local unit buttons and wireless controls are disabled.
 - c) Used with Lutron Model LUT-ELI-3PH emergency lighting interface to achieve total system UL 924 listing.

- i. 0-10 V Dimming Fixture Control Modules:
 - 1) Product(s):
 - a) 0-10 V dimming fixture control module, without emergency mode; Lutron PowPak Wireless Fixture Control for 0-10 V ballasts/drivers; Model FCJS-010.
 - b) 0-10 V dimming fixture control module, with emergency mode; Lutron PowPak Wireless Fixture Control for 0-10 V ballasts/drivers; Model FCJS-010-EM.
 - 2) Supports reporting of energy measurement to wireless hub at accuracy of plus/minus 2 percent or 0.5 W (whichever is higher).
 - 3) Single low voltage dimming module with Class 1 or Class 2 isolated 0-10V output signal conforming to IEC 60929 Annex E.2; source or sink automatically configures.
 - 4) Provides 0-10 V control for up to 3 ballasts/LED drivers (1 A load at 120-277 V, 6 mA max control current).
 - 5) Rated for switching 0-10 V ballasts, LED drivers, or fixtures that conform with NEMA 410.
 - 6) Fixture Control Modules With Emergency Mode:
 - a) Operation With Lutron Vive Wireless Hub: Upon loss of power, fixture control module enters and remains in emergency mode as long as wireless hub is de-energized; upon restoration of power to wireless hub, fixture control module returns to normal mode and lights automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
 - b) Operation Without Lutron Vive Wireless Hub: Upon loss of power, fixture control module enters and remains in emergency mode for 90 minutes, during which time local unit buttons and wireless controls are disabled.
 - c) Used with Lutron Model LUT-ELI-3PH emergency lighting interface to achieve total system UL 924 listing.
- 2. Wired Fixture Sensors:
 - a. Product(s):
 - 1) Wired occupancy/daylight fixture sensor; Lutron PowPak Fixture Sensor; Model FC-SENSOR.
 - 2) Wired vacancy/daylight fixture sensor; Lutron PowPak Fixture Sensor; Model FC-VSENSOR.
 - b. Occupancy/Vacancy Sensing:
 - 1) Passive infrared coupled with technology for sensing fine motions; Lutron XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
 - 2) Coverage: 300 square feet (28 sq m) with mounting height of 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view.
 - 3) Sensor Timeout: 15 minutes.
 - a) Sensor timeout adjustable via Lutron Vive wireless hub when connected to compatible fixture control module.
 - c. Daylight Sensing:
 - 1) Automatic calibration.
 - 2) Provide linear response to changes in perceived light level.
 - a) Response adjustable via Lutron Vive wireless hub when connected to compatible fixture control module.
 - 3) Closed loop proportional control scheme.

- 4) Sensor Range: 0 to 150 footcandles (0 to 1600 lux).
- d. Mounts to fixture or ceiling.

2.5 WIRED RECEPTACLES WITH WIRELESS COMMUNICATION INPUTS

- A. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors and ten wireless control stations.
- B. Relay:
 - 1. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
 - 2. Rated for switching of general purpose loads.
 - 3. Motor rating of 0.5 HP at 120 V for 15 A receptacles, and 1 HP at 120 V for 20 A receptacles.
- C. Finish: To be selected by Architect from the manufacturer's standard colors.
- D. Product(s):
 - 1. Half switched duplex receptacle, 20A, 125V, NEMA 5-15R; Lutron Wireless Receptacle with Clear Connect Technology; Model CAR2S-20-STR.
 - 2. Full switched duplex receptacle, 20A, 125V, NEMA 5-15R; Lutron Wireless Receptacle with Clear Connect Technology; Model CAR2S-20-DTR.
 - a. Receptacle control shall include a constant hot and controlled plug output and include the following features:
 - 1) The receptacle control shall provide a single input for incoming power, devices that require constant hot and switched inputs shall not be acceptable.
 - 2) The receptacle control shall be clearly marked "Controlled" and with the NEMA defined controlled symbol.
 - 3) The receptacle control shall include a wireless radio (IEEE 802.15.4) to provide control and power measurement data.
 - b. If the Load Control Module (Field Relay) is utilized to control plug loads instead of receptacles with wireless communications:
 - 1) Receptacle control shall include a constant hot and controlled outlet at each duplex receptacle designated to be controlled on the drawings.
 - 2) Wire the receptacle so that only the top half of the duplex receptacle shall be switched.
 - 3) The receptacle control shall be clearly marked "Controlled" and with the NEMA defined controlled symbol.
 - 4) Only the receptacles designated to be controlled on the drawings shall be switched.
 - 5) Where controlled and non-controlled receptacles are fed from the same circuit, the non-controlled receptacles shall be wired ahead of the Load Control Module (Field Relay) so that they are not switched.
 - 6) Furnish and install a Load Control Module (Field Relay) for each controlled circuit.

2.6 LUMINAIRE COMPONENTS (FACTORY-INSTALLED)

A. Luminaires specified to be provided with factory-installed wireless fixture control components as specified below.

B. Wireless Fixture Control Dongle:

1. Product(s):
 - a. RF only (no integral sensing capability); Lutron Vive Wireless Fixture Controller; Model DFCSJ-OEM-RF.
 - b. RF with occupancy/vacancy and daylight sensing; Lutron Vive Wireless Fixture Controller; Model DFCSJ-OEM-OCC.
2. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
3. Selectable minimum light level.
4. Supports configurable high- and low-end trim.
5. Plenum rated in accordance with UL 2043.
6. Mounts to fixture through hole.
7. Wireless Fixture Control Dongle with Integral Sensing Capabilities:
 - a. Occupancy/Vacancy Sensing:
 - 1) Passive infrared coupled with technology for sensing fine motions; Lutron XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
 - 2) Coverage: 300 square feet (28 sq m) with mounting height of 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view.
 - 3) Sensor Timeout: 15 minutes.
 - a) Sensor timeout adjustable via Lutron Vive wireless hub.
 - b. Daylight Sensing:
 - 1) Automatic calibration.
 - 2) Provide linear response to changes in perceived light level.
 - a) Response adjustable via Lutron Vive wireless hub.
 - 3) Closed loop proportional control scheme.
 - 4) Sensor Range: 0 to 150 footcandles (0 to 1600 lux).
 - c. Coordination between Integral and Wireless Sensors:
 - 1) Occupancy/Vacancy Sensing: Integral and wireless sensors work in conjunction (occupancy detected by either sensor turns lights on and vacancy detected by both sensors turns lights off).
 - 2) Daylight Sensing: Wireless sensor takes precedence over integral sensor.

C. Digital Bus Interface:

1. Product: Lutron OEM Digital Bus Interface; Model DFC-OEM-DBI.
2. Provides power for wireless fixture control dongle and up to four LED drivers (60mA at 17-19 VDC).
3. DALI compliant.
4. UL listed.

2.7 WIRED WALL DIMMERS AND SWITCHES WITH WIRELESS COMMUNICATION INPUTS

A. 0-10 V Wall Dimmer/Switch Combination Occupancy/Vacancy Sensors with Wireless Communication Inputs; Lutron Maestro Wireless 0-10 Dimmer Sensor/Maestro Wireless Sensor Switch Series:

1. Communicates via radio frequency with up to ten compatible wireless occupancy/vacancy sensors, ten wireless control stations, and one wireless daylight sensor.
2. Compatible with sourcing electronic 0-10 V ballasts/drivers, as per IEC 60929 Annex E.2 0-10 V protocol.
3. Selectable option to enable low light feature (automatic-on when ambient light is below threshold). Ambient light threshold to be selectable as either adaptive utilizing occupant feedback (Lutron Smart Ambient Light Detection) or as fixed (high, medium, low, and minimum presets).
4. Occupancy/Vacancy Sensors:
 - a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
 - b. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions; Lutron XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
 - c. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).
 - d. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area; adjustable timeout settings (1, 5, 15, or 30 minutes).
 - e. Adjustable sensitivity (high, medium, low, and minimum presets).
 - f. Selectable option to inhibit automatic turn-on of lights after manual-off operation while room is occupied for applications such as presentation viewing in conference rooms and classrooms; when room is vacated, returns to normal automatic-on operation after time delay period.
 - g. Selectable walk-through mode to override selected timeout and automatically turn off lights if no motion is detected within 3 minutes after initial occupancy for applications where space may be briefly occupied.
5. Vacancy-Only Sensors:
 - a. Operates only as a vacancy sensor (manual-on and automatic-off).
 - b. Adjustable sensitivity (high, medium, low, and minimum presets).
6. Dimmer Features:
 - a. Adjustable high/low end trims.
 - b. Selectable dimming curve (linear or switched).
 - c. Selectable fade on/fade off times (15, 5, 2.5, or 0.75 sec).
 - d. Adjustable auto-on light level (fully adjustable from one to 100 percent).
7. Dimmer Control: Multi-function tap switch with small, raised rocker for dimmer adjustment.
 - a. Rocker raises/lowers light level, with new level becoming the current preset level.
 - b. Switch single tap raises lights to preset level or fades lights to off.
 - c. Switch double tap raises light to full on level.

8. Switch Control: Switch single tap turns lights on/off.
9. Product(s):
 - a. Passive Infrared 0-10 V Wall Dimmer Occupancy/Vacancy Sensor; Lutron Maestro Wireless 0-10 V Dimmer Sensor/Maestro Wireless Sensor Switch Series: 0-10 V control for 0-10 V fluorescent ballasts/LED drivers (8 A load at 120-277 V, 50 mA max control current); coverage of 900 square feet (81 sq m) with mounting height of 4 feet (1.2 m); 180 degree field of view; multi-location capability using Pico wireless control stations with wallbox mounting adapter.
 - 1) Sensor dimmer; occupancy/vacancy; Lutron Model MRF2S-8SD010.
 - 2) Sensor dimmer; vacancy-only; Lutron Model MRF2S-8SDV010.
 - 3) Sensor switch; occupancy/vacancy; Lutron Model MRF2S-8SS.
 - 4) Sensor switch; vacancy-only; Lutron Model MRF2S-8SSV.

2.8 LINE-POWERED WIRELESS CONTROL STATIONS:

- A. Power: 120-277 V.
- B. Product(s):
 1. 2-Button Control; Lutron Pico Line-Powered Wireless Control Model PJJ-2B.
 2. 2-Button with Raise/Lower Control; Lutron Pico Line-Powered Wireless Control Model PJJ-2BRL.
 3. 3-Button with Raise/Lower Control; Lutron Pico Line-Powered Wireless Control Model PJJ-3BRL.
 4. Button Marking: Light (icons)

2.9 POWER INTERFACES

- A. Provide power interfaces as indicated or as required to control the loads as indicated.
- B. General Requirements:
 1. Phase independent of control input.
 2. Dimmer to meet limited short circuit test as defined in UL 508.
 3. Utilize air gap off to disconnect the load from line supply.
 4. Diagnostics and Service: Replacing power interface does not require re-programming of system or processor.
- C. Product(s):
 1. Phase-Adaptive Power Module; Lutron PHPM-PA: Provides interface for phase control input to provide full 16 A circuit output of forward/reverse phase control for compatible loads.
 2. 3-Wire Fluorescent Power Module; Lutron PHPM-3F: Provides interface for phase control input to provide full 16 A circuit output for compatible line-voltage control fluorescent electronic dimming ballasts or LED drivers.
 3. Switching Power Module; Lutron PHPM-SW: Provides interface for phase control or switched input to provide full 16 A circuit output of switching for compatible non-dim loads.

4. Ten Volt Interface; Lutron GRX-TVI: Provides interface for phase control input to provide full 16 A circuit output of switching and 0-10 V low voltage control for compatible fluorescent electronic dimming ballasts or LED drivers.

2.10 WIRELESS HUBS

- A. Product(s):
 1. Wireless hub with BACnet; Lutron Vive Premium Hub.
 - a. Flush-mount wireless hub; Model HJS-2-FM; supports up to 700 total paired devices.
 - b. Surface-mount wireless hub; Model HJS-2-SM; supports up to 700 total paired devices.
 2. Provide each hub with Lutron PS-J-20W-UNV power supply and Lutron LUT-LVU-2 Inverter.
- B. Integrated multicolor LED provides feedback on what mode the hub is in for simple identification and diagnosis.
- C. Integrated processor and web server allows hub to set up and operate the system without any external connections to outside processors, servers, or the internet.
- D. Utilizes Ethernet connection for:
 1. Networking up to 64 hubs together to create a larger system.
 2. Integration with Building Management System (BMS) via native BACnet; does not require interface (Lutron Vive Premium wireless hub with BACnet only).
 3. Remote connectivity capabilities, including maintaining system date/time and receiving periodic firmware updates (requires internet connection).
- E. A single hub or network of hubs can operate on either a dedicated lighting control only network or can be integrated with an existing building network as a VLAN.
- F. Communicates directly to compatible Lutron Vive RF devices through use Lutron Clear Connect radio frequency communications link; does not require communication wiring; RF range of 71 feet (23 m) through walls to cover an area of 15836 square feet (1471 sq m) (device and hub must be on the same floor).
- G. Communicates directly to mobile device (smartphone or tablet) or computer using built-in Wi-Fi, 2.4 GHz 802.11b/g; wireless range of 71 feet (23 m) through walls (device and hub must be on the same floor).
 1. Does not require external Wi-Fi router for connecting to the hub.
- H. Allows for system setup, control, and monitoring from mobile device or computer using Vive web-based software:
 1. Supports paired devices up to maximum number indicated including compatible wireless sensors, wireless control stations, and wireless load devices.
 2. Allows for timeclock scheduling of events, both time of day and astronomic (sunrise and sunset).

- a. Timeclock is integrated into the unit and does not require a constant internet connection.
 - b. Retains time and programming information after a power loss.
 - c. 365-day schedulable timeclock allows for:
 - 1) Scheduling of events years in advance.
 - 2) Setting of recurring events with exceptions on holidays.
 - d. Time clock events can be scheduled to:
 - 1) Send lights to a desired level and select the fade rate desired to reach that level.
 - 2) Adjust level lights go to when occupied.
 - 3) Adjust level lights go to when unoccupied.
 - 4) Enable/disable occupancy.
 - 5) Adjust timeout of sensors (requires Model FC-SENSOR wired fixture sensor or Model DFCSJ-OEM-OCC wireless fixture control dongle with integral sensing capabilities).
 - 6) Control individual devices, areas, or groups of areas. When connected to Vive Vue server, only areas or groups of areas can be controlled with timeclock events.
3. Daylighting:
- a. Daylighting can be enabled/disabled. Can be used to override the control currently taking place in the space.
 - b. Daylight set point can be adjusted with the software to increase or decrease the electric light level in the room based on the same amount of natural light.
4. Allows for control, monitoring, and adjustment from anywhere in the world (Lutron Vive wireless hub internet connection required).
5. Uses RF signal strength detection to find nearby devices for quick association and programming without having to climb ladders.
- a. Association and setup does not require a factory technician to perform.
6. System using Lutron Vive wireless hub(s) can operate with or without connection to the internet.
7. Supports energy reporting.
- a. Reports measured energy data for PowPak fixture control modules at accuracy of plus/minus 2 percent or 0.5 W (whichever is higher).
 - b. Reports calculated energy data for PowPak junction box mounted modules at accuracy of 10 percent.
 - c. Reports measured energy for DFCSJ Series wireless fixture control dongle when paired with driver that supports measured power (measurement accuracy defined by driver specification) or reports calculated power if driver does not have measurement capabilities.
8. Supports automatic demand response for load shedding via:
- a. Local contact closure without need for separate interface.
 - b. OpenADR® 2.0b compliant utility command.
 - c. BACnet (Lutron Vive Premium wireless hub with BACnet only).
9. Support automatic generation of alerts in Lutron Vive web-based application for designated events/triggers, including:
- a. Low-battery condition in battery-operated sensors and controls; alert cleared when battery is replaced.

- b. Missing device (e.g., control or sensor); alert cleared when device is detected by system.
- 10. Wireless hub can be firmware upgraded to provide new software features and system updates.
 - a. Firmware update can be done either locally using a wired Ethernet connection or Wi-Fi connection, or remotely if the wireless hub is connected to the internet.
- I. Lutron Vive Web-Based Application:
 - 1. Accessibility and Platform Support:
 - a. Web-based; runs on most HTML5 compatible browsers (including Safari and Chrome).
 - b. Supports multiple platforms and devices; runs from a tablet, desktop, laptop, or smartphone.
 - c. User interface supports multi-touch gestures such as pinch to zoom, drag to pan, etc.
 - d. Utilizes HTTPS (industry-standard certificate-based encryption and authentication for security).
 - e. Multi-level Password Protected Access: Individual password protection on both the integrated Wi-Fi network and web-based software.
 - f. WPA2 security for Wi-Fi communication with wireless hub.
 - 2. System Navigation and Status Reporting:
 - a. Area Tree View: Easy navigation by area name to view status and make programing adjustments through the software.
 - b. Area and device names can be changed in real time.
 - 3. Setup app available for iOS and Android that allows for:
 - a. Job registration to extend product warranty.
 - b. Management of setup for multiple projects in different locations.
 - c. Creation of handoff documents that are sent directly to a facility manager via email once setup is complete.
 - d. Backup of Vive wireless hub database to Lutron cloud for hub replacement.
 - e. Access to native help and instructions to assist user with Vive system setup.
- J. BACnet Integration (Lutron Vive Premium wireless hub with BACnet only):
 - 1. Provide ability to communicate by means of native BACnet IP communication (does not require interface) to lighting control system from a user-supplied 10BASE-T or 100BASE-T Ethernet network.
 - 2. Requires only one network connection per hub.
 - 3. BACnet Integrator Capabilities:
 - a. The BACnet integrator can command:
 - 1) Area light output.
 - 2) Area load shed level.
 - 3) Area load shed enable/disable.
 - 4) Enable/Disable:
 - a) Area occupancy sensors.
 - b) Area daylighting.
 - 5) Daylighting level.

- 6) Area occupied and unoccupied level
 - 7) Occupancy sensor timeouts (for fixture sensors).
 - b. The BACnet integrator can monitor:
 - 1) Area on/off status.
 - 2) Area occupancy status.
 - 3) Area load shed status.
 - 4) Area instantaneous energy usage and maximum potential power usage.
 - 5) Enable/Disable:
 - a) Area occupancy sensors.
 - b) Daylighting.
 - c) Timeclocks.
 - 6) Daylighting level.
 - 7) Light levels from photo sensors.
 - 8) Area occupied and unoccupied level.
 - 9) Occupancy sensor timeouts.
- K. API Integration:
 - 1. Support communication, without requiring interface, between lighting control system and third-party systems via RESTful API.
 - 2. Requires one network connection per wireless hub.
 - 3. API Integration Capabilities:
 - a. Control all zones or subset of zones.
 - 1) Set zones in designated area to specific level.
 - 2) Raise/lower dimmable lights in designated area.
 - b. Control individual zones.
 - c. Subscribe to and Monitor:
 - 1) Area status changes (e.g., occupancy, light level, and instantaneous power).
 - 2) Individual zone changes in light level.
 - 3) Alerts (e.g., missing device and low battery).
- L. Scenes:
 - 1. Support programmable scenes to control individual devices, areas, or groups of areas on demand.
 - 2. Scenes may be activated via:
 - a. Contact closure input.
 - b. API integration.
 - c. Manual activation in app.
- M. Emergency Mode:
 - 1. Support emergency mode to, when triggered, send lights to defined levels and lock out controls for PowPak load control modules equipped with emergency mode.
 - 2. Emergency mode may be activated via:
 - a. Contact closure input.
 - b. API integration.
 - c. Manual activation in app.
- N. Contact Closure Interface: Provide two contact closure inputs; accepts both momentary and maintained contact closures that can be used for automatic demand response.

- O. Rated for use in air-handling spaces as defined in UL 2043.
- P. Meets CAL TITLE 24 P6 requirements.
- Q. Provide Ethernet switch(es) as required for inter-hub network wiring per manufacturer's instructions; do not exceed manufacturer's required maximum wiring segment lengths.
 - 1. Product(s):
 - a. Lutron Model ETH-SWITCH-16; 16 port.
 - b. Lutron Model ETH-SWITCH-24; 24 port.
 - c. Lutron Model ETH-SWITCH-24-1M; 24 port, 1 multi-mode fiber.
 - d. Lutron Model ETH-SWITCH-24-2M; 24 port, 2 multi-mode fiber.
 - e. Lutron Model ETH-SWITCH-24-1S; 24 port, 1 single-mode fiber.
 - f. Lutron Model ETH-SWITCH-24-2S; 24 port, 2 single-mode fiber.

2.11 EMERGENCY LIGHTING INTERFACE (ELI)

- A. The LUT-ELI-3PH is a device that works with Lutron lighting controls to provide an emergency lighting solution. The device is capable of sensing normal (non-essential) line voltage power and accepting an output from a fire alarm control panel (FACP). Upon loss of normal power or receiving a signal from the FACP, the LUT-ELI-3PH will send a signal to the compatible Lutron control(s) to which it is connected. This signal will cause the controls to enter the emergency lighting mode and any lights controlled will go to the emergency light level setting.
- B. Features
 - 1. Provides total system listing to UL 924 when used with lighting control system.
 - 2. Senses all three phases of building power.
 - 3. If power on any phase fails provides output to send lights controlled to defined levels. Lights to return to their previous intensities when normal power is restored.
 - 4. Accepts contact closure input from fire alarm control panel.
 - 5. Compatible Lutron controls
 - a. GP, LP, LCP, XP, XPS, CCP, CXP, and HS
 - b. Energi Savr Node units
 - c. GRAFIK Eye QS units
 - d. Quantum lighting management hubs with EcoSystem bus supplies
 - e. Vive wireless hub with Emergency PowPak devices
 - 6. ULR 924 & CSA C22.2 No. 141-02 listed as "Emergency Lighting and Power Equipment"
 - 7. Requires a 24 V- power feed from a source on normal/emergency (essential) power for unit to operate.
 - 8. Status light indicates the phase status. Status light "ON" is normal mode, "OFF" is emergency mode.
 - 9. A test button is provided to perform a functional test of the system by simulating an emergency situation.
 - 10. Accepts a maintained dry contact closure from an FACP to actuate the emergency mode.
 - 11. Senses line voltage from 100–347 V~.

- C. Provide LUT-ELI-3PH emergency lighting interface with PP-DV power Pack at each emergency lighting panel.
- D. Connect Pin 1 & 7 outputs of the ELI to up to four (4) wireless hubs at a maximum cable length of 500 ft. at 18 AWG.

2.12 SOFTWARE DATA AND ANALYTICS DASHBOARD

A. Control and Monitor Software:

- 1. Product: Lutron Vive Vue.
- 2. General Requirements:
 - a. Web-based; runs on most HTML5 compatible browsers (including Internet Explorer, Chrome, and Safari).
 - b. Supports multiple platforms and devices; runs from a tablet, desktop, laptop, or smartphone; optimized for displays of 1024 by 768 pixels or higher.
 - c. User interface supports multi-touch gestures such as pinch to zoom, drag to pan, etc.
 - d. Utilizes HTTPS (industry-standard certificate-based encryption and authentication for security).
 - e. All functionality listed below must be available via a single application.
- 3. System Navigation and Status Reporting:
 - a. Performed using graphical floor plan view or a generic system layout.
 - b. Graphical Floor Plan View: Utilizes customized CAD based drawing of the building. Pan and zoom feature allows for easy navigation; dynamically adjusts the details presented based on zoom level.
- 4. Control of Lights:
 - a. Control and monitor zone/area lights.
 - 1) Area lights can be monitored for on/off status from a graphical floor plan or generic system layout.
 - 2) All lights in an area can be turned on/off (dimmable lights can also be dimmed up/down from current level).
- 5. Occupancy:
 - a. Area occupancy can be monitored.
 - 1) Can be monitored graphically if a graphical floor plan has been created.
 - 2) Can be monitored historically in space utilization reports.
 - b. Scheduled events can be created to change occupancy parameters as described under "Scheduling" below.
- 6. Load Shedding: View current load shed status (active/inactive) for each Vive wireless hub and enable/disable load shed for the entire building/system.
- 7. Scheduling: Schedule time of day and astronomic time clock events to automate functions.
 - a. Scheduled events can control the following:
 - 1) Area light levels for all dimmable lights in an area.
 - 2) On/off status of all switched lights and contact-closure outputs in an area.
 - 3) On/off status of all switched receptacles in an area.

- b. Scheduled events can be created to change the following occupancy parameters:
 - 1) Enable/disable sensors.
 - 2) Change occupancy mode (auto-on/auto-off versus manual-on/auto-off).
 - 3) Adjust occupied and/or unoccupied level.
 - 4) For compatible individual fixture sensors, sensor timeout can be adjusted.
 - c. Easily monitor and adjust scheduled events using a weekly calendar view.
- 8. Reporting: Provide reporting capability that allows the building manager to gather real-time and historical information about the system as follows:
 - a. Energy Reports: Show a comparison of cumulative energy used over a period of time for one or more areas.
 - b. Power Reports: Show power usage trend over a period of time for one or more areas.
 - c. Space Utilization/Occupancy Reports: Show historical occupancy over a period of time for one or more areas using a graphical floor plan, generic system layout, and graphs and charts.
- 9. Administration:
 - a. Users: Allows new user accounts to be created and existing user accounts to be edited.
 - 1) Supports Active Directory (LDAP) tying user accounts to network accounts.
 - b. Area and feature access can be restricted based on login credentials.
 - c. Supports up to 20 concurrent users and 10,000 user accounts.
- 10. Devices/Settings Adjustment:
 - a. Users with appropriate permissions can navigate to the wireless hub setup screens in order to view and/or adjust specific settings for areas or devices (including load shed settings, daylighting settings, device associations and programming, occupancy settings, high-end/low-end trim settings, etc).
- 11. Control and Monitor for Multiple Quantum Vue and/or Vive Vue Systems; Lutron Enterprise Vue:
 - a. Allows user to view aggregate data from multiple connected Quantum Vue and/or Vive Vue systems spanning multiple buildings through a single user account:
 - 1) Space utilization/occupancy.
 - 2) Energy usage/savings.
 - b. Allows user to view details and adjust settings for any connected Quantum Vue or Vive Vue system; supports system navigation through campuses and buildings using graphical floor plans.

2.13 SOURCE QUALITY CONTROL

A. Factory Testing; Lutron Standard Factory Testing:

- 1. Perform full-function factory testing on all completed assemblies. Statistical sampling is not acceptable.
- 2. Perform full-function factory testing on 100 percent of all ballasts and LED drivers.

3. Perform factory burn-in of 100 percent of all ballasts at 104 degrees F (40 degrees C).

2.14 LIGHTING CONTROL SEQUENCE OF OPERATION (SOO)

A. Initial Light Level Settings

1. General,
 - a. All dimmable light fixtures shall be programmed for a maximum 70% light output unless higher output is needed to meet footcandle levels.
 - b. All occupancy sensors shall be programmed for vacancy mode (requires manual activation of wall switch to turn ON light fixtures).
2. Classroom
 - a. Occupied Level: 70% LPD (Light Power Density). Achieve average illumination at desk level of between 35-50 footcandles with minimum of 25 footcandles at any point more than three feet from any wall.
 - b. AV Mode: Achieve an average illumination at the desk level of between 10-20 footcandles for any point in the room greater than three feet from the side walls, 10 feet from the front wall and six feet from the back wall, while limiting vertical illumination on the projection screen to no more than seven footcandles at any point on the screen.
 - c. Quite Time: override the multi sensor and achieve average illumination at desk level of between 35-50 footcandles with minimum of 25 footcandles at any point more than three feet from any wall for a preset time of one hour.
 - d. Vacancy Level: 0% LPD
3. Common Areas
 - a. Occupied Level: 70% LPD (Light Power Density). Achieve average illumination at desk level of between 35-50 footcandles with minimum of 25 footcandles at any point more than three feet from any wall.
 - b. AV Mode: Achieve an average illumination at the desk level of between 10-20 footcandles for any point in the room greater than three feet from the side walls, 10 feet from the front wall and six feet from the back wall, while limiting vertical illumination on the projection screen to no more than seven footcandles at any point on the screen.
 - c. Quite Time: override the multi sensor and achieve average illumination at desk level of between 35-50 footcandles with minimum of 25 footcandles at any point more than three feet from any wall for a preset time of one hour.
 - d. Vacancy Level (Normal Business Hours): 50% LPD
 - e. Vacancy Level (Non-Business Hours): 0% LPD
4. Office/Conference
 - a. Occupied Level: 70% LPD
 - b. Vacancy Level: 0% LPD
5. Bathroom
 - a. Occupied Level: 70% LPD
 - b. Vacancy Level (Normal Business Hours): 10% LPD
 - c. Vacancy Level (Non-Business Hours): 0% LPD

6. Utility/Storage/Maintenance
 - a. Occupied Level: 70% LPD
 - b. Vacancy Level: 0% LPD
 7. Programmed timed OFF
 - a. The system will turn off all light fixtures except for the night lights at a prescribed time designated by the Owner. However, if the system senses occupancy in the building it will override the scheduled time off until 15 minutes after building vacancy is detected through a gradual change in light levels when occupancy is no longer detected.
 8. Controlled receptacle programming
 - a. Normal Business Hours: ON (Verify time range with the Owner)
 - b. Non-Business Hours: Controlled by occupancy/vacancy sensor.
- B. Dimming Fade Rates
1. Spaces required to have light-reduction controls shall have a manual control that allows the occupant to reduce the connected lighting load by not less than 50 percent in a reasonably uniform illumination pattern with an intermediate step in addition to full on or off, or with continuous dimming control, as follows:
 - a. Continuous dimming of all luminaires from full output to less than 20 percent of full power.
- C. User Interface Settings
1. Occupant Sensor Controls
 - a. Occupant sensor controls shall be installed to control lights in the following space types:
 - 1) Classrooms/lecture/training rooms.
 - 2) Conference/meeting/multipurpose rooms.
 - 3) Copy/print rooms.
 - 4) Lounges/breakrooms.
 - 5) Enclosed offices.
 - 6) Open plan office areas.
 - 7) Restrooms.
 - 8) Storage rooms.
 - 9) Locker rooms.
 - 10) Corridors.
 - 11) Warehouse storage areas.
 - 12) Other spaces 300 square feet (28 m2) or less that are enclosed by floor-to-ceiling height partitions.
 2. Manual Controls
 - a. Where required by this code, manual controls for lights shall comply with the following:
 - 1) They shall be in a location with ready access to occupants.
 - 2) They shall be located where the controlled lights are visible or shall identify the area served by the lights and indicate their status.
- D. Scene Programming
1. Coordinate scene programming with the Owner for areas with scene controls.

E. Occupancy or Vacancy Settings, Timeout Setpoints, and Methods

1. Occupant Sensor Control Function in Open Plan Office Areas
 - a. Occupant sensor controls in open plan office spaces less than 300 square feet (28 m2) in area shall comply with the following:
 - 1) They shall automatically turn off lights within 20 minutes after all occupants have left the space.
 - 2) They shall be manual on or controlled to automatically turn on the lighting to not more than 50-percent power.
 - 3) They shall incorporate a manual control to allow occupants to turn off lights.
 - b. Occupant sensor controls in all other open plan office spaces shall comply with all of the following:
 - 1) The controls shall be configured so that general lighting can be controlled separately in control zones with floor areas not greater than 600 square feet (55 m2) within the open plan office space.
 - 2) General lighting in each control zone shall be permitted to automatically turn on upon occupancy within the control zone. General lighting in other unoccupied zones within the open plan office space shall be permitted to turn on to not more than 20 percent of full power or remain unaffected.
 - 3) The controls shall automatically turn off general lighting in all control zones within 20 minutes after all occupants have left the open plan office space.
 - 4) General lighting in each control zone shall turn off or uniformly reduce lighting power to an unoccupied setpoint of not more than 20 percent of full power within 20 minutes after all occupants have left the control zone.
2. Occupant Sensor Control Function in Corridors
 - a. Occupant sensor controls in corridors shall uniformly reduce lighting power to an unoccupied setpoint not more than 50 percent of full power within 20 minutes after all occupants have left the space.
3. Occupant Sensor Control Function in Warehouse Storage Areas
 - a. Lighting in each aisleway shall be controlled independently of lighting in all other aisleways and open areas.
 - b. Occupant sensors shall automatically reduce lighting power within each controlled area to an unoccupied setpoint of not more than 50 percent of full power within 20 minutes after all occupants have left the controlled area.
 - c. Lights that are not turned off by occupant sensors shall be turned off by time-switch control.
 - d. A manual control shall be provided to allow occupants to turn off lights in the space.
4. Occupant controls for all other spaces shall comply with the following:
 - a. They shall automatically turn off lights within 20 minutes after all occupants have left the space.
 - b. They shall be manual on or controlled to automatically turn on the lighting to not more than 50-percent power.
 - c. They shall incorporate a manual control to allow occupants to turn off lights.

- d. Exception: Full automatic-on controls with no manual control shall be permitted in corridors, interior parking areas, stairways, restrooms, locker rooms, lobbies, library stacks and areas where manual operation would endanger occupant safety or security.

F. Time-Based Schedules and Triggers

- 1. Each area of the building that is not provided with occupant sensor controls shall be provided with time-switch controls.
 - a. Exceptions:
 - 1) Luminaires that are required to have specific application controls.
 - 2) Spaces where patient care is directly provided.
 - 3) Spaces where an automatic shutoff would endanger occupant safety or security.
 - 4) Lighting intended for continuous operation.
 - 5) Shop and laboratory classrooms.
- 2. Time-Switch Control Function
 - a. Automatically turn off lights when the space is scheduled to be unoccupied.
 - b. Have a minimum 7-day clock.
 - c. Be capable of being set for seven different day types per week.
 - d. Incorporate an automatic holiday "shutoff" feature, which turns off all controlled lighting loads for not fewer than 24 hours and then resumes normally scheduled operations.
 - e. Have program backup capabilities, which prevent the loss of program and time settings for not fewer than 10 hours, if power is interrupted.
 - f. Include an override switch that complies with the following:
 - 1) The override switch shall be a manual control.
 - 2) The override switch, when initiated, shall permit the controlled lighting to remain on for not more than 2 hours.
 - 3) Any individual override switch shall control the lighting for an area not larger than 5,000 square feet (465 m²).
 - g. Exception: Within mall concourses, auditoriums, sales areas, manufacturing facilities and sports arenas:
 - 1) The time limit shall be permitted to be greater than 2 hours, provided that the switch is a captive key device.
 - 2) The area controlled by the override switch shall not be limited to 5,000 square feet (465 m²) provided that such area is less than 20,000 square feet (1860 m²).

G. Daylight-Response Setpoints and Methods

- 1. Daylight-responsive controls shall be provided to control the general lighting within daylight zones in the following spaces:
 - a. Spaces with a total of more than 100 watts of general lighting within primary sidelit daylight zones.
 - b. Spaces with a total of more than 300 watts of general lighting within sidelit daylight zones.
 - c. Spaces with a total of more than 100 watts of general lighting within toplit daylight zones.
 - d. Exceptions: Daylight responsive controls are not required for the following:
 - 1) Spaces in health care facilities where patient care is directly provided.

- 2) Sidelit daylight zones on the first floor above grade in Group A-2 and Group M occupancies.
2. Where required, daylight-responsive controls shall be provided within each space for control of lights in that space and shall comply with all of the following:
 - a. Lights in toplit daylight zones shall be controlled independently of lights in sidelit daylight zones.
 - b. Lights in the primary sidelit daylight zone shall be controlled independently of lights in the secondary sidelit daylight zone.
 - c. Daylight responsive controls within each space shall be configured so that they can be calibrated from within that space by authorized personnel.
 - d. Calibration mechanisms shall be in a location with ready access.
 - e. Daylight responsive controls shall dim lights continuously from full light output to 15 percent of full light output or lower.
 - f. Daylight responsive controls shall be configured to completely shut off all controlled lights.
 - g. When occupant sensor controls have reduced the lighting power to an unoccupied setpoint, daylight responsive controls shall continue to adjust electric light levels in response to available daylight, but shall be configured to not increase the lighting power above the specified unoccupied setpoint.
 - h. Lights in sidelit daylight zones facing different cardinal orientations [within 45 degrees (0.79 rad) of due north, east, south, west] shall be controlled independently of each other.
 - i. Exceptions:
 - 1) Within each space, up to 150 watts of lighting within the primary sidelit daylight zone is permitted to be controlled together with lighting in a primary sidelit daylight zone facing a different cardinal orientation.
 - 2) Within each space, up to 150 watts of lighting within the secondary sidelit daylight zone is permitted to be controlled together with lighting in a secondary sidelit daylight zone facing a different cardinal orientation.

H. Building System Integration Methods

1. BMS Integration
 - a. Provide integration with the BMS through BACnet/IP.
 - b. The integration of the Lighting Control System (LCS) and Building Management Systems (BMS) shall meet the objectives listed as follows:
 - 1) Consolidated Device Status: The operational status of all system devices shall be consolidated to a central repository.
 - 2) Consolidated Energy Reporting: The energy consumption of all system devices shall be published to a consolidated central repository.
 - 3) Asset Tracking: The bill of materials of each system shall be consolidated to a central repository.
 - 4) Event calendar: The maintenance schedule for each system shall be consolidated to a central repository.
 - 5) Shared Hardware: Devices common to multiple systems shall be shared in order to reduce overall part quantity. (Occupancy sensors in the lighting system shall be used to signal room/space occupancy status to the HVAC system by sharing data among both systems).

- 6) Automated Response: Events in any system shall automatically trigger a programmed, user defined response appropriate other systems. (For example, a demand response event in the HVAC system shall automatically initiate a demand response routine in the LCS).
 - 7) Central Access: The user interface shall be consolidated into a single window to perform major daily operator functions.
 - 8) Parking Lot Control: Coordinate with the BMS vendor to enable the control of the parking lot lighting through the BMS.
 - c. Carry 40-hours to facilitate integration between LCS and BMS. Coordinate requirements with the BMS vendor.
 - 2. Fire alarm integration
 - a. In the event of a fire alarm, the LCS will:
 - 1) Turn ON all the light fixtures and override all switches/programming.
 - 2) Turn OFF all controlled receptacles controlling the projector circuits.
 - 3) Turn OFF all field relays associated with the in-ceiling instructional audio system.
 - b. Once the fire alarm panel is reset, the LCS will resume normal operation.
 - 3. Night Lighting Methods
 - a. Program lobby light fixtures to 10% output in unoccupied mode.
- I. Specific Application Controls
- 1. The following lighting shall be controlled by an occupant sensor or a time-switch. In addition, a manual control shall be provided to control such lighting separately from the general lighting in the space:
 - a. Luminaires for which additional lighting power is claimed.
 - b. Display and accent.
 - c. Lighting in display cases.
 - d. Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting.
 - e. Lighting equipment that is for sale or demonstration in lighting education.
 - f. Display lighting for exhibits in galleries, museums and monuments that is in addition to general lighting.
- J. Exterior Lighting Controls
- 1. Exterior lighting systems shall be provided with controls.
 - a. Exceptions:
 - 1) Lighting for covered vehicle entrances and exits from buildings and parking structures where required for eye adaptation.
 - 2) Lighting controlled from within dwelling units.
 - 2. Lights shall be automatically turned off when daylight is present and satisfies the lighting needs.
 - 3. Parking Building facade and landscape lighting shall automatically shut off from not later than 1 hour after business closing to not earlier than 1 hour before business opening.
 - a. Lighting that is not controlled by above, shall comply with the following:
 - 1) Be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent by selectively switching off or dimming luminaires at one of the following times:

- a) From not later than midnight to not earlier than 6 a.m.
 - b) From not later than one hour after business closing to not earlier than one hour before business opening.
 - c) During any time where activity has not been detected for 15 minutes or more.
 - 2) Luminaires serving outdoor parking areas and having a rated input wattage of greater than 78 watts and a mounting height of 24 feet (7315 mm) or less above the ground shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent during any time where activity has not been detected for 15 minutes or more. Not more than 1,500 watts of lighting power shall be controlled together.
4. Time-switch controls for exterior lighting shall comply with the following:
- a. They shall have a clock capable of being programmed for not fewer than 7 days.
 - b. They shall be capable of being set for seven different day types per week.
 - c. They shall incorporate an automatic holiday setback feature.
 - d. They shall have program backup capabilities that prevent the loss of program and time settings for a period of not less than 10 hours in the event that power is interrupted.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. System and Network Integration Consultation; Lutron LSC-INT-VISIT: Include as part of the base bid for Lighting Control Manufacturer to conduct meeting with facility representative and other related equipment manufacturers to discuss equipment and integration procedures.
- B. Manufacturer recommends that this visit be scheduled early in construction phase, after system purchase but prior to system installation.

3.3 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130.

- B. The lighting control system shall be installed and fully wired as shown on the plans by the installing contractor. The contractor shall complete all electrical connections to all control circuits.
- C. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.
- D. Provide computer-generated documentation on the commissioning of the system including room by room description including:
 - 1. Sensor parameters, time delays, sensitivities and daylighting setpoints.
 - 2. Sequence of operation, (e.g. manual ON, Auto OFF. Etc.).
 - 3. Load parameters (e.g. blink warning, etc.).
- E. Sensor Locations:
 - 1. Locate sensors in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated. Where Lighting Control Manufacturer Sensor Layout and Tuning service is not specified, locate sensors in accordance with Drawings.
 - 2. Sensor locations indicated are diagrammatic. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage, in accordance with manufacturer's recommendations.
 - 3. Ensure that daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.
- F. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
- G. LED Light Engine/Array Lead Length: Do not exceed 100 feet (31 m).

3.4 PRODUCT SUPPORT AND SERVICE

- A. Factory telephone support shall be available at no cost to the owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment.

3.5 COMMISSIONING

- A. Comply with requirements specified in Division 01.
- B. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup checks according to the approved manufacturer's written instructions.
- C. Qualifications for factory certified field service engineer:
 - 1. Certified by the equipment manufacturer on the system installed.

D. System Functionality Demonstration

1. The lighting control system manufacturer shall provide a factory certified Field Service Engineer to conduct an on-site walkthrough to demonstrate system functionality to the Commissioning Agent.
2. During this visit, the manufacturer's Field Service Engineer will perform tasks, at the request of the facility representative or Commissioning Agent, such as to demonstrate wall control functions, explain or describe occupancy and/or daylight sensor functionality.

3.6 TRAINING AND SERVICE

- A. Comply with Section 260001.
- B. Conduct two 4-hour training sessions. Train the Owner's maintenance personnel on procedures and schedules related to start up and shutdown, troubleshooting, servicing, and preventive maintenance.

End of Section

Section 26 24 16

PANELBOARDS

(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

- A. Electrical bidders shall refer to spec. section 007300 – SUPPLEMENTARY INSTRUCTIONS TO BIDDERS, subsection 14: “Trade Specific Scope Notes,” item OO, specifically #s 32 and 33 for additional information on electrical scope associated with pre-purchased equipment.

1.2 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.3 SUMMARY

- A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.
- B. Panelboards 400A and larger shall be pre-purchased by the Construction Manager. Panelboards shall be installed by the Electrical Trade Contractor.
- C. All other panelboards shall be furnished and installed by the Electrical Trade Contractor.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 6. Include wiring diagrams for power, signal, and control wiring.
 - 7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.
- C. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Field quality-control reports.

PANELBOARDS

- E. Panelboard schedules for installation in panelboards.
- F. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

1.6 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.7 DELIVERY, STORAGE AND HANDLING

- A. All materials for the work of this section shall be delivered, stored, and handled so as to preclude damage of any nature. Manufactured materials shall be delivered and stored in their original containers, plainly marked with the products' and manufacturer's name. Materials in broken containers or in packages showing watermarks or other evidence of damage, shall not be used, and shall be removed from the site.
- B. For items which are to be installed but not purchased as part of the electrical work, the electrical work shall include:
 - 1. The coordination of their delivery.
 - 2. Their unloading from delivery trucks driven into any point on the property line at grade level.
 - 3. Their safe handling and field storage up to the time of permanent placement in the project.
 - 4. The correction of any damage, defacement, or corrosion to which they may have been subjected. Replacement if necessary, shall be coordinated with Contractor who originally purchased the item.
 - 5. Their field make-up and internal wiring as may be necessary for their proper operation.
 - 6. Their mounting in place including the purchase and installation of all dunnage, supporting members, and fastenings necessary to adapt them to architectural and structural conditions.
 - 7. Their connection to building wiring including the purchase and installation of all termination junction boxes necessary to adapt and connect them to this wiring. Included also shall be the purchase and installation of any substitute lugs or other wiring terminations as may be necessary to adapt their terminals to the

building wiring as called for and to the connection methods set forth in these specifications.

- C. Items which are to be installed but not purchased as part of the electric work shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the electric work will be considered only if presented in writing within one week of the date of delivery to the project of the items in question. The electric work includes all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

1.8 WARRANTY

- A. Comply with Section 260001.
- B. The Electrical Subcontractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.
- C. Transient voltage suppression devices: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved Manufacturers
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Square D; a brand of Schneider Electric.
 - 4. Or approved equal.
- B. Coordinate the manufacturer of pre-purchased equipment with the Construction Manager.

2.2 BASIS OF DESIGN

- A. The system specified is based upon products by Eaton Electrical Inc.; and represents the performance standard upon which any equivalent solution shall be based.

2.3 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- B. Enclosures: Flush- and surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1
 - b. Outdoor Locations: NEMA 250, Type 3R.

- c. Kitchen/Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
- 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
- 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- 4. Directory Card: Inside panelboard door, mounted in transparent card holder.
- C. Incoming Mains Location: Top and bottom.
- D. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
- E. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus Configured Terminators: Mechanical type.
 - 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Sub feed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
 - 1. Series rating shall not be acceptable.

2.4 DISTRIBUTION PANELBOARDS

- A. Panelboards: NEMA PB 1, power and feeder distribution type.
- B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- C. Mains: Main circuit breakers in the distribution panelboards shall be Standard Micrologic (LSI Trip Units) with solid-state trip unit and flux transfer shunt trip. Breakers shall have trip rating plugs with ratings as indicated on the drawings. Rating plugs shall be interlocked so they are NOT interchangeable between frames and interlocked such that a breaker cannot be latched with the rating plug removed.
- D. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Standard Micrologic (LSI Trip Units) with solid-state trip unit and flux transfer shunt trip. Breakers shall have trip rating plugs with ratings as indicated on the drawings.

Rating plugs shall be interlocked so they are NOT interchangeable between frames and interlocked such that a breaker cannot be latched with the rating plug removed.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Main circuit breakers in the lighting and appliance branch-circuit panelboards shall be Standard Micrologic (LSI Trip Units) with solid-state trip unit and flux transfer shunt trip. Breakers shall have trip rating plugs with ratings as indicated on the drawings. Rating plugs shall be interlocked so they are NOT interchangeable between frames and interlocked such that a breaker cannot be latched with the rating plug removed.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Provide UL listed non-linear rated panels with 200% neutral bus bars and lugs for all 120/208 volt panelboards where fed from K rated transformers. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Bussing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase bussing shall be full height without reduction.
- E. When called for, supply Surge Protective Device (SPD) units in accordance with SPD specification section here within.
- F. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
- G. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- H. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.6 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I²t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Communication Capability: Universal-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
 - f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
- B. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted is 1200 A or higher, The following shall apply:
1. Documentation. Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the circuit breaker(s).
 2. Method to Reduce Clearing Time. One of the following or approved equivalent means shall be provided:
 - a. Zone-selective interlocking
 - b. Differential relaying
 - c. Energy-reducing maintenance switching with local status indicator
 - d. Energy-reducing active arc flash mitigation system
 - e. An instantaneous trip setting. Temporary setting of the instantaneous trip setting to achieve an arc energy reduction shall NOT be permitted.
 - f. An instantaneous override.
 - g. An approved equivalent means
 3. The arc energy reduction system shall be performance tested by primary current injection testing or another approved method when first installed on site. This testing shall be conducted by a qualified person(s) in accordance with the manufacturer's instructions.

- a. A written record of this testing shall be made and shall be available to the authority having jurisdiction.

2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- E. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- I. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 COMMISSIONING

- A. Comply with requirements specified in Division 1.
- B. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup checks according to the approved manufacturer's written instructions.

3.5 TRAINING AND SERVICE

- A. Comply with Section 260001.
- B. Conduct two 4-hour training sessions. Train the Owner's maintenance personnel on procedures and schedules related to start up and shutdown, troubleshooting, servicing, and preventive maintenance.

End of Section

Section 26 24 19

MOTOR CONTROLS

(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section specifies furnishing and installing individually mounted motor starters and motor starters provided as components of equipment specified under other sections of these specifications. This section includes ac motor-control devices rated 600 V and less that are supplied as enclosed units.

1.1 SUBMITTALS

- A. Product Data: For products specified in this Section. Include dimensions, ratings, and data on features and components.
 - 1. Spare Parts: Include name, address, and telephone number of in-state supplier of spare parts. No out-of-state suppliers shall be permitted.
- B. Shop Drawings: For motor controllers in accordance with NEMA Standards ICS for Class II, Type "B" construction, including interconnection wiring diagrams.

1.2 QUALITY ASSURANCE

- A. Obtain similar motor-control devices through one source from a single manufacturer.
- B. Comply with NFPA 70, NEMA ICS, AB1.
- C. Listing and Labeling: Provide motor controllers specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the NEC, Article 100. Items to be UL listed and labeled: motor starters, combination motor starters, and motor circuit protectors.

1.3 COORDINATION

- A. Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.

- B. Coordinate features, accessories, and functions of each motor controller with the ratings and characteristics of the supply circuit, the motor, the required control sequence, and the duty cycle of the motor and load.
- C. Coordinate motor starters and combination motor starters with the provider or mechanical equipment. Some mechanical equipment is already supplied with starters and combination motor starters by the manufacturer.

1.4 WARRANTY

- A. Comply with Section 260001.
- B. The Electrical Subcontractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved Manufacturers
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. ABB.
 - 3. Square D; a brand of Schneider Electric.
 - 4. Or approved equal.

2.2 BASIS OF DESIGN

- A. The system specified is based upon products by Eaton Electrical Inc.; and represents the performance standard upon which any equivalent solution shall be based.

2.3 GENERAL

- A. The Electrical Subcontractor shall furnish and install motor starters for all motors, unless clearly indicated otherwise on the contract documents. Three phase motors shall be provided with a combination magnetic motors starter with ambient compensated overload heaters in each ground leg.
- B. Construct all products of the same type, size, rating and functional characteristics to be interchangeable and identically wired (sequence wiring).
- C. Nameplates:
 - 1. Provide a nameplate on each motor starter in accordance with NEMA ICS showing manufacturer's name and brand designation, reference standard, type class and rating as applicable.
 - 2. In addition, provide nameplate indication the starter's designation as shown on the contract drawings. Nameplates shall be 1 inch wide with ½ inch letters, constructed of three ply laminated phenolic material, engraved through black

face to white core and attached with stainless steel rivets or screws. Legend shall be furnished for approval prior to engraving.

2.4 MANUAL MOTOR CONTROLLERS

- A. Provide quick-make, quick-break, toggle switch type, with thermal alloy type overload protection. Use manual motor starters for single-phase motors rated less than 1/2 horsepower.
- B. Toggle Switch Operator: Provide operator guarded and equipped with a red indicating light to show when the switch is in the closed position.
- C. Designated units shall include "Hand-Off-Auto" selector switch and pilot light in a single enclosure (all starter selector switches shall be key operated except for in the Electrical room and Mechanical room).
- D. All "Hand-Off-Auto" controls in the bays shall be key-operated.

2.5 MAGNETIC MOTOR CONTROLLERS

- A. Combination Magnetic Controller: Full voltage, across-the-line, magnetic starter with motor circuit protector, sized to conform with standard NEMA ratings for the associated motor, for use on nominal 208 volt, three-phase, 60 Hertz service with control transformer for 120 volt control, three thermal type ambient compensated manual reset overload relays selected on basis of actual motor nameplate current, one convertible auxiliary interlock contacts in addition to units required for indicated control functions, cover mounted control devices (red and green pilot lights, start-stop pushbutton, and "Hand-Off-Auto" selector switch).

2.6 ENCLOSURES

- A. Description: Select flush or surface-mounted enclosures suitable for the environment in which they are to be used.
- B. Enclosures: Select motor controller and switch enclosures suitable for the environment in which they are to be used as follows:
 - 1. Enclosures for use indoors and in dry, dust free areas: NEMA Type1.
 - 2. Enclosures for outdoor locations or where moisture is present: Stainless steel NEMA Type 4X, weatherproof enclosure, as indicated.
 - 3. Enclosures for areas where dust and dirt likely to be present: NEMA 12 industrial type.
 - 4. Enclosures for hazardous areas: Approved for specific hazardous location.
 - 5. Factory Finish: Degrease and provide phosphate coating, after fabrication, to surfaces which are to be painted. Apply undercoat of rust-resistant paint such as zinc chromate over the phosphate coating (except for stainless steel). Apply finish painting of baked on, ANSI 61 baked enamel.

2.7 ACCESSORIES

- A. Accessories: Provide special tools or other devices normally furnished or required for installation, care and maintenance of equipment.

2.8 VARIABLE FREQUENCY DRIVE (VFD)

- A. The VFDs (also known as variable frequency control (VFC)) shall be furnished under Division 21, 22 and 23; and shall be installed and wired by the Electrical Subcontractor.
- B. All VFD shall include a disconnect switch that is pad-lockable in the open position.
- C. For VFD that are in sight from the motor, no separate disconnect is required between it and the motor if equipped with a disconnect switch that is pad-lockable in the open position.
- D. For VFD that are not in sight from the motor, provide a separate disconnect ahead of the VFD and the motor. "In sight from the motor" is defined by the National Electrical Code as being visible from and not more than 50 feet from.
- E. When a separate motor disconnect switch is provided the disconnect switch shall include automatic "early break" auxiliary contacts that deactivate the VFD whenever the motor disconnect switch is opened. The wiring associated with the early break contacts may be run in the same conduit as the power wiring to the disconnect switch. Assure the electrical drawings indicate the required early break contact wiring. When a common VFD serves multiple direct-drive fan array motors, early break auxiliary contacts are not required.
- F. Control wiring shall be as provided by the manufacturer except as modified by the approval and submittal process. Interface all local and remote devices into the control wiring and operational systems for each load as specified on the drawings.
- G. Manufacturer's Representative
 - 1. Provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in installation and start-up of the equipment specified. The manufacturer's representative shall provide technical direction and assistance to the Electrical Subcontractor in verification of general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.
 - 2. The following minimum work shall be performed under the technical direction of the manufacturer's service representative.
 - a. Check all removable cells and starter units for easy removal and insertion.
 - b. Perform insulation tests on each phase and verify low resistance ground connection on ground bus.
 - c. Verify basic operation of each starter from control power source.
 - d. Verification of proper torque on all field and factory bolted bus connections. Utilize calibrated torque wrench and submit calibration records with the startup report.
 - e. Calibrate any solid-state metering or control relays for their intended purpose and make written notations of adjustments on record drawings.
 - f. Follow the manufacturer's instruction and the contract documents concerning any short circuit device settings, HMCP settings or timing

relays. All adjustable settings shall be documented and included in the final O & M manual.

3. Submit the manufacturer's field startup report before final payment is made.

H. Training

1. Provide a training session for up to three representatives for 1/2 normal workdays at the job site or other office location chosen by the Owner's Representative.
2. A manufacturer's qualified representative shall conduct the training session.
3. The training program shall consist of the following:
 - a. Review of the one-line drawings and schedules.
 - b. Review of the factory record shop drawings and placement of the various cells.
 - c. Review of each type of starter cell, components within control and power wiring.
 - d. Review contactor coil replacement, and contact replacement procedures.
 - e. Discuss the maintenance timetable and procedures to be followed in an ongoing maintenance program.
 - f. Provide three ring binders to participants complete with copies of drawings and other course material covered.
 - g. Full operation, under any and all operating conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motor controllers according to manufacturer's written instructions.
- B. Install conduit in accordance with CSI Division 26 Section 260533, "Raceway and Boxes for Electrical Systems."
- C. Connect power cable and control wire as recommended by manufacturers. Make power cable and control cable connections to manual starters, and across-the-line magnetic starters by means of integral mechanical connectors. If such items are not furnished with integral mechanical connectors, make connections using compression connectors in accordance with CSI Division 26 Section 260519, "Low-Voltage Electrical Power Conductors and Cables."
- D. Ground motor starter in accordance with CSI Division 26 Section 260526, "Grounding and Bonding for Electrical Systems."
- E. Apply touch up paint as necessary.

3.2 IDENTIFICATION

- A. Identify motor-control components and control wiring according to CSI Division 26 Section 260553, "Identification for Electrical Systems."

3.3 CONTROL WIRING INSTALLATION

- A. Install wiring between motor-control devices according to CSI Division 26 Section 260519, "Electrical Power Conductors and Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect hand-off-automatic switch and other automatic control devices where available.
 - 1. Connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.
 - 2. Connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.4 CONNECTIONS

- A. Tighten connectors, terminals, bus joints, and mountings. Tighten field-connected connectors and terminals, including screws and bolts, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Inspection and Tests: In addition to any inspection and test requirements noted elsewhere, the following tests are required.
 - 1. The equipment shall be fully assembled, wired and tested at the factory.
 - 2. The motor controllers shall be given visual inspection, wiring checks and operation, continuity, and electric tests for each circuit in accordance with the latest standards of IEEE, NEMA and ANSI, in order to assure completeness, adequacy, and proper functioning equipment. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Sections 7.5, 7.6, and 7.16 or per manufacturer's recommendations. Certify compliance with test parameters.
 - 3. Where more than one test is indicated in test code, state by which method the test will be performed.
 - 4. All tests shall be performed in the presence of the DESIGNER. The DESIGNER shall be permitted to inspect any equipment, material or work to be furnished under these specifications and shall have the right to reject any parts considered defective or unsuitable for the use and purpose intended or not in accordance with these specifications.
 - 5. After installing motor controllers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
Remove and replace malfunctioning units with new units, and retest.

3.6 CLEANING

- A. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

3.7 COMMISSIONING

- A. Comply with requirements specified in Division 1.
- B. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup checks according to the approved manufacturer's written instructions.

3.8 TRAINING AND SERVICE

- A. Comply with Section 260001.
- B. Conduct two 4-hour training sessions.

3.9 SPARE PARTS

- A. Furnish to the Engineer spare parts described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. One spare contactor (motor starter) for each ten or less contactors (motor starters) of given size.
 - 2. One set of spare overload heater elements for each ten sets of specific size.
 - 3. Ten percent spare fuses for both primary and secondary of control power transformers.
 - 4. 100 percent replacement of indicating lamps.
 - 5. 50 percent replacement of indicating lamp lenses.

End of Section

Section 26 27 26

WIRING DEVICES

(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Receptacle Outlets.
 - 2. Switches.
 - 3. Large Format Display Backboxes.
 - 4. Wall Plates.
 - 5. Floor Service Fittings.
 - 6. Contactors.
 - 7. Conductors and Cables.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.5 WARRANTY

- A. Comply with Section 260001.

- B. The Electrical Subcontractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

- A. Approved Manufacturers
 - 1. Legrand; Wiring Devices & Accessories (Legrand).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Or approved equal.

2.2 RECEPTACLE OUTLETS

- A. General: All receptacle outlets shall be tamper-resistant.
- B. Tamper-Resistant Convenience Receptacles, 125V, 20A: Comply with NEMA WD1, NEMA WD6 configuration 5-20R, UL498 and Federal Specification W-C-596. Prewired pigtail connectors that accommodate Fed Spec receptacles are approved. Must be crimped and welded terminal right-angle application connector.
 - 1. Pass & Seymour: TR5351 (single), TR5362 (duplex), PTTR5362 (use with PTR6STRNA prewired pigtail connector).
- C. Combination Tamper-Resistant Single Convenience Receptacle with (2) USB ports (Type C), 125 V, 20 A and USB power supply of 5Vdc @ 6A, 30W output. cULus Listed, UL Fed Spec Listed. Complies with test requirements UL 498, UL 1310, Fed Spec WC596, CSA C22.2 No. 42, CSA C22.2 No. 223.
 - 1. Pass & Seymour: TR20USBPDW (use with PTR6STRNA prewired pigtail connector).
- D. Controlled Tamper-Resistant Convenience Receptacles, 125V, 20A: Comply with NEMA WD1, NEMA WD6 configuration 5-20R, UL498 and Federal Specification W-C-596.
 - 1. Controlled Tamper-Resistant Convenience Receptacles, 125V, 20A: Comply with NEMA WD1, NEMA WD6 configuration 5-20R, UL498 and Federal Specification W-C-596.
 - a. Pass & Seymour: TR5362CH** - 20A top-half controlled.
 - b. To be installed downstream and wired from the wireless controlled receptacle on the same circuit.
- E. Weather-Resistant Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD1, NEMA WD6 configuration 5-20R, UL 498, Federal Specification W-C-596 and UL943, Class A, and include indicator light that is lighted when device is tripped.
 - 1. Pass & Seymour: 2097TRWR.

2. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant thermoplastic with lockable while-in-use cover.
 - a. Hubbell: MX3200 single gang
 - b. Hubbell: MX6200 dual gang
 - F. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD1, NEMA WD6 configuration 5-20R, UL 498, Federal Specification W-C-596 and UL943, Class A, and include indicator light that is lighted when device is tripped.
 1. Pass & Seymour: 2097TR.
 - G. Range Outlet: Straight Blade Devices, Single, 50A 125/250V, 3-Pole 4-Wire Grounding, 14-50R, Flush Mount, Black.
 1. Legrand: 3894.
 - H. Dryer Outlet: Straight Blade Devices, Single, 30A 125/250V, 3-Pole 4-Wire Grounding, 14-30R, Flush Mount, Black.
 1. Legrand: 3864.
 - I. Finishes
 1. Wiring Devices Connected to Normal Power System: Color by Architect.
 2. Wiring Devices Connected to Emergency (Life Safety) Power System: Red.
 3. Controlled outlets: Color by Architect.
- 2.3 SWITCHES
- A. Comply with NEMA WD 1 and UL 20.
 - B. Switches, 120/277 V, 20 A:
 1. Pass & Seymour; CSB20AC1 (single pole), PT20AC1 (single pole – use with PTS6STR3 prewired pigtail connector), CSB20AC2 (two pole), CSB20AC3 (three way), PT20AC3 (three way – use with PTS6STR4 prewired pigtail connector), CSB20AC4 (four way).
 - C. Pilot Light Switches, 120/277 V, 20 A:
 1. Pass & Seymour; PS20AC1RPL for 120V, PS20AC1RPL7 for 277V.
 - D. Key-Operated Switches, 120/277 V, 20 A:
 1. Pass & Seymour; PS20AC1-L.
 - E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
 1. Pass & Seymour; 1251.
 - F. Timer Switch : Decora Preset 2 Hour Countdown Timer - 120VAC, 60Hz, 1800W Incandescent, 600W CFL, 5A LED, 20A Resistive/Inductive, 1HP, single pole 3-way or

more locations, four preset buttons for 1/4 - 1/2 - 1 - 2 hours, neutral required. White assembled on device, Ivory and Light Almond included.

1. Legrand; LTB02-1LZ.

G. Finishes

1. Color by Architect.

2.4 LARGE FORMAT DISPLAY BACKBOXES

- A. Designed to mount along the bottom edge behind a Plasma, LED or LCD display.
- B. Large Format Display backboxes shall be manufactured from stamped steel approved for use in new and renovation construction locations. Boxes shall have a polyester based baked enamel finished interior (white). Boxes shall be 11 1/4" L x 4" W x 10 7/8" H [287mm x 102mm x 275mm]. Provide boxes with four (4) independent wiring compartments that allow for up to four (4) receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. The box shall be provided with two (2) removable device compartments to facilitate installation and moves, additions, and changes. The cable pass-through area shall be a minimum of 2.4 in² [1560mm²] per channel. The box shall contain the following number of knockouts: four (4) 1-1/4" trade size, two (2) 3/4" trade size, and two (2) 2" trade size. The box shall be provided with a trim ring and decorative cover. The trim flange shall have an epoxy coating (white) that can be field painted. The decorative cover shall be made out of steel .048" [1.2mm] thickness minimum. The cover shall have an epoxy coating (white) that can be field painted. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 20A straight blade receptacles, Ortronics® workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.
- C. Furnish and install at each TV location shown on the drawings.
1. Legrand: EFSB4
- D. Furnish and install (2) Leviton 40834-W HDMI Feedthrough QuickPort Connectors and 41900-XX High Speed HDMI Cables between the large format display backboxes and AV outlets shown on the drawings (TVHC, TVHL and TVHF locations).

2.5 WALL PLATES

- A. Single and combination types:
1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: Stainless Steel.
 3. Material for Unfinished Spaces: Galvanized steel.
 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2.6 FLOOR SERVICE FITTINGS

A. Power/Communications/AV – Floor Box Floor Service (concrete, raised and wood floors):

1. The floor box shall be utilized for floor power and communications to accommodate duplex receptacles, voice/data outlets and AV outlets.
2. Provide where shown on the drawings with face plates and cover assembly. Cover color and type shall be as directed by the Architect.
3. Modular, flush-type, dual-service units suitable for wiring method used.
4. Compartments: 6 compartment with barrier to separate power from communications cabling.
5. Furnish and install one 3/4" conduit for power and two 2" conduits for communications. Run conduits to the nearest wall and stub up above accessible ceiling. Provide bushings and pull string in all conduits.
6. Coordinate with the structural engineer for the maximum size of the conduit allowed to run in the slab. In the event that conduits larger than 3/4" or 2" are not allowed to run in the slab, run conduits in the ceiling of the floor below or under the slab.
7. Basis of Design: Legrand EFB6S Series, Legrand EFB6S-OG (Ground), and Legrand EFB6S-FC (fire classified).

B. Power/Communications – Floor Box Furniture Feed (concrete, raised and wood floors):

1. The floor box shall be utilized for floor power and communications to accommodate duplex receptacles and voice/data outlets.
2. Provide where shown on the drawings with face plates and cover assembly. Cover color and type shall be as directed by the Architect.
3. Modular, flush-type, dual-service units suitable for wiring method used.
4. Compartments: Barrier separates power from communications cabling.
5. Furnish and install one 1" conduit for power and one 2" conduit for communications. Run conduits to the nearest wall and stub up above accessible ceiling. Provide bushings and pull string in all conduits.
6. Furnish and install power and telecommunications whips to the powered furniture.
7. Coordinate electrical work associated with the powered furniture delivery so that the work is scheduled to be performed when the powered furniture is delivered and assembled on site.
8. Run telecommunications wiring in the modular furniture, furnish and install outlet jacks and faceplates, terminate and test all devices.
9. The work shall be scheduled and performed at no additional cost to the Owner.
10. Basis of Design: Legrand EFBFF- FPF FTC Series.

C. Power/Communications/AV - Poke-Thru Floor Service:

1. The poke-thru service device shall be utilized for floor power, communications and AV to accommodate up to five duplex receptacles, or up to 22 voice/data outlets or up to 16 AV outlets or a combination of the three services.
2. Provide where shown on the drawings with 5-20R receptacles, voice/data outlets and AV outlets together with face plates and die-cast aluminum cover assembly. Color shall be as directed by the Architect.
3. Modular, flush-type, dual-service units suitable for wiring method used.
4. Compartments: Barrier separates power from communications cabling.

5. Furnish and install 3/4" bottom housing assembly for power and one 1-1/4" bottom housing assembly for communications and one 1-1/2" bottom housing for AV. Provide bushings and pull string in all conduits.
6. Run conduits in the ceiling of the floor below.
7. Basis of Design: Legrand 8AT Series.

D. Power/Communications - Poke-Thru Furniture Feed:

1. The poke-thru service device shall be utilized for floor power and communications to accommodate up to ten 10 AWG conductors for power and up to 27 Category 6 cables for communications.
2. Provide where shown on the drawings.
3. Modular, flush-type, dual-service units suitable for wiring method used.
4. Compartments: Barrier separates power from communications cabling.
5. Furnish and install 3/4" bottom housing assembly for power and 2" conduit bottom housing assembly for communications and AV. Provide bushings and pull string in all conduits.
6. Run conduits in the ceiling of the floor below.
7. Furnish and install power and telecommunications whips to the powered furniture.
8. Coordinate electrical work associated with the powered furniture delivery so that the work is scheduled to be performed when the powered furniture is delivered and assembled on site.
9. Run telecommunications wiring in the modular furniture, furnish and install outlet jacks and faceplates, terminate and test all devices.
10. The work shall be scheduled and performed at no additional cost to the Owner.
11. Basis of Design: Legrand 6ATCFF Series.

E. Power/Communications – Poke-Thru Transient Locations

1. This assembly shall be made up of an insert and an activation cover. Overall poke-thru assembly length shall be 16" 3/8" [416mm].
2. Insert:
 - a. The insert body shall have the necessary channels to provide complete separation of power and communication services. There shall be one 3/4" trade size channel for power and two 3/4" trade size channels for communication cabling. The channels shall be arranged such that communication cables can be conduit protected and connected to the insert body using a die-cast zinc conduit connector with two 3/4" trade size threaded openings to accept both rigid and flexible conduit connections.
 - b. The insert shall also consist of two 20-amp duplex receptacles. The four receptacles shall be prewired with six 12 AWG THHN solid conductors. Each duplex receptacle shall be wired with individual neutral and individual ground wires. The power receptacles shall be capable of being wired as standard receptacles or for isolated ground. Circuit identifiers shall be clearly marked on each duplex receptacle and a wiring diagram shall be stamped inside the junction box.
 - c. The insert body shall also contain a nonmetallic bracket that will accommodate Ortronics workstation connectivity modular inserts, or Wiremold open system adapters. The bracket shall allow the inserts to mount flush and recessed.
 - d. The body will consist of an intumescent fire stop material to maintain the fire rating of the floor slab. The intumescent material will be held securely in place in the insert body and shall not have to be adjusted to maintain

the fire rating of the unit and the floor slab. The insert shall have a spring steel-retaining ring that will hold the poke-thru device in the floor slab without additional fasteners. The poke-thru insert shall also consist of a 3/4" trade size conduit stub that is connected to the insert body and a 24.5 cubic inch [402ml] stamped steel junction box for wire splices and connections. The stamped steel junction box shall also contain the necessary means to electrically ground the poke-thru device to the system ground.

3. Activation Cover:
 - a. The trim flange shall be manufactured of die-cast aluminum alloy and be capable of being powder-coated or plated. The coated finish is to be textured, two-stage epoxy paint in gray or black. A gasket is attached to the underside of the trim flange to maintain scrub water tightness. The trim flange shall also be available in a brushed brass and brushed aluminum finish. Brass and aluminum finish shall be a brushed finish with a lacquer sealant. The trim flange shall be 8 1/4" [210mm] in diameter. The activation slide cover shall be 6 1/4" [159mm] in diameter.
 - b. The activation cover shall be manufactured from textured Polycarbonate or PVC and be available in gray, black, aluminum, and brass colors. The slide holder assembly shall be flush with the floor and provide "Dead-front" protection that allows the receptacle covers to snap back into place when receptacle is not in use. A gasket is attached to the underside of the cover assembly to maintain scrub water tightness by preventing water, dirt, and debris from entering the power and communication compartments. The device shall also have accommodation for up to four communication connectors. The cover shall have individual slides that allow access to the communication connectors and will close over the connectors when not in use. Each activation cover shall also provide locations to adhere labels to identify both power and communication circuits.
4. Communication Modules Mounting Accessories:
 - a. The poke-thru device manufacturer shall provide a complete line of bezels to facilitate mounting of UTP, STP (150 ohm), fiber optic, coaxial, and communication devices. Communication connectors shall be capable of being installed either flush or recessed. For communications, the unit will contain accommodations for up to four connectors for UTP, fiber optic, coaxial, audio, and video solutions. The poke-thru device shall accommodate Ortronics workstation connectivity outlets and modular inserts or the Wiremold open system adapters. To accommodate the communication solutions, the device shall accept discrete keystone type connectivity devices from various manufacturers. All communication inserts shall be nonmetallic. The system shall provide for connection of other modular inserts for additional communication options. The unit will also be supplied with four Category 6 keystone connectors with the standard version. The unit shall also accommodate a mechanism to permit protection of communication cabling. This mechanism shall be zinc die-cast with two openings to accept both flexible and rigid conduit. Openings shall accept 3/4" trade size conduit
5. Basis of Design: Legrand RC4 Series.

F. Installation

1. Preparation
 - a. Prepare substrates using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
 - b. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
2. General
 - a. Install in accordance with manufacturer's instructions for system components and approved shop drawings. Coordinate installation with adjacent work to ensure proper clearances and to prevent electrical hazards.
 - b. Install in accordance with complete system instruction sheets.
 - c. Install enclosures to be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, in accordance with manufacturer's installation sheets.
 - d. Install enclosures to be electrically continuous and bonded in accordance with the National Electric Code for proper grounding.
 - e. Mechanical Security: Raceway systems shall be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, in accordance with manufacturer's installation sheets.
 - f. Electrical Security: Metal raceway shall be electrically continuous and bonded in accordance with the National Electric Code for proper grounding.
 - g. Raceway Support: Raceway shall be supported at intervals not exceeding 5 feet (1524 mm) or in accordance with manufacturer's installation sheets.
 - h. Accessories: Provide accessories as required for a complete installation, including insulated bushings and inserts where required by manufacturer.
 - i. Unused Openings: Close unused raceway openings using manufacturer's recommended accessories.
 - j. Install floor boxes to permit all wiring to be completed at floor level.
3. Protection
 - a. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer.
 - b. Protect installed products until completion of project.
 - c. Touch-up, repair or replace damaged products before Substantial Completion.

2.7 CONTACTORS

A. Manufacturers

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Electrical Inc.; Cutler-Hammer Products.
4. Or approved equal.

B. Basis of Design

1. Basis of design based upon products by Elliott Industries, Inc.

- C. Description: Electrically operated and electrically held, combination type with fusible switch, complying with NEMA ICS 2 and UL 508.
 - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 - 3. Enclosure: Comply with NEMA 250.
 - 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.8 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at the proper heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign material from outlet boxes.

3.3 INSTALLATION

- A. Perform work in a neat and workmanship manner in accordance with NECA 1 and where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- C. Coordination with Other Trades:
 - 1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- D. Conductors:
 - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pig-tailing existing conductors is permitted provided the outlet box is large enough.
- E. Device Installation:
 - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- F. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.
- G. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- H. Dimmers:
1. Install dimmers within terms of their listing.
 2. Verify that dimmers used for fan speed control are listed for that application.
 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- I. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.
- J. Install lighting control devices in accordance with manufacturer's instructions.
- K. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- L. Install lighting control devices plumb and level and held securely in place.
- M. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough opening. Do not use oversized wall plates in lieu of meeting this requirement.
- N. Occupancy Sensor Locations:
1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.

2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturers recommendations, in order to minimum false triggers.
 - O. Outdoor Photo Control Locations:
 1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install photo sensor facing east, west or down.
 2. Locate outdoor photo controls so that photo sensor do not face artificial light sources, including light sources controlled by the photo control itself.
 - P. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.
 - Q. Lamp Burn-in: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendation prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
 - R. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel inaccessible ceiling near the sensor location.
 - S. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.
 - T. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.
 - U. Where indicated or required, provide cabinet or enclosure for mounting of lighting control device system components.
- 3.4 IDENTIFICATION
- A. Comply with Division 26 Section "Identification for Electrical Systems."
 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.
- 3.5 FIELD QUALITY CONTROL
- A. Perform tests and inspections and prepare test reports.
 1. Test Instruments: Use instruments that comply with UL 1436.
 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
 - B. Tests for Convenience Receptacles:
 1. Line Voltage: Acceptable range is 105 to 132 V.

2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

C. Lighting Control:

1. Inspect each lighting control device for damage and defects.
2. Test occupancy sensors to verify operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
3. Test outdoor photo controls to verify proper operation, including time delays where applicable.
4. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.6 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensors settings to minimize undesired activations while optimizing energy savings, and to achieve optimal coverage as required.
- C. Where indicated or as directed by Architect/Engineer, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
- D. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect/Engineer.

3.7 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.8 COMMISSIONING

- A. Comply with requirements specified in Division 1.
- B. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup checks according to the approved manufacturer's written instructions.

3.9 TRAINING AND SERVICE

- A. Comply with Section 260001.
- B. Conduct two 4-hour training sessions. Train the Owner's maintenance personnel on procedures and schedules related to start up and shutdown, troubleshooting, servicing, and preventive maintenance.

End of Section

Section 26 28 13

FUSES

(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Cartridge fuses rated 600 V and less for use in controllers and motor-control centers.

1.3 SUBMITTALS

- A. Product Data: For each fuse type indicated.
- B. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA FU 1.
- C. Comply with NFPA 70.

1.5 WARRANTY

- A. Comply with Section 260001.
- B. The Electrical Subcontractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved Manufacturers
 - 1. Bussman, Inc.
 - 2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Or approved equal.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

- A. Motor Branch Circuits: Class RK1/RK5, time delay.

3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

3.4 EXTRA MATERIALS

- A. Ten percent spare fuses. Provide a minimum of three of each type.

End of Section

Section 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
 - 1. Fusible switches.
 - 2. Non-fusible switches.
 - 3. Molded-case circuit breakers.
 - 4. Enclosures.

1.3 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.5 WARRANTY

- A. Comply with Section 260001.
- B. The Electrical Subcontractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Approved Manufacturers
 - 1. Eaton Corporation; Cutler-Hammer Products.
 - 2. General Electric Co.; Electrical Distribution & Control Division.
 - 3. Square D/Group Schneider.
 - 4. Or approved equal.
- B. Fusible Switch, 1200A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Non-fusible Switch 1200 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
 - 3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.2 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Approved Manufacturers
 - 1. Eaton Corporation; Cutler-Hammer Products.
 - 2. General Electric Co.; Electrical Distribution & Control Division.
 - 3. Square D/Group Schneider.
 - 4. Or approved equal.
- B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
 - 4. GFCI Circuit Breakers: Single- and two-pole configurations with [5] [30]-mA trip sensitivity.
- C. Molded-Case Circuit-Breaker Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.

2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

2.3 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
 1. Outdoor Locations: NEMA 250, Type 3R; Type 4X where noted.
 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 and concrete materials are specified in Division 03.
- C. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- D. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- E. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- G. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26.

3.2 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
 1. Inspect mechanical and electrical connections.
 2. Verify switch and relay type and labeling verification.
 3. Verify rating of installed fuses.
- B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

End of Section

Section 26 51 00

INTERIOR LIGHTING

(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. Section Includes:

1. Interior Lighting fixtures
2. LED Luminaires and Light Sources
3. Emergency Lighting
4. Exit Signs
5. Lamps
6. Drivers
7. Miscellaneous

- B. Related Sections include the following:

1. Division 01 Section "General Commissioning Requirements."
2. Division 01 Section "Facility Exterior Enclosure Commissioning."

1.3 DESCRIPTION OF WORK

- A. Description of Work: Provide and install all lighting fixtures, complete with lamps, drivers, wiring, and control.

1. All materials, accessories, and any other equipment necessary for the complete and proper installation of all lighting fixtures included in this Contract shall be furnished by the Contractor, including those not usually indicated on the drawings or specified, but that are necessary for the proper installation and operation of the fixtures.
2. Specifications and drawings are intended to convey the salient features, function, and character of the fixtures only, and do not necessarily illustrate or set forth every item or detail necessary for completion of the work.
3. Verify final ceiling type with final architectural reflected ceiling plans prior to ordering fixture. Provide mounting accessories for proper installation in ceiling type.

4. Minor details not usually indicated on the drawings nor specified, but that are necessary for the proper execution and completion of the fixtures, shall be included, the same as if they were herein specified or indicated on the Drawings.
5. Conformance: Fixtures shall be manufactured and installed in strict accordance with the Contract Documents. The Contractor shall be held responsible for the omission or absence of any detail, construction feature, etc. which may be required in the manufacture and installation of the fixtures. The responsibility of accurately fabricating and installing the fixtures to the fulfillment of this specification rests with the Contractor.
6. Support: Fixtures shall be securely attached to support system to meet all code requirements.
7. Codes: Materials and installation shall be in accordance with the applicable edition of the National Electrical Code (NEC) and any applicable Federal, State, and local codes and regulations.
8. UL Listing: All fixtures shall be manufactured in strict accordance with the appropriate and current requirements of the Underwriters Laboratories, Inc. "Standards for Safety," and others as they may be applicable. A UL listing shall be provided for each fixture type, and the appropriate label or labels shall be affixed to each fixture or components in a position concealing it from normal view.

B. Definitions:

1. CCT: Correlated color temperature
2. CRI: Color-rendering index
3. LER: Luminaire efficacy rating
4. Lumen: Measured output of lamp and luminaire, or both.
5. Luminaire: Complete lighting fixture, including remote driver housing (if required)
6. SDCM: Standard Deviation of Color Matching

1.4 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ANSI/ASHRAE/IES - Standard 90.1
2. ANSI C78.377 - Chromaticity
3. ANSI C62.41 - Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits
4. CIE TC1-69 - Color Rendering
5. IESNA LM-79 - Approved Method for Electrical & Photometric Measurement of SSL Products
6. IESNA LM 80 - Approved Method for Lumen Maintenance of LED Light Source
7. IESNA RP1605 - Nomenclature and Definitions for Illuminating Engineering
8. NEMA LE 4 - Ceiling Compatibility for Recessed Fixtures
9. NFPA 70 -National Electrical Code (NEC)
10. NFPA 101-Life Safety Code
11. UL 57 - Electric Lighting Fixtures
12. UL 924 - Emergency Lighting and Power Equipment
13. UL 1598 - Luminaires
14. UL 8750 - LED Equipment for Use in Lighting Products

1.5 SUBMITTALS

A. Submit the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - a. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - b. Reference catalog cuts to the applicable specification article.
2. Photometric layouts are required prior to the approval of the product data. Provide point-by-point calculations for the entire building. Calculations showing typical areas shall not be acceptable.
 - a. Provide photometric layout using industry approved lighting software.
3. For standard catalog items with no modifications, submit cut sheets that clearly show all elements to be supplied, and all corresponding product data. If a cut sheet shows more than one (1) fixture type, all non-applicable information shall be crossed out. Submittals must be prepared by the manufacturer or manufacturer's local representative agency and include a cover sheet for each fixture type which clearly indicates the following:
 - a. Lighting fixture physical description, type, size including all dimensions, material, indoor/outdoor, diffusers/lenses, baffles, finishes, and means and methods of attachment.
 - b. Manufacturer and model of fixtures (inclusive of drivers, dimming modules, power supplies, lamps, etc.).
 - c. Lighting fixture performance including system wattage, system lumen output, light quality including color temperature and color rendering index .
 - d. Project name.
 - e. Name of manufacturer's representative agency.
 - f. Complete catalog number for the lighting fixture including accessories and options and any miscellaneous items detailed in the written description of the specification.
 - g. Where applicable, LED driver information including manufacturer, characteristics, type, model number and voltage. Provide manufacturer's test report for electronic drivers and test data for drivers regarding the tripping class P units based on the specified criteria.
4. For some lighting fixtures, annotated catalog cuts will not be sufficient, and detailed factory shop drawings will be required. For linear lighting systems, provide factory shop drawings showing all run lengths and patterns, with reference to location in the project by drawing number or room number. For architecturally integrated lighting fixtures, verify field dimensions and include them on shop drawings showing exact locations of fixtures.
5. Where applicable, shop drawings shall include wiring diagrams, scale plans, and details showing the method of installation of LEDs and LED boards, reflectors, track, suspension hardware, transformers, drivers, and secondary feeds, as well as a complete bill of materials.
6. All changes to shop drawings are to be "clouded" and dated prior to resubmission. No variation from the general arrangement and details indicated in the Contract Documents shall be made on the shop drawings, unless required to suit the actual conditions on the premises, and then only with the written

acceptance of the Architect and Lighting Designer. All variations must be clearly marked as such on drawings submitted for approval.

7. Provide alphabetized index of all submitted items, listing manufacturer, catalog #, LED or lamp manufacturer, and LED or lamp catalog number.
8. Photometric test report for each luminaire type and lamp combination listed on the Fixture Schedule/Catalog cuts. Test reports shall be based on Illuminating Engineering Society published test procedures and shall contain candlepower distribution curves in five lateral planes for fixtures with asymmetric distributions and fixture luminance data for vertical angles above 45 degrees from nadir.
9. Shop drawings:
 - a. Suspension details for all fixtures recessed in, mounted on, or suspended from hung ceilings. Details shall clearly illustrate proposed fixing methods for fixtures requiring support independent of the suspended ceiling system.
10. Review of shop drawings or samples does not waive contract requirements. Approval of the shop drawings or samples does not relieve the Contractor from responsibility for deviations from the specifications or drawings, unless he has provided a letter noting such deviations at time of submission, and received written approval for such deviations from the Architect and Lighting Designer.
11. Approval of shop drawings or samples does not relieve the Contractor from responsibility for errors in the shop drawings or samples. Contractor shall be fully responsible for lighting fixtures that are manufactured or installed without approved shop drawings, and for fixtures not manufactured in accordance with the requirements of the Architect's and Lighting Designer's shop drawing reviews.
12. If requested by the Lighting Designer or Architect, submit samples of any fixture type for approval prior to manufacture.
 - a. The samples shall be complete with specified LEDs or lamps and driver ready for hanging, energizing, and examining, and shall be shipped to the Lighting Designer, or as otherwise advised.
 - b. Samples must be actual working units of fixtures to be supplied. For linear lighting fixtures, specified by the foot, provide a minimum length of four feet.
 - c. Samples will be returned but shall not be included in quantities listed for a project.
 - d. All costs to provide samples, including all shipping, shall be borne by the Contractor.
13. The Contractor shall identify any long lead times or lighting fixture delivery issues that may adversely affect the project schedule, and immediately bring them to the attention of the Owner's Representative.
14. Unit Cost Data: For each type of lighting fixture included in the fixture schedule, submit separate unit costs for materials and for labor for all components of a specified luminaire.
15. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
16. Submit manufacturer's installation instructions.
17. Complete bill of material listing all lighting fixtures and components.
18. Warranties.

B. Operation and Maintenance manuals submittals shall include the following:

1. A detailed description and catalog cut of each lighting fixture type.

2. Instructions for routine maintenance and tools required.
3. Pictorial parts list and part numbers.
4. Types of cleaners to be used.
5. Final, as-built shop drawings.
6. Telephone numbers for the authorized parts and service distributors.
7. Warranties.

1.6 SUBSTITUTIONS

- A. The light fixture package specified on the drawings has been certified by a third party employed by the Owner/Utility Company for the purpose of computing utility company rebates to the owner.
 1. The Electrical Contractor will employ and pay for the services of the third party designated by the Utility Company to evaluate the substituted fixture package and to compute utility company rebates to the owner.
 2. The Utility Company rebates to the Owner shall be equal to or greater than the specified fixture package.
 3. Once the substituted package is certified it shall be submitted to the Engineer for approval.
 - a. Provide point-by-point lighting calculations of the entire building and site.
 - b. Provide Total Light Power Density (LPD) per floor and for the whole building.
 - c. The LPD of the substituted luminaires shall be less than or equal to the specified luminaires.
 4. Provide a side-by-side comparison between the specified and the substituted fixtures include the following criteria:
 - a. Input Watts
 - b. Voltage
 - c. Output Lumens
 - d. Energy Star Rating
 - e. DLC approval
 - f. Total Light Power Density (LPD) per floor and for the whole building.

1.7 DRAWINGS

- A. The drawings, which constitute a part of these specifications, indicate the general location of the luminaires.
- B. Specifications and drawings are for assistance and guidance, but exact locations, distances and levels will be governed by actual field conditions. Contractor is directed to make field surveys as part of his work prior to submitting system layout drawings.

1.8 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new.

- B. Materials, equipment and appurtenances as well as workmanship provided under this Section shall conform to the highest commercial standard as specified.
 - C. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing and Calculation Guides. Alternatively, photometric testing data can be provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - E. Comply with NFPA 70.
 - F. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
 - G. Materials, equipment, and accessories as well as workmanship provided under this section shall conform to the highest commercial standards and as specified and as indicated on drawings. Luminaire parts and components not specifically identified or indicated shall be made of materials most appropriate to their use or function and as such resistant to corrosion and thermal and mechanical stresses encountered in the normal application and function of the luminaires.
 - H. All luminaires shall be manufactured to a consistent level of quality. Size, color and components parts shall be identical for all Luminaires.
 - I. All new luminaires and related materials shall be new.
 - J. The Contractor shall coordinate all luminaires, mounting hardware, and trim with ceiling system and other items, including work of other trades.
 - K. Mockups; Will be specified prior to fixtures procurement.
 - 1. Obtain Architect's approval of fixtures for mockups before starting installations.
 - 2. Provide interior lighting fixtures for mock-ups, complete with power and control connections.
 - 3. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work unless the Architect or Lighting Consultant stipulates otherwise.
- 1.9 WARRANTY
- A. Comply with Section 260001.
 - B. The Electrical Contractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.

- C. Luminaires shall be provided with a 5-year warranty covering, LEDs, drivers and paint finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers

- 1. Cooper Lighting
- 2. Signify
- 3. Acuity Brands
- 4. Or approved equal

2.2 LIGHT FIXTURES

- A. Provide and wire lighting fixtures scheduled or indicated by type designation on the drawings. If type designation is omitted, fixtures shall be of the same type as shown for rooms of similar usage. Verify before purchase and installation. No alternative fixtures will be accepted.
- B. Locations of fixtures on electrical drawings are diagrammatic. Verify location and spacing with architectural reflected ceiling plans and other reference data before purchasing. Coordinate space conditions, including headroom clearances and interferences with ceiling components such as ducts, openings, beams and piping prior to installation. Allow for movement of up to 9 feet from indicative location on plans.
- C. Check the architectural finishes and, regardless of the catalog prefixes and suffixes shown, furnish fixtures with the proper trim, frames, supports, hangers and other miscellaneous appurtenances or properly coordinate with said finishes. Where required, furnish reinforcing for ceiling construction to support the weight of the fixtures.
- D. Fixtures shall be free of light leaks and designed to provide sufficient ventilation of LEDs and drivers, including vent holes where required. Outdoor fixtures with vent holes shall have wire mesh screens in the vent holes.
- E. Light shields and lens shall be as specified under individual fixture types.
- F. Replace blemished, damaged, or unsatisfactory fixtures at no additional cost and in a manner satisfactory to the Owner's Representative.
- G. Reflector cones, baffles and decorative elements of fixtures shall not be installed until completion of plastering, ceiling tile work, hanging and general cleanup in the area unless fully protected from dust ingress.
- H. Provide labor and materials for final targeting of adjustable fixtures under supervision of the Owner's Representative. Targeting shall take place immediately before building is turned over to the Owner and after regular working hours where required.

- I. In fixtures with asymmetrical beams, adjustment devices shall be set to ensure permanent orientation of light beam and shall not be affected by servicing LEDs, lamps, or drivers.
- J. Surface and stem mounted fixtures: Provide auxiliary supports for mounting fixtures in areas without suspended ceilings. Luminaires shall be independently supported with dedicated fixings (unless it is agreed otherwise) from the soffit. Do not mount fixtures to piping, ducts or other mechanical equipment.
- K. Complete units and all electrical components for light fixtures shall bear the UL label. Labels shall not be placed on fixtures at locations where installation of unit labels is
- L. visible.
- M. Reflectors, cones or baffles shall be free of spinning lines, ripples or any marks or indentations caused by riveting or other assembly techniques. No rivets, springs or other hardware shall be visible after installation.
- N. All exposed metal parts of exterior lighting fixtures shall be stainless steel, anodized aluminum or have 4 mil zinc coating applied after fabrication and before finish. Screws and fastening shall be stainless steel. Painted finishes shall be as specified in schedules.
- O. If ceiling system requires, each recessed and semi-recessed fixture shall be furnished with a mounting frame or ring compatible with the ceiling in which they are to be installed. The frames and rings shall be one-piece or constructed with electrically welded butt joints, and of sufficient size and strength to sustain the weight of the fixture. Yokes, brackets and supplementary supporting members, needed to mount lighting fixtures to carrier channels or other suitable ceiling members, shall be furnished and installed by the Contractor. There should be no light leaks between ceiling trims of recessed lighting equipment and ceilings, or when fixtures are installed in partially transparent ceilings. Verify the ceiling type and suspension method prior to ordering fixtures. The Architect's favorable review of shop drawings for both the ceiling system and the lighting fixtures will not relieve the Contractor of the ceiling/lighting fixture compatibility requirement.
- P. Plastic for lenses and diffusers shall be formed of colorless 100% virgin acrylic, as manufactured by Rohm & Haas, DuPont. or equally acceptable manufacturers. The quality of the raw material must meet American Society of Testing Materials (ASTM) standards, as tested by an independent testing laboratory. Acrylic plastic lenses and diffusers shall be properly cast, molded, or extruded, as specified, and shall remain free of any dimensional instability, discoloration, embrittlement, or loss of light transmittance for at least 15 years. Glass used for lenses, refractors, and diffusers shall be crystal clear in quality with a transmittance of no less than 88%. Exterior fixtures shall use tempered Borosilicate glass, Corning #7740 or equal. For fixtures directly exposed to the elements and aimed above the horizontal, use Corning Vycor glass or equal. Where optical lenses are used, they shall be free from spherical and chromatic aberrations and other imperfections that may hinder their functional performance.

2.3 LED LUMINAIRES AND LIGHT SOURCES

- A. Only LED boards and modules supplied by [he original fixture manufacturer shall be offered for submittal.

- B. For all LFO products specified the Contractor shall submit the fixture specified with the current LED technology available within the specified fixture range at the time of submittal, ensuring that the required lumen output is achieved. If the specified fixture has been updated the revised fixture shall achieve a minimum light output ratio equal to the luminaire specified.
1. Color Tolerance: Unless otherwise specified, all LED light sources shall achieve a minimum color tolerance of at least 3-step ellipse, measured for both initial and at 25% of rated life. Color tolerance beyond this is unacceptable.
 2. Color Rendering Index: Color rendering index (CRI) of all LED light sources shall achieve the minimum CRI specified initially and at 25% of rated life. No variation in CRI between initial and 25% rated life is acceptable.
 3. Life Expectancy: Lifetime testing of LED light sources shall be carried out in accordance with LM-80-08. All LED light sources shall achieve a minimum performance of L70, where rated life of the LED light source is defined as the time taken to reach 70% of the initial lumen output.
 4. All LED light sources shall achieve a minimum lifetime of 50,000 hours at L70.
 5. All LED light sources shall not exceed a failure fraction of 10% (F10) at rated life (L70).
 6. Lumen Depreciation: Unless otherwise specified, all LED light sources shall provide a maximum lumen depreciation of 30% over the rated life of the product.
 7. Power Factor: LED drivers shall achieve a minimum power factor of 0.9.
 8. LED system shall use 16-bit or greater nonlinear scaling techniques for high-resolution output.
 9. Visible blinking, flickering or strobing shall not be acceptable at full lumen output, nor at any dimming level should dimming be specified.
 10. Audible noise when at full lumen output or at any dimming level shall not be acceptable.
 11. The Contractor shall ensure the LED driver is fully compatible with the proposed lighting control system as to ensure correct smooth operation of LED output at all dimming outputs without flicker, strobing, or other noticeable effect on lighting performance.
- C. Luminaire Testing: The following tests shall be undertaken for all LED products specified, including those identified as custom products. Confirmation that these tests have been carried out and passed is required during submittal.
1. Temperature cycling shock test: The non-energized LED luminaire shall be stored firstly at -20°C for 1 hour. The luminaire shall then be immediately moved into a cabinet having a temperature of +35°C and stored for 1 hour. Five such cycles shall be carried out. At the end of the test the LED luminaire shall operate and remain alight for 15 min.
 2. Supply voltage switching test: At test voltage the luminaire shall be switched on and off for 30 seconds. The cycling shall be repeated for a number equal to half the rated luminaire life in hours (example: 10K cycles if rated luminaire life is 20 000 hours). At the end of the test the LED luminaire shall operate and remain alight for 15 min.
 3. Thermal endurance test. The LED luminaire shall be operated at nominal voltage and at an ambient temperature of (plus) +35°C for outdoor luminaires, (plus) +25°C for indoor luminaires and (plus) +35°C for recessed luminaires until a test period equal to 25 % of the rated luminaire life (with a maximum of 6 000 hours)

has passed. At the end of this time, and after cooling down to room temperature, the luminaire shall remain alight for at least 15 min.

- D. LED Light Source and Luminaire Data: The following data for LED light sources shall be submitted for approval with all luminaires equipped with LED light sources:

1. Initial Luminaire Lumen Output at 1,000 hours (LI000).
2. RaI4 color rendering data, in addition to the general color rendering index Ra. Provide initial and data at 25% of rated life.
3. Color tolerance data, initial and at 25% of rated life, including the chromaticity coordinates of the bin.
4. Rated power of the luminaire including driver.
5. Power factor of the luminaire including driver, initial and at 25% of rated life.
6. Absolute photometry report in accordance with LM-79-08.
7. LED light source test reports in accordance with LM-80-08.

E. WHITE LED UNITS

1. Usable life shall be 50,000 hours minimum, defined by the point in which the lamp output has decreased by 30% from its initial output.
2. Base CCT shall be per specification. All LEDs supplied must be within a tolerance of +/-100K from base color temperature. Additionally, all LEDs shall be sourced from the same bin.
3. Chromaticity Tolerance shall be no more than 0.03 on the CIE chromaticity diagram from the black body curve.
4. Lamp CRI shall be a minimum of 80, unless otherwise specified.

2.4 LED EXIT LIGHT FIXTURES

- A. Description; Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction, dual circuit.
- B. Internally Lighted Signs: Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
- C. Exit light fixtures shall meet applicable requirements of NFPA and UL.
- D. Exit signs shall be edge-lit, white or mirror panel (clear panel exit sign shall not be permitted) with 90-minute backup battery power.
- E. There shall be no radioactive material used in the fixtures.
- F. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

2.5 DRIVERS

- A. LED Drivers and Dimming Controllers

1. Acceptable means of dimming unless otherwise noted in Fixture Schedule:
 - a. Pulse Width Modulation and hybrid Pulse Width Modulation with Constant Current.
 - b. All drivers shall comply with IEC Standard 62386, Parts 101 & 102.
2. Dimming: continuously from 100% to 1% unless otherwise noted in the fixture schedule and the specified performance requirements.
3. Driver shall start LED at any dimming position.
4. Life:
 - a. 70,000 hours lifetime, minimum.
 - b. Driver failure rate per 1000 hours operating at 60 degrees Celsius ambient, shall be 0.2 percent or less.
5. Input: 120-277 V, 50-60 Hz.
6. Supply: 24VDC constant current (unless otherwise specified).
7. Operation:
 - a. Driver shall automatically shut down in case of LED failure condition.
 - b. Driver shall be provided with miss-wire protection circuitry.
 - c. Driver shall be provided with short circuit and open circuit protection circuitry.
 - d. Driver shall contain automatic restart circuitry in order to restart LEDs after LED replacement.
 - e. Driver Power Factor at full light output shall be greater than 0.98.
 - f. Driver Power Factor across dimming range shall be greater than 0.90.

B. Control

1. Refer to the fixture schedule and lighting control specification for full driver control requirements.
 - a. Provide fixtures with correct drivers as specified within the fixture schedule and coordinate with the lighting control system to ensure compatibility.
 - b. Standard dimming protocol for static white light to use 0-10v control signal.
 - c. Standard dimming protocol for tunable white to use DALI control signal.
 - d. Standard dimming protocol for color changing RGB light to use DMX control signal.

2.6 MISCELLANEOUS

A. General LED Requirements:

1. Life: Rated Lumen Maintenance Life (per LM-80-08) shall be minimum 50,000 hours at L70 with Forward Phase Control
2. Maintenance
 - a. Provide plug-n-play connectors (e.g. Molex, Wago) in lieu of soldered connections so that LED boards can be removed and replaced with minimal tools in the event of a failure.
 - b. All LED boards and drivers shall be accessible for maintenance without the use of special tools.
3. Protection

- a. Protective circuitry - Power/data supply outputs shall have current limiting protection. Power/data supply shall provide mis-wiring protection.
- b. All hardwired connections to LED fixtures shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
- c. Power/data supply shall have power factor correction.

B. Disconnect Means

- 1. Provide disconnecting means for the following fixture types:
 - a. Light fixtures with multiple drivers and multi-wire circuits.
 - b. Occupancy sensor-controlled lighting without multiple override switches.
 - c. Remote lighting control without overrides within sight of the lighting.
- 2. Disconnect means is required internal or external to the fixture, for each fixture and in sight of the fixture. Acceptable means include a switch integral to the luminaire or a quick-disconnect between driver and branch circuit wiring connection internal to the luminaire.
- 3. Complete wiring disconnection including the ground wire is required for multi-wire circuits to fixtures.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Luminaires are shown diagrammatical on drawings. Coordinate luminaire installation with other trade drawings and reflected ceiling drawings. Provide luminaires, supports and accessories needed to meet space or ceiling arrangement constraints.
- B. Prior to ordering suspended or surface mounted continuous row luminaires for walls, coves, soffits, valances, or cabinets, verify overall lengths with the Architectural drawing layouts and details or specialty craft shop drawings.
- C. Recessed Downlights: Review Architectural drawings for insulation details and provide luminaires suitable for use in direct contact with insulation where required.

3.2 INSTALLATION

- A. Installation shall be in accordance with the NEC, manufacturer's instructions, and as shown on the drawings or specified.
- B. Lighting fixtures: Set level, plumb, and square with ceilings and walls.
- C. Install suspended exit signs using stem pendants from swivel hangers.
- D. Install suspended luminaries using stem pendants from swivel hangers, aircraft cable, and chain in accordance with the intended design. Provide stem pendants, aircraft cable, and chain lengths required to suspend luminaires at indicated height.

- E. Wall-mounted fixtures shall be attached to the studs in the walls, or to a 20-gauge metal backing plate that is attached to the studs in the walls. Lighting fixtures shall not be attached directly to gypsum board.
- F. Lighting Fixture Supports:
 - 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
 - 2. Shall maintain the fixture positions after cleaning and re-lamping.
 - 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
 - 4. Hardware for troffers:
 - a. Hardware devices shall independently support the fixture from the building structure at two opposite points.
 - 5. Stem hung fixtures shall be provided with ball swivels, located at the canopies, and rockers, at the fixtures, allowing a minimum 45-degree swing from the vertical. Stems shall be of 3/8-inch ID minimum pipe and shall be finished to match the lighting fixture.
 - 6. For fixtures mounted in continuous rows where individual fixtures are mounted on common mounting channels, or otherwise rigidly fastened together, install one support (stem, AC cable or chain) for each 4-foot lamp length and 2 for each 8-foot lamp length.
- G. Backing for surface mounted or stem hung linear fixtures shall be structural channel or angle iron with 5/16" bolts, except where mounted directly to concrete structures, in which case anchors and suspension shall be used. The exact method of support shall be determined in conjunction with the Owner's Representative.
- H. All light fixtures installed in gypsum board ceilings or plaster soffits shall be provided with metal frames. Fixtures in concrete shall be steel housing with bitumastic paint finish and approved for use in concrete. Fixtures shall be compatible with type of ceiling.
- I. Light fixtures which are to be mounted in continuous rows of two or more fixtures shall have at least two bolts or other interlocking devices, as approved by the Architect, at each connection to provide for positive and true alignment of the fixtures.
- J. All light fixtures contained within architectural details (i.e., cove, slots, valances, etc.) shall be continuous with fixtures tightly butted up against each other to reduce shadows. Actual illuminated length shall be centered in overall detail with equal spacing at each end. All concealed lighting of this nature shall be closely coordinated with architectural details where indicated in lighting fixture schedules.
- K. Recessed light fixtures shall be independently supported by #10 AWG wires to specified anchors in the slab above.
- L. Provide all lighting fixtures recessed in a ceiling which has a fire-resistant rating of one hour or more with box enclosures which have a fire rating equal to that of the ceiling. The space from the fixture to the enclosure shall be 3" for fixtures with 120V screw base sockets and 1" for other light fixtures.

- M. Verify weights and recommended mounting methods of all decorative fixtures with manufacturers and furnish and install supports. Fixtures weighing more than 10 pounds shall be supported independently of the outlet box.
- N. Luminous ceiling and wall cavities shall be completely enclosed with gypsum board and shall be painted with 90% reflecting white paint. Cavities shall be free of all obstructions including piping and ductwork, except for branch circuit wiring to fixtures in luminous ceiling. Branch circuit wiring in luminous ceiling shall not extend to fixtures outside luminous ceiling. The installation of luminous ceiling diffusers shall be in accordance with drawing details and as described in these specifications.
- O. Locale recessed ceiling luminaires as indicated on the Architect's reflected ceiling plan.
- P. Install wall mounted luminaires and exit signs at height as indicated on Architectural Drawings.
- Q. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- R. Lighting fixtures in mechanical spaces and machine rooms are shown in their approximate locations only. Do not install light outlets or fixtures until mechanical piping and ductwork are installed; then lighting fixtures shall be installed in locations best suited for equipment arrangement and as approved by the Architect. Verify locations of fixtures in elevator machine rooms before installation.
- S. Exterior fixtures requiring exposed exterior boxes shall be mounted on east boxes equipped with gaskets.
- T. Replace luminaires that have failed LEDs, lamps, drivers at Substantial Completion.
- U. Louvers, diffusers or lenses shall not be installed in lighting fixtures until such time as all glazing has been completed and all construction work involving plastering, grinding, sanding, painting, etc., and final clean-up sweeping and dusting have been completed.
- V. Clean all lamps, lenses, and optical chambers after installation.
- W. After the installation is completed, remove, and replace any driver which is judged by the Owner's Representative to be excessively noisy.
- X. Clean up and repair any damage to the finished building caused by installation of the light fixtures.
- Y. The electrical contractor and ceiling trades shall coordinate to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges, etc.), to match the ceiling system being installed.
- Z. Bond lighting fixtures to the grounding system as specified in Division 26.
- AA. At completion of project, replace all defective components of the lighting fixtures at no cost to the Owner.

3.3 ACCEPTANCE CHECKS AND TESTS

A. Perform the following:

1. Visual Inspection:
 - a. Verify proper operation by operating the lighting controls.
 - b. Visually inspect for damage to fixtures, lenses, reflectors, diffusers, and louvers. Clean fixtures, lenses, reflectors, diffusers, and louvers that have accumulated dust, dirt, or fingerprints during construction.
2. Electrical tests:
 - a. Exercise dimming components of the lighting fixtures over full range of dimming capability by operating the control devices(s) in the presence of the Engineer/Commissioning Agent. Observe for visually detectable flicker over full dimming range and replace defective components at no cost to the Owner.
 - b. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by the Owner. Burn-in period to be 40 hours minimum, unless specifically recommended otherwise by the lamp manufacturer. Burn-in dimmed fluorescent and compact fluorescent lamps for at least 100 hours at full voltage, unless specifically recommended otherwise by the lamp manufacturer.
 - c. Replace any lamps and ballasts which fail during burn-in.

3.4 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks and tests, the Electrical Subcontractor shall show by demonstration in service that the lighting systems are in good operating condition and properly performing the intended function.

3.5 TRAINING AND SERVICE

- A. Comply with Section 260001.
- B. Conduct two 4-hour training sessions. Train the Owner's maintenance personnel on procedures and schedules related to start up and shutdown, troubleshooting, servicing, and preventive maintenance.

End of Section

SECTION 27 05 00
COMMON WORK RESULTS FOR COMMUNICATIONS
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

A. Section Includes:

- 1. Telecommunications mounting elements.
- 2. Backboards.
- 3. Telecommunications pathways.
- 4. Grounding.

B. Related Sections:

- 1. Division 27 Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
- 2. Division 27 Section "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

- 1. Detail equipment assemblies, and location and size of each field connection.
- 2. Equipment racks and cabinets: Include workspace requirements and access for cable connections.
- 3. Grounding: Indicate location of grounding bus bar and its mounting detail.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
 3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Telecommunications Pathways and Spaces: Comply with TIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A.
- 1.5 PROJECT CONDITIONS
- A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and work above ceilings is complete.
- 1.6 COORDINATION
- A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 2. Record agreements reached in meetings and distribute them to other participants.
 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
- 1.7 WARRANTY
- A. Comply with Section 260001.
- B. The Electrical Subcontractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 RACKS

- A. Approved Manufacturers

1. Hoffman
2. Tripp Lite
3. Chatsworth
4. Or approved equal

B. Basis of Design:

1. Hoffman, P/N: EDR19FM45U6, 2-Post Rack
 2. Hoffman, P/N: E4DR19FM45U, 4-post, adjustable depth rack with tapped rails.
 3. Hoffman DV6D7 Vertical Manager.
 4. Hoffman DCHS2 Horizontal Manager.
 5. Middle Atlantic Product, P/N: DWR-35-26.
- C. 4-Post 84" H x 19" W x 30" D with 6" vertical cable management. Provide as shown in the drawings. Coordinate rack requirements with various system vendors and provide appropriate rack for each system.
- D. 2-Post 84" H x 19" W x 18" D with 6" vertical cable management. Provide as shown in the drawings. Coordinate rack requirements with various system vendors and provide appropriate rack for each system.
- E. 35U" wall mounted pivoting rack. Provide as shown in the drawings.

2.2 SERVER CABINETS

A. Approved Manufacturers

1. Great Lakes
2. Hoffman
3. Chatsworth
4. Or approved equal

B. Basis of Design

1. Grate Lakes GL840E-2932-B-SQM6MS Server Cabinet. Provide as shown on the drawings.

C. Features

1. 84"H x 29"W x 32"D
2. 44 RMU
3. 30" Usable Depth
4. 30" Max. Rail Spacing
5. 1500 lb. Weight Capacity
6. Color: Black
7. Includes: Frame with levelers; Mesh Front Door; Mesh Rear Door; Solid (2) Side Panel; 3/8" sq. (M6) Mounting Rails with Rack Mount Hardware; Solid Top Panel
8. UL2416

2.3 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Division 06.
- B. The entire room shall be wrapped with 8 FT high fire-retardant plywood.

2.4 PATHWAYS

- A. General Requirements: Comply with TIA-569.
- B. Cable Support: NRTL labeled for support of Category 6A cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Installed concealed above accessible ceilings, use the following supports unless otherwise noted:
 - a. Wire mesh basket trays.
 - b. Support brackets with cable tie slots for fastening cable ties to brackets.
 - c. Lacing bars, spools, J-hooks, J-Pros, J-Mods and D-rings.
 - d. Straps and other devices.
 - 2. Installed concealed in walls and inaccessible ceilings, use the following supports unless otherwise noted:
 - a. EMT raceways to nearest accessible ceiling or wire mesh basket tray.
 - 3. Installed exposed, use the following supports unless otherwise noted:
 - a. Wire mesh basket trays.
 - b. EMT raceways to telecommunications room, nearest accessible ceiling or wire mesh tray.
- C. Conduit and Boxes: Comply with requirements specified in Division 26.
 - 1. Outlet boxes shall be no smaller than 4 inches (100 mm) wide, 4 inches (75 mm) high, and 2-1/2 inches (64 mm) deep. Provide single-gang raise covers.
 - 2. In rated walls provide boxes listed for use in fire rated walls.
 - 3. Back-to-back device boxes shall be staggered so that only one box occupies the wall cavity between two studs. Provide EMT conduit stub with pull string above the accessible ceiling.
- D. Ladder Trays
 - 1. Approved Manufacturers
 - a. nVent Caddy
 - b. Basofil
 - c. Cablofil Inc
 - d. Or approved equal
 - 2. Provide ladder trays in all telecommunications rooms (IDF/MDF).
 - 3. Secured on 5-foot centers overhead using a standard trapeze type support system with 1/2-inch threaded rod in accordance with manufacturer specifications.
 - 4. Cable tray not to be attached to the walls, secure overhead to a single plane.

5. UL Classified, gold zinc plated and minimum 18-inches wide with 9-inch rung spacing.
6. Installed with a minimum clearance of 12-inches above the cable ladder.
7. Meet the current requirements in ANSI/TIA-569 and applicable addendums.
8. Grounded and bonded in accordance with ANSI/TIA-607. All splices, T-Sections and bends shall be bonded together. Cable runway and trays shall not be used as an equipment ground nor seismic support or bracing.
9. Meet seismic bracing standards.

E. Wire Mesh Basket Trays:

1. Approved Manufacturers
 - a. nVent Caddy
 - b. Basofil
 - c. Cablofil Inc
 - d. Or approved equal
2. Wire Mesh Basket Trays
 - a. Provide wire basket of types and sizes indicated; with all required splicing and mounting hardware. Construct units with T-weld edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
 - 1) All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be T-welded on all tray sizes.
 - 2) Wire basket cross-wire to be constructed with either flat shaped wire design or with round wire design, as directed by engineer.
 - a) Flat shaped cross wire design shall provide additional surface area for cable weight support and to avoid pressure points and strain on cables.
 - b) Round shaped cross wire design may be used in general purpose applications where cable weight and strain are not concerns.
 - b. Materials and Finishes: Material and finish specifications for Carbon Steel Wire and Pre-Galvanized steel wire are as follows:
 - 1) Pre-galvanized Zinc: Straight section shall be made from pre-galvanized steel meeting the minimum mechanical properties of ASTM A 641. Material must be cleaned after fabrication to remove any soot, manufacturing residue/oils, or metallic particles.
 - c. Wire basket shall be made of high strength steel wires and formed into a standard 2 inch by 4-inch wire mesh pattern with intersecting wires welded together. All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.
 - d. Wire basket sizes shall conform to the following nominal criteria:
 - 1) Straight sections shall be furnished in standard 118-inch lengths.
 - 2) Wire diameter shall be 0.195" (5mm) minimum on all mesh sections up to 16 linear inches. Wire diameter line wire shall be 0.234" (6mm) minimum on all mesh sections in excess of 16 linear inches. Wire diameter shall be minimum size of 4.5mm on stainless steel.
 - 3) Wire basket shall have a 4-inch usable loading depth (4), (6), (8), (10), (12), (14), (16), (18), (20), (22), (24), (26), (28) inches wide.
 - 4) All fillings shall be field formed, from straight sections, in accordance with manufacturer's instructions.

- 5) All Tray sections and splicing assemblies shall be UI7C-UL Classified as an Equipment Ground Conductor (EGC).
- 6) Wire mesh basket tray supports shall be ceiling trapeze type, center support, trapeze clips, or wall brackets.
- 7) Special accessories shall be furnished as required to protect, support and install a wire basket support system.
- e. Provide wire mesh basket trays as shown in the drawings. The main trunk shall be 18 inches wide by 4 inches deep.

2.5 GROUNDING

A. Comply with requirements of ANSI/J-STD-607-A.

B. Busbar

- 1. Telecommunications main grounding busbar (TMGB)
 - a. The TMGB shall be a predrilled copper busbar provided with holes for use with standard sized lugs and shall be listed by a nationally recognized testing laboratory (NRTL). The minimum size of the TMGB shall be 6 mm (0.25 in) thick by 100 mm (4 in) wide by a length that is determined by the number of connections (including future growth) that will be required to be made to the busbar (see ANSI/J-STD-607-A). The TMGB shall be insulated from its support attachment a minimum of 50 mm (2 in). Minimum length shall be 14 in.
- 2. Telecommunications grounding busbar (TGB)
 - a. The TGB shall be a predrilled copper busbar provided with holes for use with standard sized lugs (see figure 3) and shall be Listed by an NRTL The minimum size of the TGB shall be 6 mm (0.25 in) thick by 50 mm (2 in) wide by a length that is determined by the number of connections (including future growth) that will be required to be made to the busbar (see ANSI/I-STD-607-A). The TGB shall be insulated from its support attachment a minimum of 50 mm (2 in). Minimum length shall be 10 in.

C. Bonding to the electrical power system

- 1. The telecommunication bonding and grounding system shall be bonded to the power grounding system either at the service panel grounding busbar or the electrical grounding electrode, as described in ANSI/J-STD-607-A.

D. Bonding conductor

- 1. Bonding conductors shall be insulated stranded copper or flat braided copper and shall be Listed for the space in which they are intended to be placed according to the NEC® (e.g., plenum spaces, riser spaces), unless otherwise specified. When conductors are insulated, the jacket shall be green, green with a yellow stripe, or marked with green tape or a green adhesive label.

E. Telecommunications bonding backbone (TBB)

- 1. The TBB connects the TMGB to the telecommunications grounding busbars (TGBs). The TBB shall be a continuous green insulated copper conductor that should be sized no less than 3/0 AWG.

F. Grounding equalizer (GE)

1. The GE connects the telecommunications grounding busbar(s) in the same-floor telecommunications rooms (TRs) on the first, top, and every third floor in a multistory building. The GE shall be a continuous green insulated copper conductor that should be sized no less than 3/0 AWG.
2. NOTE: Cable shields do not satisfy the requirements for a GE.

G. Bonding connections

1. Bonding connections shall be made by means of a compression connector or an exothermic weld. Compression connectors shall have only one conductor installed unless designed or Listed for more conductors. Compression and exothermically welded connections are irreversible, can withstand multiple fault currents, and will not loosen. Mechanical connections are only allowed when connecting a conductor to equipment, raceways, cable trays, water pipe, and similar appurtenances or when a compression or exothermic connection cannot be made. Connections to the TMGB/TGB shall use exothermically welded connections or two-hole lug connectors. Two-hole lug connections can be compression connectors or exothermically welded connectors.

H. Connections to the TMGB/TGB

1. Electrical distribution panel (EDP)
 - a. When an EDP is located in the same room as the TMGB/TGB, that EDP's equipment grounding bus or the panel board enclosure shall be bonded to the TMGB/TGB using green insulated bonding conductors sized no less than 6 AWG to a maximum 3/0 AWG.
2. Building steel
 - a. Where building steel is accessible and in the same room as the TMGB/TGB, the TMGB/TGB shall be bonded to building steel using a minimum 6 AWG green insulated conductor. When the building steel is external to the room but readily accessible, it should be bonded to the TMGB/TGB. Building steel should be tested to verify its ground conductivity to earth.
 - b. NOTE: Modern building construction techniques will ground building steel to the main ac power entrance or another grounding source. Ensure that when working in existing buildings that the building steel is bonded to a suitable ground source (e.g., electrical power grounding electrode[s], building ground ring).
3. Conduit
 - a. In order to limit the potential difference between telecommunications conduits and telecommunications conduits and power conduits, the telecommunications conduits shall be bonded to the TMGB/TGB.
4. Telecommunications equipment bonding conductor (TEBC)
 - a. The TEBC shall be exothermically welded or connected, using either a compression style or exothermic style two-hole lug, to the connection point on the TMGB/TGB.
5. Bonding equipment, racks and cabinets

- a. The TMGB/TGB shall be bonded to equipment, racks and cabinets using a minimum 6 AWG green insulated conductor.
6. All cable tray, ladder rack, and access floors shall be grounded/bonded to the Telecommunications Grounding Busbar (TGB). All aforementioned telecommunications components shall be grounded/bonded to the TGB using stranded 6 AWG green insulated conductor. Cable tray and ladder rack runs shall be grounded/bonded per the manufacturer's instructions. At a minimum the cable tray and ladder rack shall be grounded/bonded to the building steel every 50 ft.

2.6 FIRE RATE SLEEVES

- A. Penetration pathways required for low voltage cabling shall meet the following requirements:
 1. Meet the hourly fire-rating of fire rated wall and or floor penetrated.
 2. Be tested for the surrounding construction and cable types involved.
 3. Have UL Systems permitting cable loads from; "Zero to 100% Visual Fill." This requirement eliminates need for fill-ratio calculations to be made by cable technicians to ensure cable load is within maximum allowed by UL System.
 4. Not have inner fabric liner that tightens around and compresses cables tightly together encouraging potential cable damage or interference.
 5. Be "Zero-Maintenance", zero-maintenance is defined as; No action required by cabling technician to open and/or close pathway for cable moves, adds or changes, such as, but not limited to:
 - a. Opening or closing of doors.
 - b. Spinning rings to open or close fabric liner.
 - c. Removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
 - d. Evaluation Services Report (ESR) from an accredited Nationally Recognized Third-party Laboratory certifying compliance with this definition of "Zero-Maintenance" and all relevant codes and standards.
 6. Penetration pathways shall be engineered such that two or more devices may be ganged together for larger cable capacities.
 7. Penetration pathways shall be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.
 8. Cable Pathway Devices passing vertically through floors shall have equal F & T Rating.
 9. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding.
- B. Fire Rated Cable Pathways: Gangable device modules capable of being retrofitted around existing cables and comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill and requiring no additional action in the form of plugs, twisting closure, putty, pillow, or sealant to achieve fire and leakage ratings.
 1. Approved Manufacturers
 - a. Specified Technologies Inc. (STI) EZ-Path Fire Rated Pathway

- b. Legrand FlameStopper thru-wall fittings
 - c. Hilti Speed Sleeve CP 653
 - d. Or approved equal
- 2. Basis of Design
 - a. The system specified is based upon products by STI and represents the performance standard upon which any equivalent solution shall be based.
 - 1) 4" – EZ-Path Series 44+
 - 2) 2" – EZ-Path Series 22
- 3. Applications
 - a. Telecommunications room floor penetrations:
 - 1) Provide a minimum of 4-4" fire rated penetrations unless otherwise noted.
 - b. Telecommunications room ceiling penetrations:
 - 1) Provide a minimum of 4-4" fire rated penetrations unless otherwise noted.
 - c. Telecommunications room wall penetrations:
 - 1) Provide a minimum of 4-4" fire rated penetrations unless otherwise noted.
 - d. Rooms accessible from corridors:
 - 1) Provide a minimum of 1-2" fire rated penetration from the corridor to each classroom or office unless otherwise noted.

2.7 LABELING

- A. Comply with TIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Install underground pathways complying with recommendations in TIA-569-A, "Entrance Facilities" Article.
- C. Install underground entrance pathway complying with Division 26 Section "Raceway and Boxes for Electrical Systems."

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Cable Trays: Comply with NEMA VE 2 and TIA-569-A-7.

- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.4 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems." Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA-606-A for Class 2 level of administration.
- C. Labels shall be preprinted or computer-printed type.

End of Section

SECTION 27 10 00
STRUCTURED CABLING
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pathways.
 - 2. UTP cable.
 - 3. Cabling identification products.

1.3 SUBMITTALS

- A. Comply with requirements specified in Division 01.
- B. Shop Drawings
 - 1. Prior to assembling or installing the system, the Contractor shall provide complete shop drawings which include the following:
 - a. Architectural floor plans indicating all system device locations.
 - b. Full schematic wiring information for all devices. Wiring information shall include cable type, cable length, conductor routings, quantities, and point-to-point termination schedules.
 - c. Complete system one-line block diagram.
 - d. Statement of the system sequence of operation.
 - e. Riser diagrams showing interconnections.
 - f. Detail drawings showing installation and mounting.
 - g. Calculations detailing 25% spare capacity of each circuit.
 - 2. All drawings shall be fully dimensioned.
 - 3. Operating License: Submit evidence of application for FCC Radio Station Authorization prior to installing equipment. Furnish the license or a copy of the application for the license, to the Owner/End User prior to operating the equipment. The original license must be delivered to the Owner/End User.
- C. As-Built Drawings
 - 1. At the conclusion of the project, the Contractor shall provide "as built" drawings. The "as built" drawings shall be a continuation of the Contractors shop drawings as modified, augmented, and reviewed during the installation, check out and

acceptance phases of the project. All drawings shall be fully dimensioned and prepared in DWG format using the latest version of AutoCAD.

2. The as-built drawings shall incorporate all updated system riser diagrams prepared in DWG format using the latest version of AutoCAD.

D. Manuals

1. At the conclusion of the project, the Contractor shall provide copies of the manuals as described herein. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each system integrator installing equipment and systems and the nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The manuals shall include all modifications made during installation, checkout, and acceptance. The manuals shall contain the following:
 - a. Functional Design Manual
 - 1) The functional design manual shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included for all system operating modes.
 - b. Hardware Manual
 - 1) The hardware manual shall describe all equipment furnished including:
 - a) General description and specifications
 - b) Installation and check out procedures
 - c) Equipment layout and electrical schematics to the component level
 - d) System layout drawings and schematics
 - e) Alignment and calibration procedures
 - f) Manufacturers repair parts list indicating sources of supply
 - c. Software Manual
 - 1) The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
 - a) Definition of terms and functions
 - b) Use of system and applications software
 - c) Initialization, start up, and shut down
 - d) Alarm reports
 - e) Reports generation
 - f) Data base format and data entry requirements
 - g) Directory of all disk files
2. Operators Manual
 - a. The operator's manual shall fully explain all procedures and instructions for the operation of the system including:
 - 1) Computers and peripherals
 - 2) System start up and shut down procedures
 - 3) Use of system, command, and applications software
 - 4) Recovery and restart procedures
 - 5) Graphic alarm presentation
 - 6) Use of report generator and generation of reports
 - 7) Data entry

- 8) Operator commands
- 9) Alarm messages and reprinting formats
- 10) System access requirements

3. Maintenance Manual

- a. The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings, and field testing program development by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Telecommunications Pathways and Spaces: Comply with TIA-569.
- D. Grounding: Comply with ANSI-J-STD-607.

1.5 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. LAN: Local area network.
- F. RCDD: Registered Communications Distribution Designer.
- G. UTP: Unshielded twisted pair.

1.6 CODES AND STANDARDS

- A. Complete installation shall meet or exceed the latest edition of following standards:

1. TIA-568: Commercial building telecommunications wiring standard and all current addenda.
2. TIA-569: Commercial building standard for telecommunications pathways and spaces.
3. TIA-606: Administration standard for telecommunications infrastructure of commercial buildings.
4. TIA-607: Commercial building grounding and bonding requirements for telecommunications.
5. ANSI, ASTM, UL, NEMA, IEEE and FCC standards as applicable.
6. BICSI Telecommunications Distribution Methods Manual, current edition.

1.7 PERFORMANCE REQUIREMENTS

- A. General Performance: Backbone cabling system shall comply with transmission standards in TIA-568, when tested according to test procedures of this standard.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical loss test set.
 2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
 3. Test each pair of UTP cable for open and short circuits.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. The ceiling cavity is being used as plenum return. Provide plenum rated cables, conduit, backboxes in all plenum rated ceilings, rated walls, penetrations through wall, floors and ceilings and where required by Local, State or Federal Codes.

1.11 PLANNING AND DOCUMENTATION

- A. Contractor must adhere to all installation procedures and utilize authorized components in provisioning the work.
- B. The parties shall hold an initial planning meeting immediately after execution of the contract documents to clarify all requirements (systems, services, distribution methods,

etc.), identify responsibilities, and schedule the events that will transpire during the implementation of the Project. Within two (2) weeks of the initial meeting, the contractor shall provide a written report and project schedule to clearly document the events and responsibilities associated with the project.

- C. The contractor shall provide to Tufts, for its records, the following:
1. A detailed drawing of all telecom Rooms. These drawings will include all telecommunication and data components and/or apparatus that reside in these rooms. All cables terminated or spliced and their routes will be documented. The Contractor will provide to Tufts a detailed layout of all wall fields and frames.
 2. All cable routes from telecom outlet to termination field.
 3. Cross Connect Documentation - Provide cross connect records for all voice, and data devices, including detailed layout of termination fields and patch panels.
 4. Riser Distribution Plan that includes all riser cable routing.
 5. Cable Tray, Conduit, and Raceway Plans.
 6. Campus Distribution Plan (if applicable).
 7. Building Control Plans in the following format:
 - a. One (1) set of computer files on CD's containing the drawings in AutoCAD format, or Visio, depending on Tufts requirements.
 - b. One (1) set of computer files of cross connects documentation on CD's in Excel form.
- D. Upon completion of the project, the contractor is to prepare "as built" documentation with a minimum of two (2) points of reference from permanent fixtures, buildings, permanent walls, etc.: showing actual site conditions and installation as constructed and provide copies of such documentation as is required by the SOW and these specifications. Final contract payment is contingent upon execution by tufts of the notice of final acceptance, and such final acceptance is contingent upon, among other things, receipt of the documentation.

1.12 REPORTS

- A. Test reports must be submitted in electronic format. Hand-written test reports are not acceptable.
- B. Tufts may require hardcopy reports, if so they are to be submitted in labeled 3 ring binders with a witness signature verifying passing and execution of all tests.
- C. Electronic reports must be submitted in cd format. Cd's shall contain the software required to view test results. Electronic reports must be accompanied by a certificate signed by an authorized representative of the contractor warranting the truth and accuracy of the electronic report. Certificate must reference traceable circuit numbers that match the electronic record.
- D. Test reports shall be submitted within seven (7) business days of completion of testing.

1.13 CABLE REMOVAL

- A. Contractor shall remove all abandoned telephone, computer, and coaxial cable in each building as specified by the tufts project manager. All removals will be accomplished by working from the telecom outlet back to the telecom room(s). This removal shall take

place after the activation of all newly installed cables and equipment. A blank plate shall be provided and installed by the contractor to fit over old workboxes.

1.14 WARRANTY

- A. Comply with Section 260001.
- B. The Electrical Subcontractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. CommScop/Systimax
 - 1. Tufts requires the installer to be SYSTIMAX certified.

2.2 HORIZONTAL CABLING

- A. UTP Cable: 2091B Plenum
 - 1. Green (Data)
 - 2. Black (A/V)
 - 3. Wi-Fi (Lilac)
 - 4. Security (Yellow)
- B. Faceplates (White)
 - 1. 2-port: FP-LBL-2P-262
 - 2. 4-port: FP-LBL-4P-262
- C. Jacks (for faceplates and patch panels)
 - 1. MGS600-GR (Data)
 - 2. MGS600-BK (A/V)
 - 3. MGS600-VI (Wi-Fi)
 - 4. MGS600-YL (Security)
- D. Modular Patch Panels
 - 1. Station cabling and AV 48 port modular: 360-E-MOD-2U-48
 - 2. For Wireless 24 port modular: 360-E-MOD-2U-24
 - 3. Horizontal management HTK-19-SS-2U (X1 per patch panel)
 - 4. *Cabinet elevation drawing to be provided by Tufts PM before cable rough*
- E. IT Room Materials
 - 1. Qty 1 – Network Cabinet CPI# TSZ1544034 *Inside delivery*
 - 2. Qty 1 - 18" Cable Runway CPI# 10250-718

3. Qty 2 - Wall Angle Support Kit CPI# 11421-718
4. Qty 1 - Cabinet Ground Bar CPI# 10610-019
5. Qty 2 - Radius Drop CPI# 12100-718
6. Qty 3 - STI FS400 Firestop sleeve

- F. Coordinate cable runs between Worcester Public School (WPS) drops and Tufts cable drops. The cables shall be terminated in separate racks. The WPS cable drops shall be terminated in the existing rack in the room. The Tufts cable drops will be terminated in the network cabinet furnished and installed under this contract.

2.3 GROUNDING

- A. Comply with requirements in Division 26.
- B. Comply with ANSI-J-STD-607-A.

2.4 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606 and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.5 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test cables on reels according to TIA-568.
- C. Factory test UTP cables according to TIA-568.
- D. Factory test multimode optical fiber cables according to TIA-526 and TIA-568.
- E. Cable will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.
- B. Provide lightning protection for all copper backbone cables entering or leaving a telecommunications closet/room.

3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in

gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
 2. Comply with requirements for raceways and boxes specified in Division 26.
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA-569.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27. Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA-569 for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Division 26 for installation of conduits, wireways and raceways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 2. Install cable trays to route cables if conduits cannot be located in these positions.
 3. Secure conduits to backboard when entering room from overhead.
 4. Extend conduits 3 inches (76 mm) above finished floor.
 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
1. Comply with TIA-568.
 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 3. Install IDC termination hardware unless otherwise indicated.

4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA-568.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA-568.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet (1800 mm) long not less than 12 inches (300 mm) in diameter below each feed point.

G. Group connecting hardware for cables into separate logical fields.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569 recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.5 FIRESTOPPING

- A. Comply with requirements in Division 07.
- B. Comply with TIA-569, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.

- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 COMMISSIONING

- A. Comply with requirements specified in Division 1.
- B. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup checks according to the approved manufacturer's written instructions.

3.8 TRAINING AND SERVICE

- A. Comply with Section 260001.
- B. Conduct two 4-hour training sessions. Train the Owner's maintenance personnel on procedures and schedules related to start up and shutdown, troubleshooting, servicing, and preventive maintenance.

End of Section

Section 27 17 20

TESTING CATEGORY 6A TWIST PAIR INFRASTRUCTURE
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

- A. This Section includes the minimum requirements for the test certification, identification and administration of horizontal balanced twisted pair cabling.
- B. This Section includes minimum requirements for:
 - 1. Copper cabling test instruments
 - 2. Copper cabling testing
 - 3. Identification
 - a. Labels and labeling
 - 4. Administration
 - a. Test results documentation
 - b. As-built drawings
- C. Testing shall be carried out in accordance with this document.
- D. Testing shall be performed on each cabling link. (100% testing)
- E. All tests shall be documented.

1.3 SUBMITTALS

- A. Manufacturers catalog sheets and specifications for the test equipment.
- B. A schedule (list) of all balanced twisted-pair copper links to be tested.
- C. Sample test reports.

1.4 QUALITY ASSURANCE

- A. All testing procedures and field-test instruments shall comply with applicable requirements of:
 - 1. ANSI/TIA-1152-A, Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

2. ANSI/TIA-568.0-E, Generic Telecommunications Cabling for Customer Premises.
 3. ANSI/TIA-568.1-E, Commercial Building Telecommunications Cabling Standard
 4. ANSI/TIA 568.2-D, Balanced Twisted-Pair Telecommunications Cabling and Components Standards.
 5. ANSI/TIA-606-D, Administration Standard for Commercial Telecommunications Infrastructure, including the requirements specified by the customer, unless the customer specifies their own labeling requirements.
- B. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:
1. Manufacturer of the connectors or cable.
 2. Manufacturer of the test equipment used for the field certification.
 3. Training organizations (e.g., BICSI, A Telecommunications Association headquarters in Tampa, Florida; ACP [Association of Cabling Professionals™] Cabling Business Institute located in Dallas, Texas)
- C. The Owner or the Owner's representative shall be invited to witness and/or review field-testing.
1. The Owner or the Owner's representative shall be notified of the start date of the testing phase five (5) business days before testing commences.
 2. The Owner or the Owner's representative will select a random sample of 5% of the installed links. The Owner or the Owner's representative shall test these randomly selected links and the results are to be stored in accordance with Part 3 of this document. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the representative shall repeat 100% testing at no cost to the Owner.
- 1.5 ACCEPTANCE OF TEST RESULTS
- A. Unless otherwise specified by the Owner or the Owners representative, each cabling link shall be in tested for:
1. Wire Map
 2. Length
 3. Propagation Delay
 4. Delay Skew
 5. DC Loop Resistance – recorded for information only
 6. DC Resistance Unbalance – recorded for information only
 7. Insertion Loss
 8. NEXT (Near-End Crosstalk)
 9. PS NEXT (Power Sum Near-End Crosstalk)
 10. ACR-N (Attenuation to Crosstalk Ratio Near-End) – recorded for information only
 11. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End) – recorded for information only
 12. ACR-F (Attenuation to Crosstalk Ratio Far-End)
 13. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
 14. Return Loss
 15. TCL (Transverse Conversion Loss) – recorded for information only

16. ELTCTL (Equal Level Transverse Conversion Transfer Loss) – recorded for information only
 17. PS ANEXT (Power Sum Alien Near-End Crosstalk) – sampled per section 3.2
 18. Average PS ANEXT (Average Power Sum Alien Near-End Crosstalk) – sampled per section 3.2
 19. PS AACR-F (Power Sum Alien Attenuation to Crosstalk Ratio Far-End) – sampled per section 3.2
 20. Average PS AACR-F (Average Power Sum Alien Attenuation to Crosstalk Ratio Far-End) – sampled per section 3.2
- B. All installed cabling Permanent Links shall be field-tested and pass the test requirements and analysis as described in Part 3. Any Permanent Link that fails these requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected Permanent Link meets performance requirements. The final and passing result of the tests for all Permanent Links shall be provided in the test results documentation in accordance with Part 3.
- C. Acceptance of the test results shall be given in writing after the project is fully completed and tested in accordance with Contract Documents and to the satisfaction of the Owner.

PART 2 - PRODUCTS

2.1 BALANCED TWISTED-PAIR CABLE TESTERS

- A. The field-test instrument shall be within the calibration period recommended by the manufacturer, typically 12 months.
- B. Certification tester
1. Accuracy
 - a. Level IIIe accuracy in accordance with ANSI/TIA-1152-A
 - b. Independent verification of accuracy
 2. Permanent Link Adapters
 - a. RJ45 plug must meet the requirements for NEXT, FEXT and Return Loss in accordance with ANSI/TIA-568.2-D Annex C
 - b. Twisted pair Category 5e, 6, 6A, 7 or 7A cords are not permitted as their performance degrades with use and can cause false Return Loss failures
 3. Results Storage
 - a. Must be capable of storing > 10,000 results for all measurements found in 2.1.B.4 below
 4. Measurement capabilities
 - a. Wire Map
 - b. Length
 - c. Propagation Delay
 - d. Delay Skew
 - e. DC Loop Resistance
 - f. DC Resistance Unbalance

- g. Insertion Loss
 - h. NEXT (Near-End Crosstalk)
 - i. PS NEXT (Power Sum Near-End Crosstalk)
 - j. ACR-N (Attenuation to Crosstalk Ratio Near-End)
 - k. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End)
 - l. ACR-F (Attenuation to Crosstalk Ratio Far-End)
 - m. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
 - n. Return Loss
 - o. TCL (Transverse Conversion Loss)
 - p. ELTCTL (Equal Level Transverse Conversion Transfer Loss)
 - q. Time Domain Reflectometer
 - r. Time Domain Xtalk Analyzer
 - s. PS ANEXT (Power Sum Alien Near-End Crosstalk)
 - t. Average PS ANEXT (Average Power Sum Alien Near-End Crosstalk)
 - u. PS AACR-F (Power Sum Alien Attenuation to Crosstalk Ratio Far-End)
 - v. Average PS AACR-F (Average Power Sum Alien Attenuation to Crosstalk Ratio Far-End)
5. PC Software
- a. Windows® based.
 - b. Must show when 3 dB and 4 dB rules are applied
 - c. Re-certification capability, where results must have their Cable IDs suffixed with (RC).
 - d. Built in PDF export – no additional third party software permitted.
 - e. Built-in statistical analysis.

2.2 IDENTIFICATION

A. Labels

- 1. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
- 2. Shall be preprinted using a mechanical means of printing (e.g., laser printer).
- 3. Where used for cable marking, provide vinyl substrate with a white printing area and a clear "tail" that self laminates the printed area when wrapped around the cable. If cable jacket is white, provide cable label with printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.
- 4. Where insert type labels are used provide clear plastic cover over label.
- 5. Provide plastic warning tape 6 inches wide continuously printed and bright colored 18" above all direct buried services, underground conduits and duct-banks.
- 6. Acceptable Manufacturers:
 - a. Brady Corporation
 - b. Silver Fox
 - c. Brothers
 - d. Or approved equal

2.3 ADMINISTRATION

- A. Administration of the documentation shall include test results of each Permanent Link.

- B. The test result information for each link shall be recorded in the memory of the field-test instrument upon completion of the test.
- C. The test result records saved within the field-test instrument shall be transferred into a Windows® -based database utility that allows for the maintenance, inspection and archiving of these test records.
- D. Alien Crosstalk measurements shall be stored to a PC upon completion of the test.

PART 3 - EXECUTION

3.1 GENERAL

- A. All outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to field-testing. Any testing performed on incomplete systems shall be redone on completion of the work.

3.2 BALANCED TWISTED PAIR CABLE TESTING

- A. Field-test instruments shall have the latest software and firmware installed.
- B. Permanent Link test results including the individual frequency measurements from the tester shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.
- C. Permanent Link testing shall be performed on each cabling segment (connector to connector). Sampling is not acceptable.
- D. Alien Crosstalk testing shall be performed using a sampling plan. An acceptance quality level (AQL) of 0,4 %, normal inspection, general inspection level I as defined in ISO 2859-1 for populations of up to 500,000 links shall be used. The following table represents this sampling level. Disturbed (Victim) links chosen for Alien Crosstalk testing shall be an equal combination of short, medium and long links.

Installation size (No. of total links)	Sample size (No. of links to test)
3 – 33	100%
34 – 3,200	33
3,201 – 35,000	126
35,001 – 150,000	201
150,001 – 500,000	315

- E. Permanent Link adapters made from twisted pair Category 5e, 6, 6A, 7 or 7A cords are not permitted as their performance degrades with use and can cause false Return Loss failures.

- F. The installer shall build a reference link. All components shall be anchored so it is not possible to disturb them. The technician is to conduct a Category 6A Permanent Link test each day to ensure no degradation of the tester or its Permanent Link adapters.
- G. Wire Map Measurement
1. The wire map test is intended to verify pin-to-pin termination at each end and check for installation connectivity errors. For each of the 8 conductors in the cabling, the wire map indicates:
 - a. Continuity to the remote end
 - b. Shorts between any two or more conductors
 - c. Reversed pairs
 - d. Split pairs
 - e. Transposed pairs
 - f. Distance to open on shield
 - g. Any other miss-wiring
 2. The correct connectivity of telecommunications outlets/connectors is defined in ANSI/TIA-568.2-D. Two color schemes are permitted. The user shall define which scheme is to be used. The field tester shall document which color scheme was used.
- H. Length Measurement
1. The length of each balanced twisted pair shall be recorded.
 2. Since physical length is determined from electrical length, the physical length of the link calculated using the pair with the shortest electrical delay shall be reported and used for making the pass or fail determination.
 3. The pass or fail criteria is based on the maximum length allowed for the Permanent Link as specified in ANSI/TIA-568.2-D plus the nominal velocity of propagation (NVP) uncertainty of 10%. For a Permanent Link, the length measurement can be 325 ft. (99 m) before a fail is reported.
- I. Propagation Delay measurement
1. Is the time it takes for a signal to reach the end of the link.
 2. The measurement shall be made at 10 MHz per ANSI/TIA-1152-A.
 3. The propagation delay of each balanced twisted pair shall be recorded.
 4. Is not to exceed 498 ns per ANSI/TIA-568.2-D Section 6.3.18.
- J. Delay Skew measurement
1. Is the difference in propagation delay @ 10 MHz between the shortest delay and the delays of the other wire pairs.
 2. The delay skew of each balanced twisted pair shall be recorded.
 3. Is not to exceed 44 ns per ANSI/TIA-568.2-D Section 6.3.19.
- K. DC Resistance
1. Often reported as Resistance, is the loop resistance of both conductors in the pair.
 2. Is not specified in ANSI/TIA-1152-A, but shall be recorded for all four pairs.

L. DC Resistance Unbalance

1. Often reported as Resistance Unbalance, is the difference in resistance of the two wires within the pair.
2. Is not specified in ANSI/TIA-1152-A for a Permanent Link, but shall be recorded for all four pairs.

M. Insertion Loss

1. Is the loss of signal strength over the cabling (in dB).
2. The frequency resolution shall be:
 - a. 1 – 31.25 MHz: 150 kHz
 - b. 31.25 – 100 MHz: 250 kHz
 - c. 100 – 250 MHz: 500 kHz
 - d. 250 – 500 MHz: 1000 kHz
3. Worst case shall be reported for all four pairs in one direction only.
4. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).
5. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-D Section 6.3.7.

N. NEXT (Near-End Crosstalk)

1. Is the difference in amplitude (in dB) between a transmitted signal and the crosstalk received on other wire pairs at the same end of the cabling.
2. The frequency resolution shall be:
 - a. 1 – 31.25 MHz: 150 kHz
 - b. 31.25 – 100 MHz: 250 kHz
 - c. 100 – 250 MHz: 500 kHz
 - d. 250 – 500 MHz: 1000 kHz
3. Shall be measured in both directions. (12 pair to pair possible combinations)
4. Both worst case and worst margins shall be reported.
5. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-D Section 6.3.8.
6. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).
7. The Time Domain Xtalk data shall be stored for any marginal or failing NEXT results.

O. PS NEXT (Power Sum Near-End Crosstalk)

1. Is the difference (in dB) between the test signal and the crosstalk from the other pairs received at the same end of the cabling.
2. The frequency resolution shall be:
 - a. 1 – 31.25 MHz: 150 kHz
 - b. 31.25 – 100 MHz: 250 kHz
 - c. 100 – 250 MHz: 500 kHz
 - d. 250 – 500 MHz: 1000 kHz
3. Shall be measured in both directions. (8 pair possible combinations)
4. Both worst case and worst margins shall be reported.

5. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-D Section 6.3.9.
6. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).
7. The Time Domain Xtalk data shall be stored for any marginal or failing PS NEXT results.

P. ACR-N (Attenuation Crosstalk Ratio Near-End)

1. Is a calculation of NEXT minus Insertion Loss of the disturbed pair in dB.
2. The frequency resolution shall be:
 - a. 1 – 31.25 MHz: 150 kHz
 - b. 31.25 – 100 MHz: 250 kHz
 - c. 100 – 250 MHz: 500 kHz
 - d. 250 – 500 MHz: 1000 kHz
3. Shall be calculated in both directions.
4. Is not specified in ANSI/TIA-1152-A, but shall be recorded for all 12 possible combinations.

Q. PS ACR-N (Power Sum Attenuation Crosstalk Ratio Near-End)

1. Is a calculation of PS NEXT minus Insertion Loss of the disturbed pair in dB.
2. The frequency resolution shall be:
 - a. 1 – 31.25 MHz: 150 kHz
 - b. 31.25 – 100 MHz: 250 kHz
 - c. 100 – 250 MHz: 500 kHz
 - d. 250 – 500 MHz: 1000 kHz
3. Shall be calculated in both directions.
4. Is not specified in ANSI/TIA-1152-A, but shall be recorded for all 8 possible combinations.

R. ACR-F (Attenuation Crosstalk Ratio Far-End)

1. Is a calculation of FEXT minus Insertion Loss of the disturbed pair in dB.
2. The frequency resolution shall be:
 - a. 1 – 31.25 MHz: 150 kHz
 - b. 31.25 – 100 MHz: 250 kHz
 - c. 100 – 250 MHz: 500 kHz
 - d. 250 – 500 MHz: 1000 kHz
3. Shall be measured in both directions. (24 pair to pair possible combinations)
4. Both worst case and worst margins shall be reported.
5. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-D Section 6.3.11.
6. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).

S. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)

1. Is a calculation of PS FEXT minus Insertion Loss of the disturbed pair in dB.
2. The frequency resolution shall be:

- a. 1 – 31.25 MHz: 150 kHz
 - b. 31.25 – 100 MHz: 250 kHz
 - c. 100 – 250 MHz: 500 kHz
 - d. 250 – 500 MHz: 1000 kHz
3. Shall be measured in both directions. (8 pair possible combinations)
 4. Both worst case and worst margins shall be reported.
 5. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-D Section 6.3.13.
 6. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).

T. Return Loss

1. Is the difference (in dB) between the power of a transmitted signal and the power of the signals reflected back.
2. The frequency resolution shall be:
 - a. 1 – 31.25 MHz: 150 kHz
 - b. 31.25 – 100 MHz: 250 kHz
 - c. 100 – 250 MHz: 500 kHz
 - d. 250 – 500 MHz: 1000 kHz
3. Shall be measured in both directions. (8 pair possible combinations)
4. Both worst case and worst margins shall be reported.
5. Shall be ignored at all frequencies where the Insertion Loss is less than 3 dB for that pair.
6. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-D Section 6.3.6.
7. Reported margins found to be within the accuracy of the field tester shall be marked with an asterisk (*).
8. The Time Domain Reflectometer data shall be stored for any marginal or failing Return Loss results.

U. TCL (Transverse Conversion Loss)

1. Is the ratio (in dB) between a differential mode signal inject at the near-end and the common-mode signal measured at the near-end on the same wire pair.
2. The frequency resolution shall be:
 - a. 1 – 31.25 MHz: 150 kHz
 - b. 31.25 – 100 MHz: 250 kHz
 - c. 100 – 250 MHz: 500 kHz
 - d. 250 – 500 MHz: 1000 kHz
3. Shall be measured in both directions.
4. Is not specified in ANSI/TIA-1152-A for a Permanent Link, but shall be recorded for all 8 possible combinations.

V. ELTCTL (Equal Level Transverse Conversion Transfer Loss)

1. Is the ratio (in dB) between a differential mode signal inject at the near-end and the common-mode signal measured at the far end on the same wire pair minus the Insertion Loss of that pair.
2. The frequency resolution shall be:
 - a. 1 – 31.25 MHz: 150 kHz

- b. 31.25 – 100 MHz: 250 kHz
 - c. 100 – 250 MHz: 500 kHz
 - d. 250 – 500 MHz: 1000 kHz
3. Shall be measured in both directions.
4. Is not specified in ANSI/TIA-1152-A for a Permanent Link, but shall be recorded for all 8 possible combinations.

W. PS ANEXT (Power Sum Alien Near-End Crosstalk)

1. Takes into account the combined alien crosstalk (statistical) on a receive pair from all external near-end disturbers operating simultaneously.
2. The frequency resolution shall be:
 - a. 1 – 31.25 MHz: 150 kHz
 - b. 31.25 – 100 MHz: 250 kHz
 - c. 100 – 250 MHz: 500 kHz
 - d. 250 – 500 MHz: 1000 kHz
3. The disturbed (victim) link shall have links to the left and right of it and if present, links above and below it.
4. Disturber cables shall include all links within the same bundle as the disturbed (victim) link and adjacent links
5. Should be measured in both directions if the link is patch panel to patch panel. If the link is patch panel to telecommunications outlet, then it shall be measured from the patch panel end only.
6. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-D Section 6.3.21.

X. Average PS ANEXT (Power Sum Alien Near-End Crosstalk)

1. Is calculated by averaging the individual PSANEXT loss values, in dB, for all four pairs in the disturbed (victim) link.
2. The frequency resolution shall be:
 - a. 1 – 31.25 MHz: 150 kHz
 - b. 31.25 – 100 MHz: 250 kHz
 - c. 100 – 250 MHz: 500 kHz
 - d. 250 – 500 MHz: 1000 kHz
3. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-D Section 6.3.22.

Y. PS AACR-F (Power Sum Alien Attenuation to Crosstalk Ratio Far-End)

1. AFEXT loss is the coupling of crosstalk at the far-end from external link pairs into a disturbed (victim) pair of the 4-pair link under test. PS AACR-F is the calculated power sum from all external pairs into the disturbed (victim) pair.
2. The frequency resolution shall be:
 - a. 1 – 31.25 MHz: 150 kHz
 - b. 31.25 – 100 MHz: 250 kHz
 - c. 100 – 250 MHz: 500 kHz
 - d. 250 – 500 MHz: 1000 kHz
3. The disturbed (victim) link shall have links to the left and right of it and if present, links above and below it.

4. Disturber cables shall include all links within the same bundle as the disturbed (victim) link and adjacent links
5. Should be measured in both directions if the link is patch panel to patch panel. If the link is patch panel to telecommunications outlet, then it shall be measured from the patch panel end only.
6. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-D Section 6.3.25.

Z. Average PS AACR-F (Power Sum Alien Attenuation to Crosstalk Ratio Far-End)

1. Is calculated by averaging the individual PS AACR-F values, in dB, for all four pairs in the disturbed (victim) link.
2. The frequency resolution shall be:
 - a. 1 – 31.25 MHz: 150 kHz
 - b. 31.25 – 100 MHz: 250 kHz
 - c. 100 – 250 MHz: 500 kHz
 - d. 250 – 500 MHz: 1000 kHz
3. The disturbed (victim) link shall have links to the left and right of it and if present, links above and below it.
4. Disturber cables shall include all links within the same bundle as the disturbed (victim) link and adjacent links
5. Should be measured in both directions if the link is patch panel to patch panel. If the link is patch panel to telecommunications outlet, then it shall be measured from the patch panel end only.
6. Is not to exceed the Category 6A Permanent Link limits found in ANSI/TIA-568.2-D Section 6.3.26.

3.3 ADMINISTRATION

A. Test results documentation

1. Test results saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-test instrument”. The file format, CSV (comma separated value), does not provide adequate protection of these records and shall not be used.
2. The test results documentation shall be available for inspection by the Owner or the Owner’s representative during the installation period and shall be passed to the Owner’s representative within 5 working days of completion of tests on cabling served by a telecommunications room or of backbone cabling. The installer shall retain a copy to aid preparation of as built information.
3. The database for the complete project, including twisted-pair copper cabling links, if applicable, shall be stored and delivered on CD or DVD prior to Owner acceptance of the building. This CD or DVD shall include the software tools required to view, inspect, and print any selection of the test reports.
4. Circuit IDs reported by the test instrument should match the specified label ID (see 3.3 of this Section).
5. For Permanent Link testing, the detailed test results documentation data is to be provided in an electronic database for each tested balance twisted-pair and shall contain the following information
 - a. The overall Pass/Fail evaluation of the link-under-test

- b. The date and time the test results were saved in the memory of the tester
 - c. The identification of the customer site as specified by the end-user
 - d. The name of the test limit selected to execute the stored test results
 - e. The name of the personnel performing the test
 - f. The version of the test software and the version of the test limit database held within the test instrument
 - g. The manufacturer, model and serial number of the field-test instrument
 - h. The adapters used
 - i. The factory calibration date
 - j. Wire Map
 - k. Propagation Delay values, for all four pairs
 - l. Delay Skew values, for all four pairs
 - m. DC Resistance values, for all four pairs
 - n. DC Resistance Unbalance, values for all four pairs
 - o. Insertion Loss, worst case values for all four pairs
 - p. NEXT, worst case margin and worst case values, both directions
 - q. PS NEXT, worst case margin and worst case values, both directions
 - r. ACR-F, worst case margin and worst case values, both directions
 - s. PS ACR-F, worst case margin and worst case values, both directions
 - t. Return Loss, worst case margin and worst case values, both directions
 - u. TCL, worst case values both directions
 - v. ELTCTL, worst case values, both directions.
 - w. Time Domain Crosstalk data if the link is marginal or fails
 - x. Time Domain Reflectometer data if the link is marginal or fails
6. For Alien Crosstalk testing, the detailed test results documentation data is to be provided in an electronic database for each tested balance twisted-pair and shall contain the following information
- a. The overall Pass/Fail evaluation of the link-under-test
 - b. The date and time the measurements were made
 - c. The identification of the customer site as specified by the end-user
 - d. The name of the test limit selected to execute the stored test results
 - e. The name of the personnel performing the test
 - f. The version of the test software
 - g. PS ANEXT, worst case margin for all four pairs
 - h. Average PS ANEXT, worst case margin
 - i. PS AACR-F, worst case margin for all four pairs
 - j. Average PS AACR-F, worst case margin

B. Record copy and as-built drawings

1. Provide record copy drawings periodically throughout the project as requested by the Construction Manager or Owner, and at end of the project on a CD or DVD. Record copy drawings at the end of the project shall be in CAD format and include notations reflecting the as built conditions of any additions to or variation from the drawings provided such as, but not limited to cable paths and termination point. The as built drawings shall include, but are not limited to block diagrams, frame and cable labeling, cable termination points, equipment room layouts and frame installation details. The as-builts shall include all field changes made up to construction completion:
- a. Field directed changes to pull schedule.
 - b. Horizontal cable routing changes.
 - c. Associated detail drawings.

End of Section

Section 28 10 00
UNIFIED SECURITY SYSTEM
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. PUBLICLY BID TRADE CONTRACT REQUIREMENTS: As provided under Section 26 00 01 - ELECTRICAL and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 26 00 01.

1.2 RELATED DOCUMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.3 SUMMARY

- A. It is the intent of these specifications that the Contractor, Manufacturer and/or it's Authorized System Integrator expeditiously furnishes and installs a system complete in every respect and ready to operate. All miscellaneous items and accessories required for such installation, whether or not each such item or accessory as shown on the plans or mentioned in these specifications, shall be furnished and installed.
- B. The unified security system shall be installed as shown on the drawings and as specified herein. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials and performance of all operations associated with the video surveillance system for a fully functional system.
- C. It is the intention of this specification that the Access Control System (ACS) and Video Surveillance System (VSS) all be integrated on a software level such that any workstation so designated will have operational and/or display capability of the three combined systems under one software platform.
- D. The school district has standardized on the Genetec VMS, HID ACS, Axis cameras and video entry system. The district already has all the core services setup at the network operation center. The district's licensing vendor is Siemens Security.
 - 1. This contractor shall procure all system licenses from Siemens Security to maintain the district's licensing agreements.
 - 2. Siemens Security point of contact is: Jon Hipsh, telephone: 857-205-7598, email: jonathan.hipsh@siemens.com.
- E. This contractor shall provide Genetec VSS, HID ACS, Axis cameras and video entry system as shown on the drawings and as specified herein. Connect new devices to the existing systems, provide all licensing and programming for a fully functioning system.
- F. The video surveillance system for Worcester Technical High School's Vet Tech program will integrate into the district's existing Genetec Security Center infrastructure. The Worcester

Public Schools (WPS) currently has a centralized Genetec directory and this site will be an additional archive role in that directory.

- G. The Vendor will provide server and workstation hardware specified as well as software licenses specified. The Vendor will provide man-hours to work with WPS Information Technology staff to load the necessary software and integrate the systems into the WPS core Genetec infrastructure.

1.4 CODES AND STANDARDS

- A. Complete installation shall meet or exceed the latest edition of following standards:
 - 1. TIA-568: Commercial building telecommunications wiring standard and all current addenda.
 - 2. TIA-569: Commercial building standard for telecommunications pathways and spaces.
 - 3. TIA-606: Administration standard for telecommunications infrastructure of commercial buildings.
 - 4. TIA-607: Commercial building grounding and bonding requirements for telecommunications.
 - 5. ANSI, ASTM, UL, NEMA, IEEE and FCC standards as applicable.
 - 6. BICSI Telecommunications Distribution Methods Manual, current edition.

1.5 PROGRAMMING

- A. Coordinate and obtain a written approval of system functionality from the Owner prior to programming.
- B. Perform a walk-through with the Owner and demonstrate the system functionality.
- C. Make any adjustments to system functionality after initial programming if necessary to achieve the desired functionality requested by the Owner. Coordinate all required reprogramming with the Owner as required as part of this contract.
- D. Obtain a written final letter of acceptance from the Owner upon completion of system functionality programming and demonstration.

1.6 SUBMITTALS

- A. Comply with requirements specified in Division 01 and the following:
 - 1. The vendor shall submit certification letter from the manufacturer of submitted equipment certifying that the installer is an authorized and certified installer of the submitted equipment.
 - 2. The vendor shall make all connections at all field devices and at the head-end; and shall make all necessary field adjustments for a fully functional system.
- B. Shop Drawings
 - 1. Prior to assembling or installing the system, the Contractor shall provide complete shop drawings which include the following:
 - a. List the name of the manufacturer's local representative and his/her phone number.
 - b. Table of contents.
 - c. Manufacturer's parts lists
 - d. Product serial numbers

- e. Catalog cut sheets
 - f. Installation instructions
 - g. Typical wiring diagrams
 - h. Drawings showing equipment locations
 - i. Manufacturer's warranty documents
 - j. Contractor is required to provide references of three similar installations completed in the last 12 months.
- 2. All drawings shall be fully dimensioned.
 - 3. Operating License: Submit evidence of application for FCC Radio Station Authorization prior to installing equipment when required for operation of the equipment.

C. As-Built Drawings

- 1. At the conclusion of the project, the Vendor shall provide "as built" drawings. The "as built" drawings shall be a continuation of the Contractors shop drawings as modified, augmented, and reviewed during the installation, check out and acceptance phases of the project. All drawings shall be fully dimensioned and prepared in DWG format using the latest version of AutoCAD.
- 2. The as-built drawings shall incorporate all updated system riser diagrams prepared in DWG format using the latest version of AutoCAD.

D. Manuals

- 1. At the conclusion of the project, the Vendor shall provide copies of the manuals as described herein. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each system integrator installing equipment and systems and the nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The manuals shall include all modifications made during installation, checkout, and acceptance. The manuals shall contain the following:
 - a. Hardware Manual
 - 1) The hardware manual shall describe all equipment furnished including:
 - 2) General description and specifications
 - 3) Installation and check out procedures
 - 4) Equipment layout and electrical schematics to the component level
 - 5) System layout drawings and schematics
 - 6) Alignment and calibration procedures
 - 7) Manufacturers repair parts list indicating sources of supply
 - b. Software Manual
 - 1) The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
 - 2) Definition of terms and functions
 - a) Use of system and applications software
 - b) Initialization, start up, and shut down
 - c) Alarm reports
 - d) Reports generation
 - e) Data base format and data entry requirements
 - f) Directory of all disk files
- 2. Operators Manual
 - a. The operator's manual shall fully explain all procedures and instructions for the operation of the system including:
 - 1) Computers and peripherals
 - 2) System start up and shut down procedures
 - 3) Use of system, command, and applications software

- 4) Recovery and restart procedures
- 5) Use of report generator and generation of reports
- 6) Data entry
- 7) Operator commands
- 8) Alarm messages and reprinting formats
- 9) System access requirements

3. Maintenance Manual

- a. The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

1.7 QUALITY ASSURANCE

- A. The Contractor shall have successfully installed similar IP / NVR systems on a previous project of comparable size and complexity. The owner reserves the right to reject any control components for which evidence of a successful prior installation performed by the Contractor cannot be provided.
- B. The Contractor shall have in-house engineering and project management capability consistent with the requirements of this project. Qualified and approved representatives of the system manufacturer shall perform the detailed engineering design of central and remote-control equipment. The Contractor is responsible for retaining qualified and approved representative(s) of those system manufacturers specified for detailed system design and documentation, coordination of system installation requirements, and final system testing and commissioning in accordance with these specifications.
- C. The Vendors providing equipment installation services shall use adequate numbers of skilled workmen who are certified by the component manufacturer, thoroughly trained and experienced with the necessary technology and systems, and completely familiar with the specified requirements and methods needed for proper performance of work. The system head-end installation, start-up and commissioning shall be by the manufacturer certified vendor.
- D. Each vendor is required to provide a letter from the manufacturer indicating that they hold a current certification for the specified system.
- E. Use adequate numbers of skilled workers thoroughly trained and experienced on the necessary crafts and completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section.
- F. The Contractor must provide a project manager who has demonstrated the ability to supervise a project of this magnitude. The Project Manager must be available to attend meetings as required.

1.8 WARRANTY

- A. Comply with Section 260001.
- B. The Electrical Trade Contractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Video Management System (VMS)

1. Genetec
 - B. Video Surveillance System (VSS) Cameras
 1. Axis
 - C. Access Control System (ACS)
 1. Genetec
- 2.2 UNIFIED SECURITY SYSTEM PERIPHERALS
- A. Cameras
 1. Interior Corridor Camera: Axis P3267-LVE
 2. Interior 180 Degree w/ 90 Degree Down Camera: Axis P3818-PVE
 3. Interior 360 Degree Camera (ceiling mount): Axis P3727-PLE
 - B. Video Intercom System
 1. Axis: I8116-E Network Video Intercom
 - a. Program the intercom such that when the call button is pressed, the I8116-E initiates a SIP call to a pre-configured SIP phone (or group of phones) connected to a PBX server, allowing the person who answers the call to see video from the door station. From the SIP phone's interface, the user can then enter a code on the phone to trigger the A8105-E's built-in relay, which in turn signals the access control panel to unlock the door.
 - C. 4-Reader Access Control Panel
 1. Genetec SY-DV4RD-E2M-NET
 - D. MultiClass Card Readers
 1. HID Signo 20 – Mullion Mounted
 2. HID Signo 40
 - E. Request-to-exit devices
 1. Furnish and install motion request-to-exit sensors as shown on the drawings and as required. Devices shall mount directly above each door. Utilize doors that have hardware which have integral request-to-exit switches as required. Coordinate with door hardware.
 2. Provide DS 150i or approved equal with trim plate.
 - F. Auxiliary Power Supply
 1. Provide auxiliary power supply(s) for REX sensors as required. Provide Altronix or approved equal.
 - G. Locking device power supply
 1. Furnish and install electric strikes and magnetic locks power supplies as needed and required.

2. 8 or 16 outputs, individually programmable for: Fail safe, Fail secure, Form 'C' relay contact, Constant voltage for auxiliary devices, Fire Alarm Interface (FAI), Negative or open collector trip, Positive trip, Isolated trip.
3. Each output shall be fuse protected.
4. Provide coordination with door hardware Contractor on proper current draws.
5. Power supplies shall be interfaced to the fire alarm system.
6. Power supply shall be UL Listed.
7. Provide Altronix AL series or approved equal.

H. Locking Devices (Electric strike/Magnetic locks/Electric locks/Electric Hinges)

1. Furnished and installed by others. Wired by security Contractor.

2.3 MAINTANANCE AGREEMENT

A. Unified Security Platform Software Maintenance Agreement

1. Provide a manufacturer approved software upgrade plan for the Unified Security Platform software for a period of one year after final completion. The plan should include:
 - a. New USP software revisions for a period of one year from final completion at no cost to the owner.
 - b. New USP software patches for a period of one year from final completion at no cost to the owner.
2. All labor associated with the software patches and upgrades shall be included.

B. Extended Service and Preventative Maintenance Agreement

1. General
 - a. The Systems Integrator shall supply a one-year service and preventive maintenance agreement. The owner shall have the option to renew the agreement upon expiration.
 - b. The agreement must be provided by the Systems Integrator which provided and installed the entire Integrated Security System.
 - c. Equipment warranty shall be provided for a period of one year as described elsewhere within the specification.
 - d. Access to 24/7/365 phone support. A technician will be
 - e. dispatched the next day of when the service call was placed.
 - f. A technician will be dispatched within 4 hours of when the call was placed for an emergency service call. Emergency service is defined as any one of the following: Video Server/ Video Workstation/Access Control Server/Access Control workstation fails, corridor camera/photo badge reader/card reader/intrusion panel or intrusion alarm keypad does not work.
 - g. A technician will be dispatched within 24 hours of when the call was placed for a normal service call.
 - h. Provide the client with 48 hours' notice of arriving for all preventative maintenance work. And provide a one-hour notice prior to arrival for all preventative maintenance work.
 - i. Provide the client a written report explaining the scope of the service call within 48 hours after completing the service call.
2. Preventative Maintenance
 - a. Upon a monthly basis:
 - 1) Reboot all Video servers. Verify all cameras are properly reporting and recording. Verify all workstations are reporting and working properly.
 - 2) Provide written report to end user stating the above is working properly.

- b. Upon a quarterly basis:
- 1) Inspect CCTV Cameras. Verify Camera Field of View and Focus.
 - 2) Verify Cameras are viewing the desired image by the customer.
 - 3) Check System Alarm and Event Logs.
 - 4) Verify Camera Programming, Naming, Image Quality Settings and Recording Settings.
 - 5) Verify System is Recording and Note Retention Period.
 - 6) Verify Recording Hard Drive Configuration and Status. Check for Drive Failures or Bad Sectors.
 - 7) Verify Motion Detection Recording Settings. Verify all cameras are capturing the expected Motion Activity. Note any discrepancies.
 - 8) Verify PTZ Control of applicable Cameras. Check Presets, Tours and Home Position Settings.
 - 9) Verify all channels of the Video Encoder (s) are working properly.
 - 10) Provide Microsoft Window updates to each Security Workstation.
 - 11) Verify network switch utilization and network switch ports are functioning.
 - 12) Check Access Control Panel / Controller Communications Status.
 - 13) Check Access Control Panel / Controller Batteries. Note Battery Type, Voltage, Amp-Hour Rating and Date Code. Test and Note Battery Voltage.
 - 14) Inspect Door Hardware for Operation, Damage & Mis-Alignment.
 - 15) Inspect and Test Operation of Access Control Equipment at each Door [Card Readers, Door Contacts, REX & Door Release Push Buttons where applicable].
 - 16) Test Operation of Ancillary Access Control Inputs and Outputs.
 - 17) Check System Alarm and Event Logs. Attach a printed copy of the logs if applicable.
 - 18) Verify Camera Call-Up upon Event / Alarm where applicable.
 - 19) Verify Door Programming, Time Schedules, Access Levels and Door Unlock Schedules. Note programming operation.
 - 20) Verify Photo Badge Reader and Workstation Photo-ID Call-up Operation.
 - 21) Verify System Time of Day is configured and is synchronizing with a time server or consistent source.
 - 22) Verify and Note Current Software Version and Device Firmware Versions.
 - 23) Verify Client and Server Computer Hardware Specifications. Verify CPU, Memory & Network Utilization. Note Performance Stats. Perform Reboot of all Computers and verify system back-online and note any changes in performance stats.
 - 24) Verify Access Control System Database is configured for a regular back-up.
 - 25) Check each Intrusion motion detector, intrusion door contact, glass break device, duress button and keypad to verify its working properly.
 - 26) Provide written report to end user stating the above is working properly.

2.4 HARDWARE SUPPORT

- A. The Systems Integrator shall perform scheduled maintenance services on all systems and equipment as specified in this section.
- B. Components and parts that are found to be defective, have failed operationally or which exhibit signs of near-term failure will be identified during each preventive maintenance inspection or test. If the component or part is covered under a current Systems Integrator or factory warranty, said part or component will be replaced at no charge to CUSTOMER including labor during normal business hours.
- C. For any equipment requiring repair or replacement that is not covered, an estimate will be prepared and submitted for approval on a reimbursable basis and repair authorization shall be

issued in writing by an authorized representative of the CUSTOMER before proceeding with the work.

2.5 RESPONSE TIME

- A. Should an emergency arise, the Systems Integrator personnel will assess the situation either by phone or remote diagnostics, or both, and will determine the required course of action with the CUSTOMER.
- B. On-Site Response Time: If it is determined that a site visit is required, the Systems Integrator personnel will arrive at the affected premises within four (4) hours of the request of the CUSTOMER.
- C. If the resolution of the emergency service call requires the Systems Integrator to provide service for equipment that is not listed in this specification section, CUSTOMER will be liable for charges and expenses prevailing for such service.
- D. Emergency Service will be provided during the following periods.
 - 1. Provide Emergency Service Monday through Friday 8:00 AM – 5:00PM excluding evenings and weekends, city, state, federal and Systems Integrator observed holidays at no additional charge to the base annual service fee. Labor for travel time is included under this Agreement. The Systems Integrator will provide a response time as stated and agreed to above. Emergency Service requested by the CUSTOMER to be provided outside of the above stated times will be reimbursed by the CUSTOMER as shown below.
- E. Emergency Service during the following periods is not included.
 - 1. Emergency Service Monday through Friday 5:00PM – 8:00AM, weekends, city, state, federal and Systems Integrator observed holidays are not included. Emergency Services provided under this scope will be reimbursable by the CUSTOMER to the Systems Integrator at then current Systems Integrator published service labor rates and standard service charges (Minimum Labor Charge, Vehicle Charges, Round Trip Travel Time, Mileage, etc).

2.6 NETWORK SWITCHES

- A. Network ports shall be furnished by the Owner.

PART 3 - EXECUTION

3.1 GENERAL

- A. The ceiling cavity is being used as plenum return. Provide plenum rated cables, conduit, backboxes in all plenum rated ceilings, rated walls, penetrations through wall, floors and ceilings and where required by Local, State or Federal Codes.

3.2 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.

- B. Examine roughing-in for LAN, WAN, and IP network before device installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 VIDEO SURVEILLANCE SYSTEM INSTALLATION

A. General

- 1. Comply with requirements in Division 26.
- 2. Video surveillance wiring color to be distinct and specific to the system. Contractor to coordinate cable colors with all other vendors to ensure color is not duplicated.
- 3. Wiring Method: Install cables in 'J' hooks or raceways unless otherwise indicated.
- 4. Except raceways are not required in accessible indoor ceiling spaces and attics.
- 5. Conceal raceways and wiring except in unfinished spaces.
- 6. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- 7. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- 8. Set pan unit and pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms and adjust.
- 9. Install power supplies and other auxiliary components at control stations unless otherwise indicated.
- 10. Provide suitable UPS for all network switch equipment, workstations, servers and storage arrays.
- 11. Avoid ground loops by making ground connections only at the control station.

B. Field Quality Control

- 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- 2. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - b. Include Manufacturer On-Site Field Engineering services for one day of system commissioning.

C. Adjusting

- 1. Check cable connections.
- 2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
- 3. Adjust all preset positions; consult with appointed Owner's personnel.
- 4. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.
- 5. Provide a written report of adjustments and recommendations.

D. Tests and Inspections:

- 1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.

2. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:
 - a. Prepare equipment list described in "Submittals" Article.
 - b. Verify operation of auto-iris lenses.
 - c. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
 - d. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet (17 to 23 m) away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
 - e. Set and name all preset positions; consult Owner's personnel.
 - f. Set sensitivity of motion detection.
 - g. Set sensitivity of motion detection.
 - h. Verify operation of control-station equipment.
 3. Test Schedule: Schedule tests after pre-testing has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
 4. Operational Tests: Perform operational system tests to verify that system complies with specifications. Test equipment for proper operation in all functional modes.
- E. Video surveillance system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.4 ACCESS CONTROL SYSTEM INSTALLATION

- A. Door Hardware Coordination
1. Doors shall not be locked in path of legal egress.
 2. Refer to Section 08 71 00 for door hardware requirements and coordination. Contractor shall work directly with door hardware supplier to ensure the provision of specified mechanical and electronic functionality.
 - a. Coordinate the exact location of power supplies with the door hardware supplier prior to installation. Coordinate which power supplies shall be furnished by the door hardware supplier and installed by the Electrical Trade Contractor. Furnish and install any power supplies that are not being furnished by the door hardware supplier.
 3. Request-To-Exit Activation: Contractor shall configure system such that Request-To-Exit devices and System Controllers will react quickly enough to bypass alarms before a fast-moving individual can reach and open the door. This bypass process shall be evaluated and verified by the Contractor on the fully configured and operational ACS system, prior to acceptance testing.
 4. Fire Alarm Interface: Electrified locks and strikes which are part of this work and which may be locked in the path of legal exiting, shall be connected to the building Fire Alarm System in accordance with AHJ requirements such that they automatically unlock in the event of activation of the Fire Alarm System. This shall occur whether the activation is a result of a manual pull station, smoke detector or sprinkler flow switch.
 - a. A fire alarm "general/common alarm relay" shall be programmed at the fire alarm control panel to activate the ACS interface relays located in each Lock Power Supply cabinet.

- b. This interface shall not depend on the ACS Host or Remote Controllers for its operation. Locate these interface relays electrically ahead of lock power distribution

B. Access Control and Lock Configuration

1. Secured Doors: Doors equipped with electric locks shall be individually programmed for locking and unlocking at specific times of the day. A valid credential presented at a reader will allow the portal to unlock for a programmed period of time.
2. Stairwell Door Locks
 - a. Stairwell doors which are locked from the stairwell side shall have the capability to be simultaneously unlocked upon a signal from the Fire Command Center, Fire Alarm Panel, or the Access Control Command Center.
 - b. Contractor shall provide clearly labeled switches, in the required locations, to unlock all stairwell doors simultaneously. Coordinate wall or desk mounted switch style, with the Owner and the Authority Having Jurisdiction.
 - c. This interface shall not depend on the ACS Host or Remote Controllers for its operation. Locate interface relays for each stairwell door electrically ahead of ACS lock control, to independently override ACS control.
3. Upon authorization by card reader or manual means, "door force" and "door held open" alarms associated with the portal shall be automatically bypassed (prevented from reporting an alarm) for a duration of time that is programmable on an individual door and individual cardholder basis.
4. The door shall re-lock immediately upon closing, after an authorized access, and the bypass duration shall be immediately truncated. A door position switch will be required at every door for this purpose. The same door position switch shall be used to sense the position of the door for "door forced" and "door held open" alarms.
5. Free Egress Authorization
 - a. Unless otherwise shown on the plans or described herein, the system shall detect the normal egress of a user at any individual portal and shall bypass any alarm associated with the portal for a duration of time that is programmable on an individual door and individual cardholder basis.
 - b. Timing shall be independently programmed for each portal during the initial enrollment process. This function allows extended timing for disabled persons to pass through a portal.
 - c. The timing function shall automatically truncate after an adjustable period (0 - 4 seconds) after a portal is closed. This feature allows a subsequent alarm at the portal to be detected and prevents the portal from being re-opened without an authorized request.
 - d. "Request-to-Exit" devices shall be used to signal the system that an individual is ready to exit the secured door. Request-to-Exit devices may include but not be limited to:
 - 1) Integral Lock Handle Signal Switches
 - 2) Touch Bars (Electro-mechanical or electronic)
 - 3) Push Bars (Mechanical)
 - 4) Push Buttons
 - e. On doors with integral electro-mechanical locking mechanisms (strikes, electrical panic hardware, or electrical mortise locks), the mechanical action of the door hardware shall enable egress without requiring release of the electrical mechanism. The Request-to-Exit device shall not unlock the door.
 - f. On doors with integral electro-mechanical locking mechanisms (magnetic locks), a Request-to-Exit device may have to unlock the door, releasing the electrical mechanism for the programmed duration. Refer to the drawings and details for direction.
 - g. On doors with Intercom system, Contractor shall interconnect the intercom system door release button to activate the Request to Exit function and unlock the door.

The door release request contact shall be connected to an input on the ACS, such that an event shall be registered into the ACS system indicating this operation.

- C. Sequences: Verify each door type sequence at each door with the Owner prior to programming.
1. Doors with Door Position Switch (DPS) and Request-to-Exit (REX) devices
 - a. DPS and REX contacts shall be wired to ACS auxiliary input. Configure the ACS to mask the associated DPS alarm for a minimum of 45 seconds. Coordinate the required masking duration with the Owner.
 - b. ACS shall report a "door forced" alarm when any time the door is opened without a valid REX request. The subsequent operation of an associated REX shall not abort a "door forced" alarm already sensed by the system.
 - c. ACS shall report a "door-held-open" alarm after the door has been opened and the masking duration has ended.
 2. Doors with Electronic Locking (EL), DPS and REX devices
 - a. DPS and REX contacts shall be wired to ACS auxiliary input. Configure the ACS to mask the associated DPS alarm for a minimum of 45 seconds. Coordinate the required masking duration with the Owner
 - b. Electronic lock shall be wired to ACS auxiliary output. Configure the ACS to mask the associated DPS alarm during timed or commanded unlock
 - c. Electric lock shall be locked and unlocked based on preprogrammed schedules and conditions, and by manual control from the ACS client workstations.
 - d. ACS shall not cause an alarm event when door is unlocked.
 - e. ACS shall report a "door forced" alarm when any time the door is opened without a valid REX request. The subsequent operation of an associated REX shall not abort a "door forced" alarm already sensed by the system.
 - f. ACS shall report a "door-held-open" alarm after the door has been opened and the masking duration has ended during locked mode
 - g. REX device shall not unlock the door.
 3. Doors with Card Access Control (CR), EL, DPS and REX devices
 - a. CR, EL, DPS and REX devices shall be wired to a door controller board.
 - b. Electronic lock shall be locked on command from the system at any time.
 - c. Electronic lock shall unlock during a preset time zone or from the system.
 - d. Electronic lock shall be unlocked and shall not require use of card reader during timed unlock mode.
 - e. ACS shall not report activity when door is unlocked.
 - f. During locked mode Card Reader shall unlock the door, mask DPS preventing alarm.
 - g. ACS shall report a "door-held-open" alarm after the door has been opened and the masking duration has ended.
 - h. ACS shall report a "door forced" alarm when any time the door is opened without a valid REX request. The subsequent operation of an associated REX shall not abort a "door forced" alarm already sensed by the system.
 - i. REX device shall not unlock door.
 4. Doors with Auto-Operators, Proximity CR, EL, DPS and REX devices
 - a. Auto-Operator controls, CR, EL, DPS and REX devices shall be wired to a door controller board
 - b. Electronic lock shall be locked on command from the system at any time
 - c. Electronic lock shall unlock during a preset time zone
 - d. ACS shall not report alarm activity when door is unlocked
 - e. Day mode; proximity card reader shall activate the auto operator to open the door.
 - f. Secure mode:
 - 1) Card reader, auto operator function, shall activate the auto door operator at all times.

- 2) Card Reader shall unlock the door, mask the DPS device preventing alarm and allow use of door open pushbuttons. Electronic lock to be unlocked prior to door open mechanism is engaged. The door open mechanism shall not engage until the electronic lock is unlocked. Where auto door equipment is not provided with door open pushbuttons, the door shall automatically open after unlocking.
 - g. ACS shall report a "door-held-open" alarm after the door has been opened and the masking duration has ended during locked mode
 - h. ACS shall report a "door forced" alarm when any time the door is opened without a valid REX request. The subsequent operation of an associated REX shall not abort a "door forced" alarm already sensed by the system.
 - i. Use of push plate shall activate the ACS REX, unlock the door and operate the auto door system
 - j. Door shall report a door held open time when REX (push plate or signal from the door operator) is activated, door is opened from the secured side and the system bypass time has expired during locked mode.
 - k. Verify interior push plate is operational in both locked and unlocked modes.
 - l. Verify exterior push plate is operational during unlocked mode.
 - m. Verify exterior push plate is non-operational until valid card read during locked mode.
 - n. Verify exterior push plate is operational after valid card read during locked mode.
 - o. Verify door can be manually opened during locked mode from secured side.
5. Doors with Auto-Operators, Dual CR, EL, DPS and REX devices
- a. Auto-Operator controls, CR, EL, DPS and REX devices shall be wired to a door controller board.
 - b. Electric lock shall be locked on command from the system at any time.
 - c. Electric lock shall unlock during a preset time zone.
 - d. Door shall not report alarm activity when door is unlocked.
 - e. Secure mode
 - 1) Card reader, auto operator function, shall activate the auto door operator at all times.
 - 2) Card Reader shall unlock the door, mask the DPS device preventing alarm and allow use of door open pushbuttons. Electronic lock to be unlocked prior to door open mechanism is engaged. The door open mechanism shall not engage until the electronic lock is unlocked. Where auto door equipment is not provided with door open pushbuttons, the door shall automatically open after unlocking.
 - f. ACS shall report a "door-held-open" alarm after the door has been opened and the masking duration has ended during locked mode.
 - g. ACS shall report a "door forced" alarm when any time the door is opened without a valid REX request. The subsequent operation of an associated REX shall not abort a "door forced" alarm already sensed by the system.
 - h. Use of push plate shall activate the ACS REX, unlock the door and operate the auto door system.
 - i. Door shall report a door held open time when REX (push plate or signal from the door operator) is activated, door is opened from the secured side and the system bypass time has expired during locked mode.
 - j. Verify interior push plate is operational in both locked and unlocked modes.
 - k. Verify exterior push plate is operational during unlocked mode.
 - l. Verify exterior push plate is non-operational until valid card read during locked mode.
 - m. Verify exterior push plate is operational after valid card read during locked mode.
 - n. Verify door can be manually opened during locked mode from secured side.
6. Auto Sliding Doors shall operate similar to Doors with Auto-Operators.

- a. Contractor to coordinate and confirm door hardware includes electronic remote door locking control capability.
 - b. Verify sliding door break a way feature is not disabled when door is in legal path of egress.
- 7. Roll Up Doors
 - a. Provide monitoring position switch with armored cable.
 - b. Provide keypad for local bypass of alarm with remote indicator (where shown on plans) to indicate bypass of alarm.
- D. Tamper Devices
 - 1. Terminal cabinets, equipment cabinets, enclosures, power supply cabinets, exposed wireways, and pull and junction boxes with wire connections or splices shall be equipped with tamper switches programmed to report an alarm.
 - 2. Junction boxes requiring tamper switches that are associated with an individual alarmed device (such as a door position switch) may report to the respective device alarm point, if end-of-line resistors and the system are configured to support 6-state alarm reporting. Other cabinet and box tamper switches shall report as independent alarm points.
 - 3. Power Supply/Battery Chargers: Power supply/battery chargers shall be connected to alarm monitoring points to provide an "Event" indication of tamper, power failures and other system troubles.
- E. ACS Connectivity
 - 1. Access Control Network: ACS Servers, Client Workstations and Controllers shall reside on the Owners' Local Area (LAN) and/or Wide Area Network (WAN) to allow global event activity and shared data interchange.
 - 2. Provide and coordinate with Owner IT adequate network "firewalls" to maintain the security of ACS controls and information while connected to shared computer networks and transmission media. Contractor shall coordinate shared resource usage with the Owner and develop network security schemes acceptable to the Owner to ensure the integrity of the ACS.
 - 3. LAN Communications & Connectivity, (Integrated CPU's and Controller's)
 - a. Provide LAN communications interfaces for the applicable ACS Server, Clients and Controllers to support multiple workstation and integration schemes that are part of this work.
 - b. LAN Communications: Contractor shall utilize the facility's Local Area Network for ACS connections and interfaces, as shown on the drawings and described herein.
 - c. Coordinate with ACS equipment and software manufacturers to provide network interface devices compatible with the established LAN/WAN network.
 - d. Coordinate with the USC Information Systems Department to provide servers, ACS clients, network interface devices, bandwidth utilization, and appurtenances acceptable to the Owner.
 - 4. Controller Communications
 - a. Inter-Facility: Between facilities, buildings and controller "groups", the controller network shall be implemented utilizing the access control Owners infrastructure and connectivity, as shown on the drawings and described herein.
 - b. Between controllers at an individual location, and between controllers located within the same building, the controller network may be implemented using standard, twisted, shielded copper conductors as approved by the system manufacturer. It is also acceptable for controllers to be LAN connected, regardless of location.
- F. Emergency Standby Power

1. Servers, Computers, Clients, and Other 120VAC Equipment: Provide a UPS with sufficient time for power transfer where the respective buildings have an Emergency Power (EP) source. Where a building EP source is not available, provide sufficient UPS time to allow the system to run for a minimum of 1-Hour, plus (15) minutes to manage the shutdown process.
2. Low-Voltage Equipment: ACS Remote Controllers, peripheral devices and Lock Power Supplies shall also have their own 4-hour battery back-up systems.
 - a. Power back-up may be in the form of direct DC battery power back-up or by 120VAC Uninterruptable Power Supplies (UPS), depending upon equipment requirements.
 - b. Lock Power Supplies shall allow fail-secure locks to be operated by the system a minimum of 100 times-per-hour, during this time period. Fail-safe locks shall be maintained for the full 4-hours.
 - c. Battery back-up systems may be distributed throughout the facility to provide the required emergency power to individual components.
 - d. Battery back-up systems shall include battery chargers to keep storage batteries at their peak charge.

G. Card Reader Sensor

1. Install onto finished walls adjacent to door to be controlled, using concealed screws or bolts as required by wall construction and manufacturer's instruction. Where surface mount readers are required, mount on recessed conduit back box network. Coordinate construction with general Contractor. Insure no metallic construction within 6" of the reader other than reader conduit and backbox.
2. Coordinate final placement and mounting of unit to assure placement is compatible with conduit and cable runs, device operation, and ADA requirements. Refer to Architect's interior elevations for exact placement requirements.
3. Wire electric lock "energize" circuit through card reader interface (CI) output relays to achieve activation of lock and/or shunting of local audible alarm.
4. Set energize relay adjustable timer to allow adequate time for passage through from access side location. Confer with Owner's representative and program time accordingly to allow passage but discourage tailgating.
5. Allow valid door exiting and assure detection of forced entry, by use of "request-to-exit" motion detector(s), and/or panic bar and/or mortised electric lock microswitches and programming of alarm shunt functions. REX to shunt contact only, not unlock lock. Review REX shunt timing with Owner's representative and program time accordingly to allow exiting but enforce "door forced" alarms.
6. Wire card readers to dedicated CI or FMP, using cable per manufacturer's recommendations with shield, and terminate shield on dedicated RF ground in CI or FMP enclosure, separate from 120VAC grounding.
7. Review reader mounting with General Contractor and manufacturer's instructions, paying special attention to related, adjacent construction material constraints. Review prior to reader rough-in to insure compliance with manufacturer's recommended mounting details and adequate physical blocking to insure strong and secure attachment, minimal interference with reading of proximity tags, and reliable operation of the access control system.
8. Ensure extra cable coils are not left in reader backbox where proximity readers are used.

H. Magnetic Switches

1. Install, at selected interior, perimeter doors, and roll-up doors and grilles per manufacturer's instructions and as shown on the Drawings.
2. At doors with card readers, contacts shall be installed. The contact shall be wired to the appropriate card reader field multiplex panel door open detect circuit.

3. Magnetic contact system to be fully supervised for circuit open, short, normal, and alarm. Provide required end-of-line resistors as required by Access Control System field multiplex panel manufacturer to achieve this supervision.
4. Switches to be recess/flush mounted to conceal all elements of switch and wiring wherever possible. Rolling doors and grilles only shall utilize surface mounted contacts.
5. One pair (magnetic switches) required per door leaf. See Security Drawings, for locations and details.
6. Coordinate all door, frame, or other preparation with the Construction Manager and the appropriate Contractors for general construction. Frames must be factory prepared to receive contacts by the Security System Contractor and shall be coordinated to achieve exact preparation details per manufacturer's installation instructions. Only under duress, if special conditions so require, field drill doors under the supervision of the Architect or his designee and the General Contractor.
7. Connect to field multiplex input panel module for device status signal transmission and provide one end ground of cable shield at the panel.
8. Prepare aluminum doors and frames to receive magnetic contacts to match recessed hollow metal locational details if material geometry allows.
9. Magnetic contacts shall be typically placed at the door head. Jamb mounting of contact on strike side of door is also acceptable, based on field conditions. Mounting of contacts of the hinge side is prohibited.
10. Door contact wiring shall be spliced to homerun signal wiring in door buck junction box, or through purchase of suitable length contact wire, in stainless steel sheathing, to adjacent junction box, based on field conditions associated with door contact mounting details. Purchase contacts with sufficient armor-clad wire and lead length to reach associated junction box with no intermediate splices. Mount associated junction box in or above ceiling or in wall in protected space as directed by the Architect or his designee. Wherever an accessible ceiling is provided, mount J-box above ceiling. Where drywall ceilings exist, mount J-box with flush, single gang cover at location agreed to by Owner. Use tamper proof screws where fasteners required and exposed.
11. Use suitable rubber bush compression fittings to secure miniature armor clad door contact cable entry to junction box if used, per Article 10 above.
12. Installation of contacts in special conditions at door frames shall be reviewed in the field and a sample installation of each typical condition shall be created in a working session between Construction Manager, Contractors, Engineer and the Architect or his designee, prior to final installation.
13. Silicone/RTV glue-in all flush mount where button-type contacts in hollow metal and aluminum frames are allowed. Insure adequate clearance exists between contact mounting, flanges and door and frame. Advise General Contractor, Architect and Engineer whenever inadequate clearances exist.

I. 12/24 VDC Security Device Low Voltage Power Supplies

1. Install in locations shown on Drawings at SDF's adjacent to other power supply panels, card access field multiplex panels, IDS remote input module enclosures, CCTV power supplies, etc., and connect to field multiplex panels and security devices, per floor plan notes and riser details, manufacturer recommendations and device installation specifications.
2. Hard wire into 120VAC source provided by Electrical Trade Contractor. Wire loss of "AC" power relay and low battery relay in panel enclosure and connect as separate alarm zones to intrusion detection field multiplex input panel module, using end-of-line resistors.
3. Wire from 12VDC individually fused terminals to 12VDC security device power circuits. Do not exceed 200 milliamps of connected load to any one fused circuit without the approval of the engineer. Do not exceed 50% of overall power supply power output rating.
4. Connect power supplies to CA/IDS field multiplex panels (if they require 12/24VDC input) to provide required normal and standby power for their operation. Do not connect more than 2 FMP's to any power supply, without FMP manufacturer and engineer's approval.

5. Check to assure charging circuits and power supply module is operating, producing proper "on-battery" current, proper output voltage at load, and does not exceed advertised ripple, and that power supervision relays change state. Battery back-up shall be 16 hours minimum at full load. Calculate number of 12 VDC powered devices per 12 VDC circuit, and number of circuits per power supply.
6. Assume all devices in normal state (largest current draw), and systems back up time capability present under this heaviest device load condition. Provide additional batteries in separate, externally protected, enclosure, if required.
7. Tag all 12VDC circuits with panel and 12VDC circuit number at both devices and at power supply fuse strip.
8. Wire out to 12 VDC devices using twisted, shielded, unique color-coded cable per specifications. Utilize wire gauge of adequate size to eliminate voltage drop outside of detector/device manufacturer's specification at furthest device from the panel. Increase size of wire from that shown on the drawings, based on actual run length used in the field.
9. Unit shall be UL listed, and come complete in enclosure with batteries, lock, tamper switch, loss of AC relay, low battery monitoring, fused output circuits, etc.
10. Activation of power kill switch shall initiate a "trouble" input to the IDS system field multiplex panel to indicate a protective circuit is temporarily disabled.
11. Provide an accessible power switch with a power "on" indicator between the 120V source and the 12VDC power supply load side connection.

J. System Software

1. Develop, install, and test software and databases for the complete and proper operation of systems involved. Assign software license to Owner.

K. Startup Service

1. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup check according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.
2. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

L. Testing

1. Prior to performing Preliminary Testing, inspection, and/or final testing procedures, Contractor shall insure the following:
 - a. Safe and proper operation of all components, devices or equipment, and the absence of extraneous or interfering signals.
 - b. Proper grounding of devices and equipment.
 - c. Integrity of signal and electrical system ground connections.
 - d. Proper powering of devices and equipment.
 - e. Integrity of all insulation, shield terminations and connections.
 - f. Integrity of soldered connections and absence of solder splatter, solder bridges, debris of any kind.
 - g. Proper dressing of wire and cable with labels matching as-build documents.
 - h. "Wire-checking" of all circuitry, including phase and continuity.
 - i. Preliminary targeting and setup of video camera assemblies.
 - j. Mechanical integrity of all support and positioning provisions, i.e.: as provided for video cameras, monitors and any other equipment.
 - k. Sequencing: If applicable, determine and record the sequence of energizing systems to minimize the risk of damage from improper startup.
 - l. Proper operation of devices and systems in accordance with specified performance requirements.

- m. System is programmed for alarm reporting of each device and associated with the graphical maps.
 - n. Verify system programming is defined.
2. Testing Electronic Access Control Security Terminal Cabinets.
- a. Test each equipment enclosure for tamper alarm.
 - b. Test each power supply battery for power loss alarm reporting.
 - c. Test each STC for 120VAC power loss alarm.
 - d. Test each STC for communication loss with server reporting.
3. Testing Electronic Access Control Doors
- a. Doors with Door Position Switch (DPS) and Request to Exit device (REX) shall be tested for:
 - 1) Door Forced Open alarm is generated when door is opened from unsecured side.
 - 2) Door Held Open alarm is generated when door is held open past its preprogrammed duration after valid REX event.
 - 3) REX shunts alarm on egress.
 - 4) REX does not shunt forced door alarm.
 - b. Doors with Electrified Exit Device, DPS and REX
 - 1) Door is locked in secure mode.
 - 2) Door is unlocked by manual command from system workstation.
 - 3) Door is unlocked by time zone.
 - 4) Door Forced Open alarm is generated during secure mode only.
 - 5) Door Held Open alarm is generated during secure mode only.
 - 6) REX shunts alarm on egress during secure mode, for the preprogrammed duration.
 - 7) Door relocks immediately when door closes after valid passage (does not wait for preprogrammed duration).
 - 8) REX does not unlock door.
 - 9) REX does not bypass forced door alarm.
 - 10) Door relocks on time zone.
 - 11) Door relocks during day mode on manual command from system workstation.
 - c. Doors with Automatic door operators
 - 1) Door is locked in secure mode.
 - 2) Door is unlocked by manual command from system workstation during secure mode.
 - 3) Door is unlocked by time zone.
 - 4) Door Forced Open alarm is generated during secure mode only.
 - 5) Door Held Open to long alarm is generated during secure mode only.
 - 6) REX shunts alarm on egress during secure mode.
 - 7) REX does not unlock door.
 - 8) Door relocks on time zone.
 - 9) Door relocks during day mode on manual command from system workstation.
 - d. Doors or Gates with card reader
 - 1) Door unlocks by use of the card reader for programmed unlock time and does not alarm when door is opened.
 - 2) Door is locked in secure mode.
 - 3) Door is unlocked by manual command from system workstation.
 - 4) Door is unlocked by time zone.
 - 5) Door Forced Open alarm is generated during secure mode.
 - 6) Door Held Open alarm is generated during secure mode.
 - 7) REX shunts alarm on egress during secure mode.
 - 8) Door relocks immediately when door closes after valid passage (does not wait for preprogrammed duration).

- 9) REX for door does not unlock door.
- 10) REX for gates does not unlock gate.
- 11) Door relocks on time zone.
- 12) Door relocks during day mode on manual command from system workstation.

- M. The Contractor shall maintain a complete log of all inspections and tests. Upon final completion of system tests, a copy of the log records shall be submitted as part of the as-built documentation.

3.5 CLEANING

- A. Clean installed items using methods and materials recommended in writing by manufacturer.

3.6 COMMISSIONING

- A. Comply with requirements specified in Division 1.
- B. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup checks according to the approved manufacturer's written instructions.

3.7 TRAINING AND SERVICE

- A. Comply with Section 26 00 01.
- B. Conduct two 4-hour training sessions. Train the Owner's maintenance personnel on procedures and schedules related to start up and shutdown, troubleshooting, servicing, and preventive maintenance.

End of Section

SECTION 28 31 11
ADDRESSABLE FIRE-ALARM SYSTEM

(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section.

1.2 SCOPE OF WORK

- A. It is the intent of these specifications that the Contractor, Manufacturer and/or its Authorized System Integrator expeditiously furnishes and installs a system complete in every respect and ready to operate. All miscellaneous items and accessories required for such installation, whether or not each such item or accessory as shown on the plans or mentioned in these specifications, shall be furnished and installed.
- B. The work covered by this Section of the Specification shall include all labor, equipment, materials and services to furnish and install a complete fire alarm system of the addressable, non-coded type. It shall be complete with all necessary hardware, software and memory specifically tailored for this installation. It shall be possible to permanently modify the software on site by using a plug-in programmer. The system shall consist of, but not be limited to, the following:
1. Visual notification appliances - strobes.
 2. Audiovisual notification appliances – speaker strobes.
 3. Smoke detectors
 4. Heat detectors
 5. Duct smoke detectors
 6. Pull stations
- C. Existing Fire Alarm Network:
1. Perform software and firmware upgrades to the existing Simplex 4100U panel and nodes in the building.

1.3 RELATED WORK

- A. The Contractor shall coordinate work in this Section with all related trades. Work and/or equipment provided in other Sections and related to the fire alarm system shall include, but not be limited to:
1. Duct smoke detectors shall be furnished, wired and connected by the electrical contractor. The HVAC contractor shall furnish necessary duct opening to install the duct smoke detectors.
 2. New air handling and smoke exhaust system fan control circuits and status contacts to be furnished by the HVAC control equipment.
 3. Security/Access Control. Provide control relays to all lock power supplies as required per code.

- B. Secure permits and approvals prior to installation.
- C. Prior to commencement and after completion of work notify Authorities Having Jurisdiction.
- D. Submit letter of approval for installation before requesting acceptance of system.

1.4 APPLICABLE CODES AND STANDARDS

- A. All equipment shall be UL listed for its intended use and conform to the latest UL Standards.
- B. Underwriters Laboratories Inc.: The system and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:
 - 1. UL 864/UOJZ, APOU Control Units for Fire Protective Signaling Systems.
 - 2. UL 268 Smoke Detectors for Fire Protective Signaling Systems.
 - 3. UL 268A Smoke Detectors for Duct Applications.
 - 4. UL 217 Smoke Detectors Single Station.
 - 5. UL 521 Heat Detectors for Fire Protective Signaling Systems.
 - 6. UL 228 Door Holders for Fire Protective Signaling Systems.
 - 7. UL 464 Audible Signaling Appliances.
 - 8. UL 1638 Visual Signaling Appliances.
 - 9. UL 38 Manually Activated Signaling Boxes.
 - 10. UL 346 Waterflow Indicators for Fire Protective Signaling Systems.
 - 11. UL 1971 Standard for Signaling Devices for the Hearing Impaired
 - 12. UL 1481 Power Supplies for Fire Protective Signaling Systems.
 - 13. UL 1711 Amplifiers for Fire Protective Signaling Systems.
 - 14. UUKL The Fire Alarm system shall be UUKL for Smoke Control.
- C. This installation shall comply with:
 - 1. Americans with Disabilities Act (ADA)
 - 2. National Electric Code, Article 760.
 - 3. National Fire Protection Association Standards: NFPA72
 - 4. Local and State Building Codes and the Local Authorities Having Jurisdiction.
 - 5. International Standards Organization (ISO): ISO-9001

1.5 SUBMITTALS

- A. Provide list of all types of equipment and components provided. This shall be incorporated as part of a Table of Contents, which will also indicate the manufacturer's part number, the description of the part, and the part number of the manufacturer's product datasheet on which the information can be found.
- B. Provide description of operation of the system (Sequence of Operation), similar to that provided in Part 2 of this Section of the Specifications, to include any and all exceptions, variances or substitutions listed at the time of bid. Any such exceptions, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment. The sequence of operation shall be project specific and shall provide individual sequences for every type of alarm, supervisory, or trouble condition, which may occur as part of normal or off-normal system use.

- C. Provide manufacturer's ORIGINAL printed product data, catalog cuts and description of any special installation procedures. Photocopied and/or illegible product data sheets shall not be acceptable. All product datasheets shall be highlighted or stamped with arrows to indicate the specific components being submitted for approval.
- D. Provide manufacturer's installation instruction manual for specified system.
- E. Provide samples of various items when requested.
- F. Provide copy of State License to perform such work.
- G. Provide copies of NICET Level IV Fire Alarm certifications for a minimum of two (2) technicians assigned to this project.
- H. Provide shop drawings as follows:
 - 1. Coversheet with project name, address and drawing index.
 - 2. General notes drawing with peripheral device backbox size information, part numbers, device mounting height information, and the names, addresses, point of contact, and telephone numbers of all contract project team members.
 - 3. Device riser diagram that individually depicts all control panels, annunciators, addressable devices, and notification appliances. Shall include a specific, proposed point descriptor above each addressable device. Shall include a specific, discrete point address that shall correspond to addresses depicted on the device layout floor plans. Drawing shall provide wire specifications, and wire tags shown on all conductors depicted on the riser diagram. All circuits shall have designations that shall correspond with those require on the control panel and floor plan drawings. End-of-line resistors (and values) shall be depicted.
 - 4. Control panel termination drawing(s). Shall depict internal component placement and all internal and field termination points. Drawing shall provide a detail indicating where conduit penetrations shall be made, so as to avoid conflicts with internally mounted batteries. For each additional data gathering panel, a separate control panel drawing shall be provided, which clearly indicated the designation, service and location of the control enclosure. End-of-line resistors (and values) shall be depicted.
 - 5. Device typical wiring diagram drawing(s) shall be provided which depict all system components, and their respective field wiring termination points. Wire type, gauge, and jacket shall also be indicated. When an addressable module is used in multiple configurations for monitoring or controlling various types of equipment, different device typical diagrams shall be provided. End-of-line resistors (and values) shall be depicted.
 - 6. Device layout floor plans shall be created for every area served by the fire alarm system. CAD Files (AutoCAD latest version) shall be provided by the consulting engineer for the use of the fire alarm system equipment vendor in the preparation of the floor plans. Floor plans shall indicate accurate locations for all control and peripheral devices. Drawings shall be NO LESS THAN 1/8 INCH SCALE. All addressable devices shall be depicted with a discrete address which corresponds with that indicated on the Riser Diagram. All notification appliances shall also be provided with a circuit address which corresponds to that depicted on the Riser Diagram. If individual floors need to be segmented to accommodate the 1/8" scale requirements, KEY PLANS and BREAK-LINES shall be provided on the plans in an orderly and professional manner. End-of-line resistors (and values) shall be depicted.
 - 7. Contained in the title block of each drawing shall be symbol legends with device counts, wire tag legends, circuit schedules for all addressable and notification appliance circuits, the project name/address, and a drawing description which corresponds to that indicated in the drawing index on the coversheet drawing. A section of each drawing title block shall be reserved for revision numbers and notes. The initial submission shall be Revision 0, with Revision A, B, or C as project modifications require.

- I. Battery calculations shall be provided on a per power supply/charger basis. These calculations shall clearly indicate the quantity of devices, the device part numbers, the supervisory current draw, the alarm current draw, totals for all categories, and the calculated battery requirements (which reflect a 20% DEGRADE, for 24 Hour supervisory, 15 minute alarm operation). Battery calculations shall also reflect all control panel component, remote annunciator, and auxiliary relay current draws. Failure to provide these calculations shall be grounds for the complete rejection of the submittal package.
- J. Table of contents, product data sheets, sequences of operation, battery calculations, installation instructions, licenses, NICET certifications and B-Size (blackline) reduced shop drawings shall be provided by the fire alarm vendor as part of a single, spiral bound submittal book. The submittal book shall have laminated covers indicating the project address, project number, system type, and contractor. The book shall consist of labeled dividers, and shall not exceed 9 ½" in width, and 11 ½" in height. No less than three (3) sets of submittal booklets shall be provided to the consulting engineer for review and comment. Additional copies may be required at no additional cost to the project.
- K. Scale drawing sets shall be submitted along with the submittal booklets. These drawings may be either D-Size or E-Size Blue-line drawings and of a sufficient resolution to be completely read. Sets shall be bound and folded so that it does not take up more than 100 square inches of space. No less than three (3) sets of scale drawing sets shall be provided to the consulting engineer for review and comment. Additional copies may be required at no additional cost to the project.
- L. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
- M. Field quality-control reports.
- N. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 include the following:
 - 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 - 3. Record copy of site-specific software.
 - 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 - 5. Manufacturer's required maintenance related to system warranty requirements.
 - 6. Abbreviated operating instructions for mounting at fire-alarm control unit.
 - 7. Retain subparagraph below if Project contains water-based sprinkler or standpipe systems.
 - 8. Copy of NFPA 25.
- O. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.6 AS-BUILT DRAWINGS

- A. At the conclusion of the project, the Contractor shall provide "as built" drawings. The "as built" drawings shall be a continuation of the Contractors shop drawings as modified, augmented, and reviewed during the installation, check out and acceptance phases of the project. All drawings shall be fully dimensioned and prepared in DWG format using the latest version of AutoCAD.
- B. The as-built drawings shall incorporate all updated system riser diagrams prepared in DWG format using the latest version of AutoCAD.
- C. The as-built drawings shall show point-to-point wiring of all devices.

1.7 OPERATION AND MAINTANANCE MANUALS

A. Manuals

- 1. At the conclusion of the project, the contractor shall provide copies of the manuals as described herein. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each system integrator installing equipment and systems and the nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The manuals shall include all modifications made during installation, checkout, and acceptance. The manuals shall contain the following:
- 2. Operators Manual
 - a. The operator's manual shall fully explain all procedures and instructions for the operation of the system including:
 - 1) Computers and peripherals
 - 2) System start up and shut down procedures
 - 3) Use of system, command, and applications software
 - 4) Recovery and restart procedures
 - 5) Graphic alarm presentation
 - 6) Use of report generator and generation of reports
 - 7) Data entry
 - 8) Operator commands
 - 9) Alarm messages and reprinting formats
 - 10) System access requirements
- 3. Maintenance Manual
 - a. The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician. Provide certification with the submittal package.
- C. System Engineering and Shop Drawings Qualifications: System engineering and shop drawings shall be by performed by a NICET fire-alarm Level IV technician. Provide certification with the submittal package.

- D. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.10 WARRANTY

- A. Comply with Section 260001.
- B. The Electrical Contractor shall warranty that all materials furnished shall be free from defects of material for a period of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The existing fire alarm control panel is Simplex 4100U addressable panel.
 - 1. Connect new initiating and signaling devices to new initiating and signaling circuits.
 - 2. Furnish and install all necessary hardware for a complete functioning system.
 - a. Provide notification appliance circuit (NAC) panel as required.
 - b. Provide SLC card as required.
 - 3. Connection to existing initiating and signaling circuits:
 - a. The electrical subcontractor may connect new devices to the existing initiating and signaling circuits should calculations and field testing permit it. The electrical subcontractor shall qualify the existing fire alarm initiating and signaling circuits for installation of additional devices (load considerations) prior to connecting new devices. Provide battery calculations to ensure new devices can be connected to existing loops.
 - 4. Existing fire alarm devices on the floor are to remain until the new devices are commissioned and operational.
 - 5. Coordinate with Owner and the fire department for shut down before ANY alarm system work.

2.2 FIRE ALARM SYSTEM SEQUENCE OF OPERATION

- A. The system shall identify any off normal condition and log each condition into the system database as an event.
 - 1. The system shall automatically display on the control panel Liquid Crystal Display the first event of the highest priority by type. The priorities and types shall be alarm, supervisory, trouble, and monitor.
 - 2. The system shall have a Queue operation and shall not require event acknowledgment by the system operator. The system shall have a labeled color-coded indicator for each type of event; alarm - red, supervisory - yellow, trouble - yellow, monitor - yellow. When an unseen event exists for a given type, the indicator shall be lit.
 - 3. For each event, the display shall include the current time, the total number of events, the type of event, the time the event occurred and up to a 42-character custom user description.
 - 4. The user shall be able to review each event by simply selecting scrolling keys (up-down) for each event type.
 - 5. New alarm, supervisory, or trouble events shall sound a silencing audible signal at the control panel.
- B. Operation of any alarm initiating device shall automatically:
 - 1. Update the control/display as described above (A.1.)
 - 2. Sound all audible speaker appliances with a prerecorded message. Audible devices shall have the ability to be silenced.
 - 3. Activate all strobe appliances throughout the facility. All strobe appliances shall be synchronized with each other in any location with two or more devices in a common field of view. Visual devices shall be non-silenced unless the system is successfully reset.
 - 4. Operate control relay contacts to shut down all HVAC units serving the floor of alarm initiation.
 - 5. Operate control relay contacts to return all elevators that serve the floor of alarm initiation to the ground floor. If the alarm originates from the ground floor, operate control circuits contacts to return all elevators to the floor above or to a level as directed by the local fire department.
 - 6. Operate control relay contacts to release all magnetically held smoke doors throughout the building.
 - 7. Visually annunciate the individual point of alarm on all remote annunciator panels. The visual indication shall remain on until the alarm condition is reset to normal.
 - 8. Transmit an alarm condition to Local Fire Department (as required by the AHJ).
- C. Elevator smoke and heat detector sequences shall comply with the ANSI A17.1 requirement for main/alternate floor recalls.
- D. Activation of a sprinkler supervisory initiating device shall:
 - 1. Update the control/display as described above.
 - 2. Transmit a supervisory condition to Local Fire Department (as required by the AHJ).
 - 3. Visually annunciate the individual point of alarm on all remote annunciator panels. The visual indication shall remain on until the alarm condition is reset to normal.
- E. The entire fire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the fire alarm control panel. Any opens, grounds or disarrangement of system wiring and shorts across alarm signaling wiring shall automatically:
 - 1. Update the control/display as described above.

2. Transmit a trouble condition to Local Fire Department (as required by the AHJ).
3. Visually and audibly annunciate a general trouble condition, on the remote annunciator panels. The visual indication shall remain on until the trouble condition is repaired.

2.3 INTELLIGENT MANUAL PULL STATIONS

- A. General: The manual stations shall have a minimum of 2 diagnostic LEDs mounted on their integral, factory assembled single or two stage input module. A red LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. Input circuit wiring shall be supervised for open and ground faults. The fire alarm pull station shall be suitable for operation in the following environment: Temperature: 32F to 120F, Humidity: 0-93% RH, non-condensing.
- B. Manual Pull Station: Provide intelligent dual action, single stage fire alarm stations at locations shown on the drawings. The fire alarm station shall be of metal construction with an internal toggle switch. Provide a locked test feature. Finish the station in red with silver "PULL IN CASE OF FIRE" English lettering. The manual station shall be suitable for mounting on North American 2 1/2" deep 1-gang boxes and 1 1/2" deep 4" square boxes with 1-gang covers.
- C. Parking or outdoor area Pull Stations shall be NEMA 4X rated for outdoor use and key operated. Matching weatherproof back box to be included. Addressable monitor module for monitoring of pull station to be installed in environmentally controlled area.

2.4 NOTIFICATION APPLIANCES

- A. Notification Appliances
 1. Visual Appliance: shall be listed to UL 1971 listed for indoor applications. The device shall consist of a xenon flash tube with clear lens/reflector, cover shall have the lettering "FIRE", and a mounting plate. For ease of installation the mounting plate shall mount directly to a vertically mounted four gang electrical box, without the use of special adapters or trim rings. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control unit. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. The device shall be provided with multiple minimum flash intensities of 15cd, 30cd, 75cd, 110cd, 135cd and 185cd. The candela levels shall be settable from the fire alarm control unit or by using a hardware selector on the appliance.
 2. Weatherproof Visual Appliances: shall be UL 1638 listed for outdoor applications with strobe rated at 75 cd (WP75) or 185 cd (WP185). The devices shall be acceptable for indoor and outdoor, extended temperature and extended humidity applications. The device shall consist of two xenon flash tubes one clear lens/reflector and one amber lens/reflector, cover shall have the lettering "FIRE" for the clear lens and "ALERT" for the amber lens, weatherproof cover and weatherproof mounting box. The Candela levels shall be settable from the fire alarm control unit or by using a hardware selector on the appliance.
- B. Audible Notification Appliance: shall be listed to UL 1480. Individual device level supervision and activation control shall be provided by the fire alarm control unit.
 1. Speakers shall be individually powered, addressed, and controlled from a compatible fire alarm control unit Signaling Line Circuit (SLC) using Unshielded Twisted Pair (UTP) cable and T-taps shall be allowed for Class B installation reducing wiring costs and wiring distances. Shielded cable shall not be required.
 2. Speakers shall provide for Fire Alarm and General Signaling functionality in a single unit, eliminating additional devices. Device "Self-Test" shall be supported by a compatible fire

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- alarm control unit and shall be UL listed and NFPA 72 compliant. Speakers shall be UL listed to provide a 520Hz audio tone in compliance with NFPA 72 for sleeping areas.
3. The speaker audio shall be provided by a standard 25VRMS or 70.7VRMS audio circuit using Unshielded Twisted Pair (UTP) cable. Shielded cable shall not be required.
 4. Speaker power taps shall be at a minimum of 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker shall have a minimum UL rated sound pressure level of 86dBA at 10 feet for the Standard Output version and 84dBA at 10 feet for the High Fidelity version.
 5. Speakers shall be available in either "Standard Output" with a minimum frequency response of 400 to 4000 Hz or in "High Fidelity Output" with a minimum frequency response of 200 to 10,000 Hz. Standard Output speakers shall use a multi-tapped speaker for audio/tone notification. Provide High Fidelity Speakers for this project.
 6. Wall mount appliances shall be available in White and Red and ceiling mount appliances shall be available in White, Red, and Black. Labeling shall be available as either "FIRE", "ALERT" or no labeling.
 7. The speaker shall install directly to a 4" square, 2 1/8" deep electrical box. Extensions for these boxes shall not be required. Units shall be modular in design to allow for easy installation and for easy changing of device color and labeling.
- C. Combination Notifications Appliance: Combination appliances combine the speaker and visual functions into a common housing. The combination appliance shall be listed to UL 1971 and UL 1480.
1. Operational functions and features of the Speaker above shall apply to this section. Operational functions and features of the Strobe above shall apply to this section.
 2. Wall mount appliances shall be available in White and Red and ceiling mount appliances shall be available in White, Red, and Black. Labeling shall be available as either "FIRE", "ALERT" or no labeling.
 3. The speaker shall install directly to a 4" square, 2 1/8" deep electrical box. Extensions for these boxes shall not be required. Units shall be modular in design to allow for easy installation and for easy changing of device color and labeling.
 4. Notification appliance operation shall provide power, supervision and separate control of speakers/horns/strobes and combination devices over a single pair of wires. The controlling channel (SLC) digitally communicates with each appliance and receives a response to verify the appliance's presence on the channel. The channel provides a digital command to control appliance operation. SLC channel wiring shall be unshielded twisted pair (UTP), with a capacitance rating of less than 60pf/ft and a minimum 3 twists (turns) per foot.
- D. All Notification Appliances shall operate as a completely independent device allowing for specific location alerting of both fire alarm and Mass Notification functions. Each visible device (both clear fire alarm and amber mass notification) shall be capable of operating on multiple notification zones or completely separate from all other notification devices, this allows "On the fly" program operation changes for Mass Notification alerting and fire alarm notification.
- E. All Notification Appliances shall operate as a completely independent device allowing for appliances in handicap accessible rooms and other locations to operate on the same SLC and to activate individually based on an alarm condition in a room or as part of a general alarm condition where all appliances activate together.
1. Individual Notification Appliances shall be able to be grouped into zones (or operational groups) by central programming at the main fire alarm control unit.
 2. Notification Appliances shall provide for "unobtrusive" testing. Each Notification Appliance shall be tested for audible and visible operation on an individual basis at the device or from the main fire alarm control unit, allowing for minimal invasive impact.
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PART 3 - EXECUTION

3.1 INSTALLATION

- A. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagram. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type recommended by the manufacturer, approved by the local Fire Department and specified within.
- B. End of Line Resistors shall be furnished as required for mounting as directed by the manufacturer. Devices containing end-of-line resistors shall be appropriately labeled. Devices should be labeled so removal of the device is not required to identify the EOL device.
- C. All manual pull stations shall be mounted 48 inches above the finished floor, as measured to the handle.
- D. All audio/visual devices shall be mounted 80 inches above the finished floor, as measured to the lens. Devices shall be mounted no less than 6 inches from the ceiling. All audiovisual devices shall have Lexan covers in all areas subject to mechanical damage.
- E. In areas with concealed ceiling spaces all device plenum rated wiring shall be mechanically protected with conduit or shall be Type MC Listed fire alarm cable where allowable by code.
- F. All low voltage wiring terminated to the fire alarm system shall be PLENUM RATED with no exceptions and no less than No. 18 AWG in size, and solid copper.
- G. All wiring shall be color-coded throughout, to National Electrical Code standards.
- H. Power-limited/Non-power-limited NEC wiring standards SHALL BE OBSERVED.
- I. All junction box covers shall be painted federal safety red and labeled FIRE ALARM SYSTEM ONLY in black letters.
- J. Fire alarm system wiring shall not co-mingle with any other system wiring in the facility. Conduits shall not be shared under any circumstance. Only when fire alarm wiring enters the enclosure of a monitored or controlled system will co-habitation be permitted (i.e. at fan starters or elevator controllers).
- K. All fire alarm wiring shall be continuous and un-spliced. Terminations shall only occur at fire alarm devices or control panel enclosures under terminal screws. All other splicing methods are specifically disallowed (i.e. plastic wire nuts).
- L. All fire alarm wiring shall be installed using a dedicated system of supports (i.e. bridle rings). Fire alarm wiring shall not be bundled or strapped to existing conduit, pipe or wire in the facility.
- M. All fire alarm wiring shall be sleeved when passing through any wall, using conduit sleeves (1" min.) with bushings, and fire stopped in accordance with Code.
- N. All fire alarm devices shall be accessible for periodic maintenance. Should a device location indicated on the Contract Drawings not meet this requirement, it shall be the responsibility of the installing contractor to bring it, in writing, to the attention of the Project Engineer. Failure to bring such issues to the attention of the Project Engineer shall be the exclusive liability of the installing Electrical Contractor.

- O. The existing fire alarm system shall remain in operation until such time that approval has been granted for its removal. The installing Electrical Contractor shall be responsible for the upkeep of the existing system until such time that it can be removed.

3.2 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Electrical Identification."
- B. Install instructions frame in a location visible from the FACP.

3.3 GROUNDING

- A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.4 FIELD QUALITY CONTROL

- A. The system shall be installed and fully tested under the supervision of a trained manufacturer's representative. The system shall be demonstrated to perform all of the function as specified.
- B. The installing contractor or fire alarm equipment vendor shall have no less than two (2) NICET Level IV fire alarm technicians dedicated to this project.
- C. The Installing Contract and the Fire Alarm System Vendor shall, upon the request of the Consulting Engineer or End-User, attend any and all project meetings for the purpose of accurately determining progress.
- D. It shall be the responsibility of the installing contractor to assure that construction debris does not adversely affect any sensing devices installed as part of this project. Should it be deemed necessary by the Consulting Engineer, End-User or AHJ, the installing contractor shall be responsible for the cleaning of all smoke detectors prior to final acceptance.

3.5 TESTING AND ACCEPTANCE

- A. The Contractor is responsible for giving all notices, filing all plans, obtaining all permits, fire alarm system testing and obtaining necessary approvals from authorities having jurisdiction.
- B. The authority having jurisdiction, the Fire Department., requests periodic inspection of the fire alarm system during the installation period. The Contractor shall contact the Fire Dept. to schedule these inspections.
- C. The Contractor shall schedule all fire alarm tests a minimum of 2 weeks in advance. Coordinate testing times with the Owner, Designers, and authorities having jurisdiction. Fire Alarm Testing will be performed before or after normal business hours or on weekends and holidays. Additional compensation will not be provided to the Contractor for non-business hours testing.
- D. Initial Acceptance Testing
 - 1. All new systems shall be inspected and tested in accordance with the requirements of NFPA 72, Chapter 14.
 - 2. The authority having jurisdiction shall be notified prior to the initial acceptance test.

E. Reacceptance Testing

1. When an initiating device, notification appliance, or control relay is added, it shall be functionally tested.
2. When an initiating device, notification appliance, or control relay is deleted, another device, appliance, or control relay on the circuit shall be operated.
3. When modifications or repairs to control equipment hardware are made, the control equipment shall be tested in accordance with NFPA 72, Table 14.4.3.2, items 1 (a) and 1 (d).
4. When changes are made to site-specific software, the following shall apply:
 - a. All functions known to be affected by the change, or identified by a means that indicates changes, shall be 100 percent tested.
 - b. In addition, 10 percent of initiating devices that are not directly affected by the change, up to a maximum of 50 devices, also shall be tested and correct system operation shall be verified.
 - c. A revised record of completion in accordance with NFPA 72, 7.5.6 shall be prepared to reflect these changes.

- F. Changes to the system executive software shall require a 10 percent, functional test of the system, including a test of at least one device on each input and output circuit to verify critical system functions such as notification appliances, control functions, and off-premises reporting.

3.6 FINAL ACCEPTANCE TEST

- A. This test is required for issuance of the Certificate of Occupancy by the Fire Department. The Electrical Trade Contractor shall submit to the Fire Department the following documentation prior to requesting the final fire alarm system acceptance test:
1. Affidavit from the fire alarm system designer letter certifying the system has been installed according to plans and specifications and the system is 100% operational and ready for the final testing.
 2. Affidavit from the Electrical Trade Contractor letter certifying the fire alarm system has been installed according to the plans and specifications and is ready for final testing.
 3. Fire alarm manufacturer completed and signed NFPA Record of Completion form.
 4. Copy of the approved Fire Alarm Narrative, Matrix and English language device list.
 5. Copy of the fire alarm manufacturer's program notes and approved shop drawings.
 6. Copy of the stamped fire alarm drawings (as-built drawings if available).
- B. The Contractor shall schedule the final fire alarm test with the Fire Department, the Owner and other required participants.
- C. Required participants at the final acceptance test to include:
1. Fire Department
 2. General Contractor's site Superintendent
 3. Electrical Trade Contractor
 4. Owner's Representative
 5. If the final acceptance fire alarm test is successful, the Fire Department will issue a letter of acceptance. If the fire alarm test is not successful, the Contractor shall immediately provide the required changes and reschedule the fire alarm test.

3.7 COMMISSIONING

- A. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup checks according to the approved manufacturer's written instructions.

3.8 TRAINING AND SERVICE

- A. Comply with Section 26 00 01.
- B. Conduct two 4-hour training sessions. Train the Owner's maintenance personnel on procedures and schedules related to start up and shutdown, troubleshooting, servicing, and preventive maintenance.
- C. Training shall include fire department personnel.

End of Section

Section 31 20 00
EARTH MOVING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 00 and 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 SPECIAL INSTRUCTIONS

- A. The Contractor shall become familiar with other Sections of the Specifications to determine the type and extent of work there under which affects the work of this section whether or not such work is specifically mentioned.

1.3 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, services, and equipment, including all items incidental thereto, necessary to complete the work as specified in this Section and as shown in the drawings, including but not limited to the following:
 - 1. Control of surface water runoff, dust control and clean up during construction.
 - 2. Excavating all types of materials to limits indicated or required, including soil, rock, and other materials for new, below-grade construction and other site improvements as shown on the Drawings. All topsoil, subsoil, root balls, organic soil, existing fill, and other deleterious matter should be removed as required. The existing fill shall be improved under the subbase of paved areas.
 - 3. Excavation, covering, and backfilling of onsite soils, as required during construction.
 - 4. Coordination of all disposal activities as required to complete the work described in this Section and as required/detailed in the contract document. The site contractor shall be responsible for the cost of legal disposal, off-site, including permitting and/or fees, of all unsuitable or surplus excavated and or stockpiled materials.
 - 5. Coordination of material testing shall be the responsibility of the Contractor as outlined under testing requirements. All imported material tested shall be under ASTM D442 and shall be paid for by the Contractor.
 - 6. Furnishing, from an approved borrow source or processing material onsite, fill or backfill materials for placement and compaction on site as required to complete the work of this section.
 - 7. Furnishing and installing shoring, sheeting, and support of excavations.
 - 8. Dewater excavations as required
 - 9. Proof rolling trenches and excavations.
 - 10. Excavation, bedding, backfill and compaction for:
 - a. Building footings, slabs, walls, pads, bases, sidewalks, etc.
 - b. All pads and items indicated on the drawings.
 - c. Parking areas, handicap parking areas, ramps, curb cuts, etc.
 - d. All other work indicated on the drawings requiring excavation, backfill and/or compaction including but not limited to excavation and backfill for all trades inside the new building footprint.
 - 11. Coordinating with all trades for complete building systems as follows:

- a. Excavation, bedding, and backfill for all interior utilities, I, foundations, and work.
 - 12. Providing, operating, and maintaining all temporary shoring and/or hoisting equipment and provide, maintain, and remove all staging and scaffolding, and rigging required for all work.
 - 13. Contractor shall be responsible to contract with a utility location service to review the area of excavations and work, and r notifying all affected utility companies and Digsafe before starting work.
 - 14. Installing fencing and safety devices or controls as specified and as necessary.
 - 15. Sitework shall be scheduled not to affect the operations of the school or activities, the area of the work to be fenced off separating any school activity for any work done over the school session
 - 16. The elevations shown of the drawings are from record information, this contract includes in its scope verifying that all the grades are accurate, and the required accessible slopes will be provided. Submit a plan with the confirmed grades and any adjustments.
 - 17. The irrigation contractor provides their own excavations, coordinate all line locations with them in advance of this work, and cap off any lines required for the new work, provide pvc sleeves under concrete and pavements as required. Scope is on the drawings.
 - 18. Coordinate excavations and soil required by the landscape contractor, for the trees, plantings and grass. Scope is on the drawings.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1.

1.4 UNIT PRICES

- A. None
- B. Backfill: Soil material or Controlled Density Fill (CDF) used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- C. Base Course: Course placed between the subbase course and hot-mix asphalt paving and concrete paving.
- D. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- E. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Owner's Representative or the Designer. Authorized additional excavation and replacement material will be paid for a per change order.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Owner's Representative or the Designer.

Unauthorized excavation, as well as remedial work directed by Designer, shall be without additional compensation.

- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that cannot be removed by normal rock excavating equipment without systematic drilling, ram hammering, ripping, or blasting, when permitted.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, stairs, hard-scapes, exterior pads, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- L. Utilities: Onsite underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- M. Unsuitable Soils: Excavated soils that are determined by the Designer to not be reusable as fill or backfill on-site due to gradation, moisture content, and/or the presence of organic matter or other deleterious materials.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of plastic warning tape.
 - 2. Geotextile.
 - 3. Controlled Density Fill, including design mixture.
- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each onsite and borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 1557 for each onsite and borrow soil material proposed for fill and backfill.
- C. Submit a detailed construction sequence plan for project excavations indicating temporary stockpile areas, and the work in general.
- D. Backfill Materials: Submit a grain size analysis and distribution curve performed in accordance with ASTM D422 for each proposed backfill material for review by the Engineer. The sieve analysis will be based on a washed sieve test. Additional samples and analysis shall be submitted if a change in material occurs at the borrow source. Material that is processed by crushing of onsite materials shall be tested for compliance with the gradation requirements specified herein at the Contractor's expense.

- E. Submit the name of each material supplier and specific type and source of each material. Any change in source throughout the job requires approval of the Architect or Geotechnical Engineer. No fill material shall be delivered to the site or placed until the material has been approved.
- F. Support of Excavation: Contractor shall submit, for record, proposed excavation support systems (if required). The proposed lateral support systems shall be designed and stamped by a registered professional engineer licensed in the Commonwealth of Massachusetts. The design of excavation support and protection systems, the Contractor shall remain solely responsible for the adequacy and safety of materials and methods used in construction
- G. Pre-excavation Photographs and Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins. Maintain catalog of up-to-date photographs at the site.
- H. Plan to Maintain Safe Path of Travel: Submit plans for maintaining safe paths of travel for the general public during the entire project, including requirement for police details if necessary.
- I. Filter fabric: Submit the manufacturer's information and a one square foot representative sample of the filter fabric.
- J. Obtain required permits for discharge of dewatering effluent. Submit two copies of all permits obtained at least one week prior to system installation.

1.6 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this section to the extent referenced herein or if the item is indicated on the Drawings or specified without a detail.
 - 1. City of Worcester Standard Specifications and Details, latest edition.
 - 2. MassDOT Construction Standards, latest edition with amendments, hereinafter referred to as the "Construction Standards".
 - 3. ASTM: American Society for Testing and Materials.
 - 4. S.S.H.B. Standard Specifications for Highways and Bridges, the Commonwealth of Massachusetts, Department of Public Works, latest edition.

1.7 COORDINATION

- A. Prior to start of earthwork, the Contractor shall arrange an onsite meeting with the Architect, Engineer, the Geotechnical Engineer, and the testing agency for the purpose of establishing the Contractor's schedule of operations and scheduling observation and testing procedures and requirements as further described in Section 1.18.
- B. As construction proceeds, the Contractor shall be responsible for notifying the Geotechnical Engineer and the testing agency prior to the start of earthwork operations requiring observation and/or testing.
- C. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work, as necessary to ensure the steady progress of all work of the Contract.

1.8 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others except in accordance with the Construction Manager's project phasing requirements provided in Specification Section 01 12 00, or unless permitted in writing by the Owner's Representative and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify the Owner's Representative not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without the Owner's Representative's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
 - a. The Contractor shall notify "Dig Safe" at 1-888-DIG-SAFE prior to commencing any excavation work.
- B. Survey Work: Contractor shall engage a qualified professional to lay out the proposed work, and verify all the existing grades, , provide a plan and layout of the walks and drives showing that the layout based on the existing grades meets the standards and slopes required by the AAB, Submit layout for review under the submittal process.
- C. The Contractor shall not close or obstruct any street, sidewalk, or passageway without written permission from authorities having jurisdiction unless otherwise indicated on the Contract Drawings. Refer to the Temporary Traffic Control Plans included in the Contract Drawings related to the closure of Lake Street. The Contractor shall conduct the construction operations as to minimize interference with the use of roads, driveways, or other facilities near enough to the project to be affected by the work.
- D. The Contractor shall provide police details if working in roadways, as required by local jurisdictional authorities. The Contractor shall pay for any and all police details.

1.9 SUBSURFACE CONDITIONS

- A. The existing school drawings are available for review. The original testing lab/engineer reviewed the records, and advised that the subgrade conditions were adequate for the vestibule addition, and is contracted by the City to review prior to foundations installation, as coordinated
- B. The Contractor shall visit the site prior to submitting a bid to become familiar with the extent of the work to be done under this Contract. The Contractor shall be responsible for determining the quantities of earth materials necessary to complete the work under this Section.
- C. The Owner assumes no responsibility for the Contractor's failure to make his own site investigation and makes no representation of subsurface conditions. Failure by the Contractor to be aware of existing site conditions shall not be cause for additional cost to the Owner. Information on subsurface conditions is made available for the convenience of the Bidders. The Owner does not present the information to the Contractor as either an accurate or a comprehensive indication of subsurface conditions. Bidders are invited to review the information to

apprise themselves of the information available, and also to make additional investigations at their own expense.

- D. No claim for extra cost or extension of time resulting from reliance by the Contractor on information presented herein shall be allowed, except as provided in the Contract Documents.

1.10 REUSE OF ONSITE MATERIALS

- A. The Contractor may re-use onsite excavated soils that meet the gradation requirements of materials specified herein, at locations where specified.
- B. Excavated on-site soils which are suitable for re-use at the time of excavation but become frozen or too wet for re-use due to poor material handling practices shall be disposed of off-site and replaced as necessary at no additional cost to the Owner.

1.11 EXCAVATION

- A. The Contractor shall perform all excavations and of whatever materials encountered, in a manner as required to allow for placing of temporary earth support, forms, installation of pipe and other work, and to permit access for the purpose of observing the work. Excavations shall be to such widths as will give suitable space for the required work. Bottoms of trenches and excavations shall be protected from frost and shall be firm, dry and in an acceptable condition to receive the work. Work shall not be placed on frozen surfaces nor shall work be placed on wet or unstable surfaces.
- B. All excavations made in open cut will be controlled by the conditions existing at that location. In no case shall earth be excavated or disturbed by machinery so near to the finished subgrade for structures and pipelines as to result in the disturbance of the earth below the subgrade. The final excavation to subgrade should be accomplished with a smooth faced bucket or by hand.

1.12 EXCAVATION SUPPORT AND PROTECTION

- A. The Contractor shall furnish, install, monitor and maintain excavation support and protection systems (sheeting, shoring, and bracing) at locations necessary to support the sides of excavations and resist soil and hydrostatic pressure and superimposed and construction loads; to prevent danger to persons or damage to adjacent pavements, facilities, utilities, or structures; to prevent injurious caving or erosion or the loss of ground; and to maintain pedestrian and vehicular traffic as required by the Contract Documents, the Contractor's sequence of construction, and as directed by the Owner's Representative.
- B. The Contractor shall comply with all federal, state, and local safety regulations, and requirements.

1.13 DEWATERING

- A. The Contractor shall provide, at his own expense, adequate dewatering of excavations if required
- B. The Contractor shall control the grading in the areas surrounding all excavations so that the surface of the ground will be properly sloped to prevent water from running into the excavated area. Where required, temporary ditches shall be provided to control drainage. Upon completion of the work and when directed, all areas shall be restored by the Contractor in a satisfactory manner and as directed.

- C. The Contractor shall obtain and maintain all required local, state, and federal permits necessary for construction dewatering for the duration of dewatering activities including all chemical testing required for disposal and discharge of dewatering effluent. The Contractor shall be responsible for treatment of water, if necessary, to meet minimum discharge criteria specified in the permits.

1.14 QUALITY CONTROL

- A. The Owner may retain and pay for the services of an independent testing agency to monitor backfill operations and to perform field density tests, and a Geotechnical Engineer to periodically observe the earthwork operations and observe the preparation of the subgrade for building footings, slabs,
- B. If fill soils are not obtained from a commercial gravel pit, the Contractor shall provide certified analytical testing of offsite backfill to demonstrate that the soil does not exceed the limitations for MCP reference/reportable concentrations. Analyses shall include RCRA-8 metals, Extractable and Volatile Petroleum Hydrocarbons (EPH/VPH), and Volatile Organic Compounds (by EPA Method 8260B/5035). No testing will be required of imported fill soils obtained from a commercial gravel pit, provided the soils are free of odors, discoloration, staining or other conditions indicative of contamination, in the opinion of the Geotechnical Engineer and/or the Designer.
- C. Costs related to retesting due to unacceptable quality of work and failures discovered by testing shall be paid for by the Contractor at no additional expense to Owner, and the costs thereof will be deducted by the Owner from the Contract Sum.
- D. Tests and analysis of soil material will be performed in accordance with ASTM D422, ASTM D1557, ASTM D2922, ASTM D3017 and ASTM D4318.
- E. If tests indicate materials do not meet specified requirements, the Contractor shall identify an alternative borrow source, test the new material, and submit results to the Designer at no cost to Owner.

1.15 EXCAVATION CLASIFICATIONS

- A. Additional Excavation:
 - 1. When excavation has reached required subgrade elevations, notify the Owner's Representative who will review subgrade conditions.
 - 2. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace excavated material as directed.
 - 3. Removal of unsuitable material beyond the grades and lines shown on the Drawings and specified herein and its replacement as directed will be paid on the basis of contract conditions relative to changes in work or as provided for under the unit rates for this classification.
- B. Unit Prices
 - 1. Unit prices: NONE

1.16 LAYOUT AND GRADES

- A. The Contractor is responsible for establishing vertical and horizontal control for the work and shall establish permanent benchmarks and replace as directed any, which are destroyed or

disturbed. The Contractor shall maintain sufficient reference points at all times during construction to properly perform site grading. The existing survey benchmark shall be protected throughout the construction project.

- B. Finished grades, contours, and elevations indicated on the Drawings describe final surface elevation for completed construction. The words "finished grade" as used herein shall mean final grade elevations indicated on the Drawings. Spot elevations shall govern over proposed contours. Where not otherwise indicated, project site areas shall be given uniform slope between points and existing established grades.

1.17 QUALITY ASSURANCE

- A. Pre-Excavation Conference: Conduct conference at Project Site to comply with requirement in Section "Project Coordination".
 - 1. Before commencing earthwork, meet with representatives of the governing authorities, Owner, Architect, Civil Engineer, Geotechnical Engineer, consultants, independent testing agency, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.
- B. Testing: Compaction tests will be required by the Owner and will be paid for by the owner. No specific testing schedule has been established at this time. If tests indicate that density requirement have not been achieved, the contractor will continue compacting the tested material. All retesting in these areas shall be paid for by the contractor.
- C. Density and Compaction Testing: The contractor is responsible to schedule compaction tests and allow adequate time for the proper execution of said tests.
- D. The Owner's Testing Agency will perform water content, gradation tests on onsite and processed materials, and compaction tests at a frequency and at locations as required. The results of these tests will be submitted to the Architect, and a copy submitted to the Contractor, on a timely basis so that the Contractor can take such action as is required to remedy the indicated deficiencies.
- E. Field inspection and testing may be performed by a Geotechnical or Civil Engineer at the Owner's expense to supplement the Contractor's Quality Control testing. Classification of all materials will be made by the Geotechnical Engineer whose decision shall be final and binding on the Contractor.
- F. The Contractor shall be responsible for managing and tracking all materials excavated and placed in stockpiles for testing.
- G. Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.
- H. The Contractor is responsible for the adequacy of the dewatering systems.
 - 1. The dewatering systems shall be capable of effectively reducing the hydrostatic pressure and lowering the groundwater levels to a minimum of 2 feet below excavation bottom unless otherwise directed by the Designer so that all excavation bottoms are firm and dry.

2. The dewatering system shall be capable of maintaining a dry and stable subgrade until the structures, pipes, and appurtenance to be built therein have been completed to the extent that they will not be floated or otherwise damaged.
 3. The dewatering system and excavation support shall be designed so that the lowering of the groundwater level outside the excavation does not adversely affect adjacent structures, utilities, or other improvements.
- I. The Owner will perform in place density tests in accordance with ASTM D2922 or D3017 as the Work progresses, to determine the degree of compaction. Any corrective work required as a result of such tests, such as additional compaction, or a decrease in the thickness of layers, shall be performed by the Contractor at no additional expense to Owner. In place density testing shall be made at the Contractor's expense by a qualified geotechnical testing laboratory.
 - J. The Designer's duties do not include the supervision or direction of the actual work by the Contractor, his employees or agents. Neither the presence of the Designer nor any observation and testing by the Geotechnical Engineer shall excuse the Contractor from defects discovered in his Work at that time or subsequent to the testing.
 - K. Contractor shall assist the Owner's Testing Laboratory in performing in-place density testing at a minimum frequency of one test per lift but no less than one test per 200 cubic yards of material placed in any one lift. Compaction testing will be performed in accordance with ASTM D1557, D2922, and D3017.
 - L. Subgrades shall be approved for compactness and material composition prior to placing subsequent lifts. If inspections indicate Work does not meet specified requirements, the work shall be removed, replaced, and compacted at no additional cost to Owner.

1.18 REGULATORY REQUIREMENTS

- A. Comply with the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to the Massachusetts Department of Labor and Industries, Division of Industrial Safety "Rules and Regulations for the Prevention of Accidents in Construction Operations (454 CMR 10.0 et seq.). Contractors shall be familiar with the requirements of these regulations.
 1. All excavations shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926.650 Subpart P), State, and local requirements. Where conflict between OSHA, State, and local regulations exist, the most stringent requirements shall apply.
- B. Comply with governing EPA notification regulations before, during, and upon completion of dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Comply with all rules, regulations, laws, and ordinances of the municipality, the Commonwealth of Massachusetts, and other authorities having jurisdiction over the project site or work. All labor, materials, equipment, and services necessary to make the work comply with requirements shall be provided by the Contractor without additional cost to the Owner.
- D. The Contractor shall obtain and pay for all permits and licenses required to complete the work specified herein and indicated on the Contract Drawings.
- E. The Contractor shall not close or obstruct any street, sidewalk, or passageway without written permission from authorities having jurisdiction unless otherwise indicated on the

Contract Drawings. The Contractor shall conduct his operations as to minimize interference with the use of roads, driveways, or other facilities near enough to the work to be affected by the work.

- F. The Contractor shall notify "Dig Safe" at 1-888-DIG-SAFE prior to commencing any excavation work.
- G. The Contractor shall provide police details when working in roadways as required by local jurisdictional authorities. The Contractor shall pay for any and all details.

1.19 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.
- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.20 PROTECTION OF EXISTING CONDITIONS

- A. All work shall be executed in such a manner as to prevent any damage to existing buildings, streets, curbs, paving, service utility lines, structures and adjoining property.
- B. Locate and mark underground utilities to remain in service before beginning the work. Protect all existing utilities to remain in service during operations. Do not interrupt existing utilities except when authorized in writing by authorities having jurisdiction unless otherwise indicated on the Contract Drawings.
- C. When an active utility line is exposed during construction its location and elevation shall be recorded on the Record Drawings by the Contractor and both the Engineer and the Utility Owner shall be notified in writing. Active utilities existing on the site shall be carefully protected from damage or relocated as required by the work.
- D. Inactive or abandoned utilities encountered during construction operations shall be removed, plugged, capped or filled. The location of such utilities shall be recorded on the Record Drawings.
- E. Provide barricades, fences, lights, signs, and all other safety devices required to protect the public against injury.
- F. In case of any damage or injury caused in the performance of the work the Contractor shall, at his own expense make good such damage or injury to the satisfaction of, and without cost to, the Owner. Existing streets, sidewalks and curbs damaged during the project work shall be repaired or replaced to their condition prior to commencement of Earth Moving operations.
- G. Acceptance of any of the Contractor's plans, design calculations and methods of construction by the Designer shall not relieve the Contractor of the responsibility for the adequacy of the excavation lateral support system; preventing damage to existing or new structures,

utilities and streets adjacent to excavations; the safety of persons working within excavated areas and the public at large; and excavation dewatering.

1.21 DISPOSAL

- A. All excess and unsuitable excavated soil shall be removed from the site and legally disposed offsite by the Contractor at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Fill material shall be free from frost/ice and snow, rocks with a diameter greater than 2/3 of the loose lift thickness as specified herein, and foreign matter, such as construction debris, asphalt, trash, wood, roots, leaves, sod, and organic matter. All fill material shall be maintained by the contractor at suitable moisture contents for proper placement and compaction as specified herein.
- C. Offsite pulverized pavement and crushed concrete are not acceptable for fill material. On-site pulverized pavement and crushed concrete that meets one of the gradation requirements specified herein can be used as backfill.
- D. Fill material shall be obtained from required onsite cut to the extent suitable material is available, and off-site to the extent suitable material is not available from onsite cuts.
- E. Fill material below the roadway pavement section (pavement and gravel borrow material) shall be sieved and the sieve analysis reviewed by the design team prior to installation. Placement of the material shall be in six (6) inch lifts and compacted to 95% relative density.
- F. Onsite material for use in compacted fill shall be natural inorganic granular soil taken from areas of cut after removal of pavement, topsoil, or other unsuitable materials. Onsite materials should be tested for compliance with the specifications before placement.
- G. Ordinary Fill shall be well-graded, natural inorganic soil with a plasticity index of less than 6 and with no stone greater than 6 inches maximum dimension. The materials shall be free of trash, ice, snow, tree stumps, roots, and other organic and deleterious materials. It shall be free of materials subject to decay, or other materials that will corrode piping or metals. Soil finer than the No. 200 sieve shall be non-plastic Ordinary Fill shall have a maximum dry density from a laboratory compaction tests of not less than 110 pounds per cubic foot. It shall be of such a nature and character that it can be compacted to the specified densities. Topsoil shall not be considered Ordinary Fill. Existing available fill materials from onsite excavations may be reused as Ordinary Fill if it meets the above requirements and the gradation requirements. It shall be graded within the following limits:

<u>U. S. Standard Sieve Size</u>	<u>Percent Finer by Weight</u>
6 inch	100
1 inch	50-100
No. 4	20-100
No. 20	10-70
No. 60	5-45

No. 200

0-20

- H. Gravel Borrow: Gravel borrow shall meet the requirements of MassDOT M1.03.0, Type B. It shall be an inert, hard, durable sand and gravel or stone soil obtained from an offsite commercial source. It shall be free of ice, snow, roots, sod, rubbish, oil, hazardous material, and other deleterious or organic matter. It shall be graded within the following limits:

<u>U. S. Standard Sieve Size</u>	<u>Percent Finer by Weight</u>
3 inch	100
½ inch	50-85
No. 4	40-75
No. 50	8-28
No. 200	0-10*
*7% max. under sidewalks	

- I. Structural Fill shall consist of inert, hard, durable sand and gravel, free from ice and snow, organic matter, clay, surface coatings, and deleterious materials, and shall have a plasticity index of less than 6. Structural fill shall be placed in 9-inch loose lifts and shall conform to the following gradation requirements:

<u>U. S. Standard Sieve Size</u>	<u>Percent Finer by Weight</u>
3 inches	100
1 ½ inches	80-100
½ inches	50-100
No. 4	30-85
No. 20	15-60
No. 60	5-35
No. 200	0-10*
*7% max. under sidewalks	

The fines content of imported Structural Fill shall be less than 10 percent as shown in the table above. The fines content of Structural Fill processed onsite shall be less than 12 percent, except in the top 12 inches immediately beneath the slab or the under-slab drainage system where it shall be less than 10 percent.

- J. Select Structural Fill shall meet the requirements of Structural Fill except that the percent passing the No. 200 sieve shall be less than 7 percent.
- K. ¾" Crushed Stone: ¾" crushed stone shall meet the requirements of MassDOT M2.01.4. It shall consist of durable crushed rock or crushed gravel stone, free of ice, snow, sand, silt, clay, loam, shale, or other deleterious or organic matter. It shall be graded within the following limits:

<u>U. S. Standard Sieve Size</u>	<u>Percent Finer by Weight</u>
1 inch	100
¾ inch	90-100
½ inch	10-50
3/8 inch	0-20
No. 4	0-5

- L. 1-1/2" Crushed Stone: 1-1/2" crushed stone shall meet the requirements of MassDOT M2.01.1. It shall consist of durable crushed rock or crushed gravel stone, free of ice, snow,

sand, silt, clay, loam, shale, or other deleterious or organic matter. It shall be graded within the following limits:

<u>U. S. Standard Sieve Size</u>	<u>Percent Finer by Weight</u>
2 inch	100
1-1/2 inch	95-100
1 inch	35-70
3/4 inch	0-25

- M. Crushed stone required around utility piping, detention/recharge systems, other stormwater infrastructure, underslab drain piping and radon mitigation piping within the building, and building perimeter drain piping shall meet the gradation requirements of Sections K and L above. Onsite material may be processed and crushed to meet those requirements.
- N. Dense Graded Crushed Stone: Dense graded crushed stone shall meet the requirements of MassDOT M2.01.7. It shall consist of a mixture of crusher-run aggregate of crushed stone mixed with natural sand and gravel soil obtained from an offsite commercial source. It shall be free of ice, snow, roots, sod, rubbish, soil, hazardous material, and other deleterious or organic matter. It shall be graded within the following limits:

<u>U. S. Standard Sieve Size</u>	<u>Percent Finer by Weight</u>
2-inch	100
1-1/2 inch	70-100
3/4 inch	50-85
No. 4	30-55
No. 40	8-24
No. 200	3-10*
*7% max. under sidewalks	

- O. Sand: Sand shall meet the requirements of MassDOT M1.04.1. It shall consist of clean inert, hard, durable grains of quartz or other hard durable rock, free from clay, organics, surface coatings, or other deleterious or organic matter. It shall be graded within the following limits:

<u>U. S. Standard Sieve Size</u>	<u>Percent Finer by Weight</u>
1/2 inch	100
3/8 inch	85-100
No. 4	60-100
No. 16	35-80
No. 50	10-55
No. 100	2-10

- P. Dumped Riprap: Stone used for dumped riprap shall be hard, durable, angular in shape stones, resistant to weathering and shall meet the gradation requirement specified. Neither breadth nor thickness of a single stone should be less than one-third its length. Rounded stone or boulders will not be accepted unless authorized by the Engineer. Each load of riprap shall be reasonably well graded from the smallest to the maximum size specified. Stone shall be free from overburden, spoil, shale, and organic material and shall conform to the following gradation with no more than 5% by weight passing a 3-inch sieve:

<u>Weight of Stone (lbs.)</u>	<u>Percent Finer by Weight</u>
400	100

300	50
200	30
25	10

- Q. Stone for Pipe Ends: Stone for pipe ends shall be sound, curable rock which is angular in shape. Rounded stones, boulders, sandstone or similar stone or relatively thin slabs will not be acceptable. Each stone shall weigh not less than 50 pounds not more than 125 pounds and at least 75% of the volume shall consist of stones weighing not less than 75 pounds each. The remainder of the stones shall be so graded that when placed with the larger stones the entire mass will be compact.
- R. Controlled Density Fill (CDF) shall be a cement concrete backfill material that flows like a liquid, supports like a solid when cured, and levels without tamping or vibrating to reach 100 percent compaction. CDF shall meet the requirements of MassDOT Specifications M4.08.00 for Type 1E (Very Flowable, Excavatable) or type 2E (Flowable, Excavatable) CDF. The mix formulation will be submitted to the Designer for review prior to placement of the material in the project.
- S. Reuse of Excavated Rock: Excavated onsite rock materials processed by the Contractor meeting the gradation limits for $\frac{3}{4}$ " Crushed Stone, 1- $\frac{1}{2}$ " Crushed Stone, Dense Graded Crushed Stone, and Stone for Pipe Ends contained herein may be segregated and reused as approved by the Owner.

2.2 UNSUITABLE MATERIALS

- A. Unsuitable material shall be material having at least one of the following properties:
1. Material with a maximum unit dry weight per cubic foot less than 100 lbs., as determined by ASTM D1557.
 2. Material containing greater than 3% organic matter by weight, topsoil, organic silt, peat, construction debris, roots and stumps.
 3. Material which has a Liquid Limit greater than 55 when tested in accordance with ASTM D 4318.
 4. Materials that do not meet one of the gradation specifications in this section.
 5. Material classified as unsuitable by the Geotechnical Engineer.
 6. Unsuitable material shall be disposed of off-site as directed by the Architect.
 7. Materials that are unstable as a result of inadequate construction dewatering, excessive subgrade disturbance, or other means and methods used by the Contractor are not considered unsuitable materials.
 8. Onsite processed material that is not well graded and that exhibits honeycombing during placement and compaction.

2.3 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 2; AASHTO M 288.
 2. Elongation: 50% minimum; ASTM D 4632
 3. Grab Tensile Strength: 160 lbs; ASTM D 4632.
 4. Trapezoid Tear Strength: 60 lbs; ASTM D 4533.
 5. CBR Puncture Strength: 410 lbs; ASTM D 6241

6. Apparent Opening Size: No. 70 sieve maximum; ASTM D 4751.
 7. Permittivity: 1.50 sec-1 minimum; ASTM D 4491
 8. UV Stability: 70% after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 1; AASHTO M 288.
 2. Elongation: 15% maximum; ASTM D 4632
 3. Grab Tensile Strength: 315 lbs; ASTM D 4632.
 4. Trapezoidal Tear Strength: 120 lbs; ASTM D 4533.
 5. Puncture Strength: 1,000 lbs; ASTM D 6241.
 6. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
 7. Permittivity: 0.05 sec-1 minimum; ASTM D 4491.
 8. UV Stability: 70% after 500 hours' exposure; ASTM D 4355.

2.4 ACCESSORIES

- A. Detectable Underground Warning Tapes: Acid and alkali-resistant polyethylene plastic film warning tape, 6-inches wide by 4-mils minimum thickness, with continuously printed caption in black letters "CAUTION - xxxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5-feet deep.

Color	Utility
Safety Red	Electric
High Visibility Safety Yellow	Gas, Oil, Steam
Safety Alert Orange	Telephone, Communications, Cable Television
Safety Precaution Blue	Water System, Irrigation
Safety Green	Sanitary Sewer, Storm Sewer
White	Proposed Excavation

2.5 USES OF MATERIALS

- A. Fill materials listed in Paragraph 2.1 above shall be utilized as follows and as otherwise indicated on the Drawings, specified or directed.
- B. Gravel Borrow:
1. As fill (base course) below the Dense Graded Crushed Stone placed immediately beneath concrete and asphalt pavements as shown on the Contract Drawings.
 2. Bedding for ductile iron drain, water, and sewer piping.
- C. Dense Graded Crushed Stone:
1. As base course soils immediately below concrete and asphalt pavement as shown on the Contract Drawings.

- D. $\frac{3}{4}$ " and 1- $\frac{1}{2}$ " Crushed Stone:
 - 1. Base for drain manholes, catch basins, sewer manholes, and utility structures.
 - 2. Bedding for drain pipe and sewer pipe.
 - 3. Around perforated drain lines.
 - 4. To stabilize wet subgrade conditions.
 - 5. Elsewhere as shown on the Drawings or specified herein.
 - 6. To aid in dewatering.
- E. Sand:
 - 1. Bedding for drain, water, sewer, and other utility piping.
 - 2. Elsewhere as shown on the Drawings or specified herein.
- F. Structural Fill
 - 1. Within the proposed building footprint.
 - 2. Under site retaining walls.
 - 3. Backfill with the 3 feet of the back face of site retaining walls.
- G. Ordinary Fill:
 - 1. For general site fill outside of the proposed building footprint, concrete, and below sub-base layer of asphalt and concrete pavement areas.
 - 2. Trench backfill material.
 - 3. In fill slopes.
 - 4. Elsewhere as shown on the Drawings or specified herein.
- H. Geotextiles:
 - 1. Subsurface non-woven Drainage Geotextile shall fully wrap 3-4-inch Crushed Stone.
 - 2. Use to prevent soil intrusion into drains and/or to assist in stabilizing soil subgrades prior to placement of fill materials.
 - 3. Subsurface woven separation geotextile as separation material between crushed stone and gravel borrow base materials below concrete and asphalt pavement as shown on the Contract Drawings.
 - 4. Where indicated or shown in the Contract Drawings.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The Contract Drawings indicate the proposed finish alignment, elevation, and grade of the work. Establish the line and grade in close conformity with the Contract Drawings. The Owner's Representative, however, may make minor adjustments in the field as necessary due to conditions encountered.
- B. The Contractor is responsible for establishing construction phasing, means, and methods and interim grading and temporary conditions required to attain the finish product required by the Contract Documents. The Contractor is responsible for all construction, protection, movement, and maintenance of stockpiles. Establish and maintain suitable benchmarks and grade control to accurately perform the work.

- C. Protect all benchmarks, monuments, and property boundary pins. Replace if destroyed by contractor's operation.
- D. All excavation shall be performed in the dry. Excavation and dewatering shall be accomplished by methods, which preserve the undisturbed state of the subgrade soils.
- E. No excavation will be permitted below a line drawn downwards at 2 horizontal to 1 vertical from the underside of the closest edge of any in-place footing or utility at a higher elevation without providing adequate sheeting and bracing to prevent movement of the in-place footing or utility.
- F. When excavations have reached the prescribed depths, the condition of the bottom of the trench or hole shall be inspected by the Owner's Representative. After inspection, the Contractor will receive approval to proceed if conditions meet project requirements.
- G. No excavated material shall be deposited or stockpiled at any time to endanger portions of new or existing structures, either by direct pressure or indirectly by overloading banks contiguous to the operation. Material, if stockpiled, shall be stored so as not to interfere with the established sequence of the construction. If there is not sufficient area available for stockpiling within the limits of the project, the Contractor will be required to furnish his own area for stockpiling.
- H. When the plans require excavation in areas in close proximity to existing buildings, roads, structures and utilities it shall be the responsibility of the Contractor at his expense to use satisfactory means and methods to protect and maintain the stability of such roads, and structures located immediately adjacent to but outside the limits of excavations.
- I. Temporary ditches shall be made as needed to drain off surface water to avoid damaged to areas of cut or fill. Such ditches shall be maintained as required for efficient operations, at no additional cost to the Owner.
- J. Provide shoring, sheeting, and/or bracing at excavations, as required, to assure complete safety against collapse of earth at the side of excavations. Provide shoring of public utility lines where exposed in the excavations in accordance with rules and regulations of the local authorities, as no additional cost to the Owner.
- K. Cut and remove trees, remove stumps and brush. Legally dispose of off-site. Wood wastes may be chipped and shredded onsite and reused onsite with permission of the Architect.
- L. Strip topsoil to its full depth within the Contract limits. Remove the subsoil, roots, stumps and other deleterious matter entirely under footings, slabs, and paved areas. Where the subsoil extends to depths greater than 18 inches beneath the bottom of the proposed pavement, the subsoil deeper than 18 inches beneath the bottom of the proposed pavement may remain in place provided that it is improved in accordance with the recommendations in Section 4.1. The removal of the topsoil and subsoil should laterally extend 5 feet outside the limits of improvement areas.
- M. Sump pumps shall be surrounded by suitable filter media to minimize the fines removed during pumping. Pumped groundwater and surface water runoff shall be pumped to a settling basin to remove suspended solids prior to discharge.

- N. Discharge of pumped water, either surface water runoff or groundwater, shall be in compliance with discharge criteria contained in permits issued by governing agencies, and all legal requirements and regulations. All permits shall be obtained by the Contractor.
- O. The crushed stone placed in the sump pump pits should be wrapped in a geotextile fabric. Where a geotextile fabric is not used, the crushed stone should be entirely removed after the sump pump is no longer in use and the sump pump pit should be restored with suitable backfill.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect and maintain erosion and sedimentation controls, during earthwork operations.
- C. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.3 DEWATERING

- A. Provide Dewatering as required to maintain dry excavations.
- B. Prevent surface water and groundwater from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system to keep subgrades dry and convey groundwater away from excavations. Maintain until dewatering is no longer required.
 - 3. Where soil has been softened or eroded by flooding, equipment, traffic or placement of fill or concrete during unfavorable weather or such other conditions, it shall be removed and replaced by the Contractor with suitable material and at the Contractor's expense. The necessity and extent of such removals shall be determined by the Designer.
- D. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
- E. Monitor dewatering systems continuously.
- F. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 1. Space well points or wells at intervals required to provide sufficient dewatering.
 - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- G. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and

sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

- H. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.4 EXCAVATION SUPPORT AND PROTECTION

- A. Work shall not be started until all materials and equipment necessary for the construction are either on the site of the work or satisfactorily available for immediate use as required.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
1. Shore, support and protect utilities encountered.
- C. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Owner's Representative and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- D. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces or installation of improvements is not impeded.
- E. The excavation support and protection systems shall be securely and satisfactorily braced to withstand all pressures to which it may be subjected and be sufficiently tight to minimize lowering of the groundwater level outside the excavation.
- F. Monitor, including by means of DMPs, excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- G. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.
- H. Responsibility for the satisfactory construction and maintenance of the excavation support system, complete in place, shall rest with the Contractor. Any work done, including incidental construction, which is not acceptable for the intended purpose shall be either repaired or removed and reconstructed by the Contractor at his expense.
- I. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bare soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlaying construction and abandon remainder.
 2. Fill voids immediately with approved backfill compacted to density specified herein.
 3. Repair or replace, as approved by Owner's Representative, adjacent work damaged or displaced by the installation, performance, and removal of the excavation support and protection systems.

3.5 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms.
 - b. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - c. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
- B. Provide sheeting, shoring and bracing to complete and protect all excavated areas, are required for safety and compliance with OSHA. Cost for sheeting, shoring and bracing shall be included as a part of the contract price for completing the work and Owner shall make no separate payment for this work.
- C. Perform excavation work in accordance with all applicable Federal, State, and Local regulations regarding safe excavation work.
- D. Excavation in the area of existing utilities. Expose utilities by hand or other excavation methods that will prevent damage. Required excavation near electric, gas, water lines, and fiber-optic telecommunication lines shall be hand dug within 3 feet of the lines.
- E. Do not excavate to full depths when freezing temperatures may be expected unless subgrades are protected from freezing.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks, pavements and utilities to indicated lines, cross sections, elevations, and subgrades.

3.7 SUBGRADE PREPARATION AND INSPECTION

- A. The subgrade shall be shaped to line, grade, and cross section, and be thoroughly compacted in accordance with the requirements of paragraph 3.03. This operation shall include any required reshaping and wetting to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material from excavation or borrow. The resulting area, and all other low sections, holes, or depressions shall be brought to the required grade with accepted material and the entire subgrade shaped to line, grade and cross section and thoroughly compacted. The geotechnical engineer may at his discretion request proof-rolling using a loaded rubber tire truck.
- B. Before surface or base materials are spread, the subgrade shall be shaped to an accurate and true surface conforming to the line and grades indicated on the Contract Drawings. All surface irregularities shall be filled with suitable material or removed and such areas re-compact until the surface is properly shaped and properly compacted. A tolerance of 3/8-inch in paved areas and 1/2-inch in non-paved areas above or below the finished subgrade elevation will be allowed provided that this dimension above or below grade is not maintained for a distance longer than 50-feet and that the required crown is maintained in the

subgrade. Any portion, which is not accessible to a roller, shall be thoroughly compacted by other mechanical or manual methods.

- C. Notify the Owner's Representative when excavations have reached required subgrade.
- D. If the Owner's Representative, Geotechnical Engineer, and/or the Designer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- E. Proof-roll granular subgrade below structures and pavements with heavy vibrating drum roller to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with approved equipment weighing not less than 15 tons.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Designer, and replace with compacted backfill or fill as directed.
- F. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Geotechnical Engineer and/or the Designer, without additional compensation.
- G. Protect all subgrades from disturbance.
 - 1. Place Gravel Borrow or Crushed Stone wrapped in non-woven geotextile over clayey, silty or wet footing subgrades. Fill shall not be placed in standing water.
 - 2. Grade around prepared subgrade areas to direct stormwater runoff away from the work area.
 - 3. Protect subgrades from frost at all times during construction. Fill should not be placed over frozen soil.

3.8 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavations under site improvement construction or utility pipe as directed by Designer. Lean concrete fill, with 28-day compressive strength of 2500 psi may be used when approved by Designer.

3.9 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials (from offsite sources) and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
 - 2. Stockpile soil materials in a location, acceptable to the Owner's Representative, that will preclude having to relocate stockpiled soil materials that would otherwise delay or impact the Work.

3.10 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for Record Documents.
 3. Testing and inspecting underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
 6. Removing temporary shoring and bracing, and sheeting.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on previously placed and compacted fill and/or subgrades free of mud, frost, snow, or ice.
- C. Excavated onsite natural soils may be used as Ordinary Fill, provided the material can be placed and compacted as required herein and at the approval of the Designer.
- D. The Contractor shall not commence backfilling operations without approval of the Owner's Representative and/or the Designer.
- E. The Contractor shall maintain a dry and firm subgrade throughout construction. Dewatering shall be performed as needed at the Contractor's expense.
- F. The Contractor shall strip the existing subgrade of any vegetation, topsoil, organics, debris, or other unsuitable materials. The subgrade shall be proof compacted using a vibratory roller to treat any loose or disturbed areas and to provide a dense uniform surface.
- G. After the subgrade has been prepared, fill material shall be placed and built-up in successive layers until the required elevations are reached. No fill shall be placed on a frozen surface, nor shall snow, ice, or other frozen materials be included in fill. Wet materials containing moisture in excess of the amount necessary for satisfactory placement or compaction shall not be used.
- H. All fills shall be placed in horizontal layers. Fill shall not be placed following the natural contours of the ground. Fill shall be placed starting in the lowest areas working up to finish grades in horizontal layers in the manner specified herein. Each layer of fill shall be benched into the existing slope in order to avoid the formation of a shear plane.
- I. All fill shall be brought up in essentially level lifts and shall be placed in levels by standard methods. Layers of fill outside of utility trenches shall not exceed nine (9) inches in uncompacted thickness before compaction, unless otherwise specified, or as required for proper subgrade stabilization.
- J. Filling operations shall continue until the fill has been brought up to the finished slopes, lines, and grades making proper allowances for thickness of the overlying topsoil.
- K. The entire surface of the work shall be maintained free from ruts and in the condition that will permit construction equipment to travel over any section readily. The top surface of each layer shall be made level or slightly sloped toward the center of the filled area.
- L. Backfilling shall not be performed when weather conditions or the conditions of the materials are such that, in the opinion of the Geotechnical Engineer or the Designer, work cannot be performed satisfactorily.
- M. Backfill Material: Unless otherwise specified or directed, material used for filling and backfilling shall meet the material requirements specified herein. In general, the material used

for backfilling utility trench excavations shall be material removed from the excavations provided that the reuse of these materials results in the required trench compaction and meets the requirements specified for Ordinary Fill. All backfill placed within the building limits shall be Structural Fill unless otherwise specified. In areas where the bottom of the excavation is in fine sand and silt, and is below the groundwater table, the first lift of backfill shall be 12 inches of 3/4-inch maximum crushed stone to provide a working mat and drainage layer. Place backfill to a maximum loose lift thickness of 12-inches. Maintain backfill material with a uniform moisture content, with no visible wet or dry streaking, between plus two percent and minus three percent of optimum moisture content. The final filled soil mass shall be as uniform as possible in lift thickness, moisture content, and effort required to compact soil mass.

3.11 BACKFILLING AGAINST STRUCTURES

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Backfilling against masonry or concrete shall not be done until permitted by the Owner's Representative. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking or other damage.
- C. As soon as practicable after the structures are structurally adequate and other necessary work has been satisfactorily completed and approved, special leakage tests of the structures shall be made by the Contractor, as required by the Owner's Representative. After the satisfactory completion of leakage tests and the satisfactory completion of any other required work in connection with the structures, the backfilling around the structures shall proceed using suitable and approved excavation material.
- D. Only hand-operated roller or plate compactors shall be used within a lateral distance of 5 feet of back of wall for walls less than 15 feet high and within 10 feet of back of wall for walls more than 15 feet high. The backfill material shall be compacted with a dynamic vibratory compactor weighing no more than 1000 pounds and imparting a minimum of no more than 8 kips of force to the subgrade.
- E. The best of the backfill material shall be used for backfilling within 2-feet of the structure. Just prior to placing backfill, the areas shall be cleaned of all excess construction material and debris and the bottom of excavations shall be in a thoroughly compacted condition.
- F. Symmetrical backfill loading shall be maintained. Special care shall be taken to prevent any wedging action or eccentric loading upon or against the structures. During backfilling operations, care shall be exercised that the equipment used will not overload the structures in passing over and compacting these fills. Except as otherwise specified or directed, backfill shall be placed in layers not more than 12 inches in loose depth and each layer of backfill shall be compacted thoroughly and evenly using approved types of mechanical equipment. Each pass of the equipment shall cover the entire area of each layer of backfill.
- G. In compacting and other operations, the Contractor shall conduct his operations in a manner to prevent damage to structures due to passage of heavy equipment over, or adjacent to, structures, and any damage thereto shall be made good by the Contractor at no additional expense to the Owner.

3.12 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 2. Remove and replace or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.
 3. In no case shall fill be placed over material that is frozen. Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until the moisture content and the density of the previously placed fill are as specified.
 4. Fill that is too dry for proper compaction shall receive water uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.

3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

Area	ASTM Density Degree of Compaction
Structural Fill below footings	95%
Structural Fill below slabs	95%
Dense Graded Crushed Stone and Gravel Borrow for pavement and walkway base/subbase course	95%
Pavement and walkway subgrade where scarified	95%
Ordinary Fill below pavement and walkway subbase and in fill slopes	95%
Ordinary Fill for trench backfill - below pavements - below landscaped areas - below structures	95% 92% 95%
All other areas	90%

1. Under structures and pavement, proof-compact existing subgrade. Compact each layer of backfill soil material at 95 percent of the soils' maximum dry density (per ASTM D 1557). Fill areas within the 1H:1V influence zone of foundations and retaining wall footings shall also be compacted to 95 percent of the soils' maximum dry density (per ASTM D 1557).
 2. Under walkways, scarify and re-compact top 6 inches below subgrade to 95 percent of the soils' maximum dry density (per ASTM D 1557). Fill and base course material within 2 feet of the finished asphalt or concrete pavement grade shall be compacted to 95 percent of the soils' maximum dry density (per ASTM D 1557).
 3. Under lawn or unpaved areas, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill soil material to at least 90 percent of the soils' maximum dry density (per ASTM D 1557).
 4. Subsoil deeper than 18 inches beneath the bottom of the proposed pavement shall be improved by compacting the exposed surface with at least six (6) passes of a vibratory roller compactor imparting a dynamic effort of at least 40 kips.
- D. In confined areas, place Crushed Stone in maximum 6-inch lifts and compact each lift with at least 4 passes of a vibratory plate compactor to a firm and unyielding surface. In open areas, place Crushed Stone in maximum 12-inch lifts and compact each lift with at least four passes of a vibratory drum roller with a minimum static weight of 10,000 pounds. Crushed stone fill shall be wrapped on all sides with non-woven filter fabric.

3.14 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1 inch.

3.15 TESTING AND OBSERVATION COORDINATION

- A. Independent Testing Agency: Cooperate with the Independent Testing Agency engaged by the Owner for field quality control activities for the Work of this Section. Refer also to Section 01 45 29 - TESTING LABORATORY SERVICES.
- B. Cooperate with field quality control personnel.
- C. Additional inspections and retesting of materials which fail to comply with specified material and installation requirements shall be performed at Contractor's expense.
- D. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Building slabs and footings: at subgrade and at each compacted fill and backfill layer, at least 1 test per 500 sq. ft. but in no case fewer than 1 test per lift regardless of area.
 - 2. Paved Areas: at subgrade and at each compacted fill and backfill layer, at least 1 test per 2,000 sq. ft. but in no case fewer than 1 test per lift regardless of area.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained. Costs related to re-testing due to unacceptable quality of work and failures discovered by the testing shall be borne by the Contractor.
- G. Notify the Independent Testing Agency a minimum of 72 hours prior to start of earthwork operations, to comply with Code requirement that a registered design professional be present at all times during backfill to assure adequate compaction with no bridging effects. The services of the Testing Agency, Geotechnical Engineer, and the Designer shall include, but not be limited to, the following:
 - 1. Observation during excavation, backfilling, and compaction.
 - 2. Laboratory testing and analysis of fill materials specified or proposed for use as required.
 - 3. Observation of construction and performance of water content, gradation, and compactions tests at a frequency and at locations that he/she shall select. The results of these test will be submitted to the Owner's Representative so that the Contractor can take such action as is required to remedy any indicated deficiencies.
 - 4. Observation of proof-compaction of exposed subgrades. Proof-compaction may be waived if, in the opinion of the Geotechnical Engineer, disturbance will occur and cause loss of strength of underlying soil.
- H. The Contractor shall make provisions for allowing observations and testing of Contractor's Work by the Testing Agency and the Geotechnical Engineer, and the Designer. The presence of the Testing Agency, Geotechnical Engineering, and/or the Designer does not include supervision or direction of the actual work by the Contractor, his/her employees, or agents. Neither the presence of the Testing Agency, Geotechnical Engineer, and/or the Designer nor any observations and testing performed by those entities or any notice or failure to give notice, shall excuse the Contractor from defect discovered in his/her work.

3.16 PROTECTION

- A. No excavation will be permitted below a line drawn downwards at 2 horizontal to 1 vertical from the underside of the closest edge of any proposed in-place footing or utility at a higher elevation without providing adequate sheeting and bracing or underpinning to prevent loss of support of the footing or utility.
- B. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- C. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Designer; reshape and recompact.
 - D. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
- 3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS
- A. Disposal: Contractor shall remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

End of Section

Section 32 12 16
ASPHALT PAVING

PART 1-GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 00 and 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Demolition of existing pavement
 - 2. Hot-mix asphalt paving.
 - 3. Hot-mix asphalt patching.
 - 4. Pavement-marking paint
 - 5. Setting new and existing granite curb.
- B. Items to Be Installed Only: Not Applicable.
- C. Items to Be Furnished Only: Not Applicable.
- D. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 31 20 00 - EARTH MOVING for aggregate subbase and base courses and for aggregate pavement shoulders.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
 - 1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities. Submit shop drawings for curbing items.
- C. Material Certificates: For each paving material, from manufacturer.

1.4 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
 - 1. Commonwealth of Massachusetts, Massachusetts Highway Department (MHD), Standard Specifications for Highways and Bridges, latest English Edition with amendments. All references to method of measurement, basis of payment and payment items in the Standard Specifications are hereby deleted. References made to particular

sections or paragraphs in the Standard Specifications shall include all related articles mentioned herein.

2. ASTM: American Society for Testing and Materials
3. AASHTO: American Association of State Highway and Transportation Officials
4. ACI: American Concrete Institute
5. MUTCD: Manual on Uniform Traffic Control Devices
6. City of Worcester Department of Public Works and Parks Standard Specifications and Details, latest edition.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the Massachusetts Highway Department (MHD).
- B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the Massachusetts Highway Department (MHD) for hot mix asphalt paving work.
 1. Comply with requirements of the Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, including supplemental specifications and special provisions.
 2. Comply with requirements of the Americans with Disabilities Act (ADA) and the Massachusetts Architectural Access Board (MAAB). If these requirements cannot be met with the grades and slopes indicated on the plans, notify the Designer immediately.
 3. Comply with requirements of the local authority having jurisdiction concerning the location and construction of accessible curb cuts.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review condition of subgrade and preparatory work.
 - c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

1.7 Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Tack Coat: Minimum surface temperature of 60 deg F.
 - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement. (Minimum 3" at driveways, 2" at walkways)
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement. (Minimum 1" at driveways, 1" at walkways)
- C. Pavement-Marking Paint: Fast drying water-borne traffic paint. The color shall match the existing adjacent striping.

1.9 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Construction Documents, or obvious from observation of the site.
- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.10 ADA AND MAAB COMPLIANCE

- A. Comply with American with Disabilities Act (ADA) and the requirements of the Massachusetts Architectural Access Board (MAAB).
 - 1. Slopes: Walkways, as defined by Section 22.1 of 521 CMR, shall be graded to a maximum of 4.5%. The cross-pitch (perpendicular to travel) for walkways and paths shall be constructed at 1.5%. The slopes of ramps and side slopes on handicap curb cuts as defined by Section 21.1 of 521 CMR shall be constructed at 7% maximum. Ramps, as defined in Section 24.1 of 521 CMR, shall be constructed to a maximum slope of 7%.
 - 2. The Contractor is to assume that sidewalk grades will be verified and checked with a 2-foot long electronic 'smart level'.
 - 3. A 5'-0" minimum level, 1.5% pitch, area shall be provided at entrances to buildings. Puddling or ponding of water at the entrances will not be accepted.
 - 4. Handicap parking spaces and access aisles shall be graded level with the slope not to exceed 1.8% in any direction.

5. The requirements specified hereinabove shall supersede the grades indicated on the Drawings. If these requirements cannot be met with the grades indicated on the Drawings, the Designer shall be notified immediately for direction.

PART 2-PRODUCTS

2.1 AGGREGATES

- A. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- B. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
- C. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.
- D. Reclaimed Asphalt Pavement (RAP): Provide material obtained from the highways or streets by crushing, milling, or planing existing hot mix asphalt pavements.
 1. The proportion of RAP to virgin aggregate for base course mixtures and intermediate course mixtures shall be limited to a maximum of 40% for drum mix plants and 20% for modified batch plants. The maximum amount of RAP for surface course mixtures shall be 10%.

E. RECLAIMED BASE COURSE

1. The work under this item may consist of scarifying and pulverizing in place the existing asphalt pavement and underlying material, mixing and blending the material, and spreading and compacting the mixture to the lines and grades shown on the Contract Drawings, or complete removal at the discretion of the contractor.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder, Performance Graded: AASHTO M320 or AASHTO MP 1a, performance grade as required by MHD Specifications.
- B. Tack Coat: AASHTO M 140 emulsified asphalt, or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

2.3 PAVEMENT MARKINGS

- A. Fast Drying White Water-borne Traffic Paint and Fast Drying Yellow Water-borne Traffic Paint as specified in the MassDOT Standard Specification Sections M7.01.23 and M7.01.24, respectively. Traffic paint shall be lead free, VOC compliant, fast drying, 100% acrylic waterborne traffic paint. Traffic paint shall conform to the performance specifications referenced in Federal Specification TT-P-1952E Type I & II, Federal Specification TT-P-195F Type I & II.
- B. Pavement markings color shall match existing adjacent markings, unless otherwise noted on Contract Drawings.
- C. General pavement marking delineation for parking stalls shall measure 4 inches in width. All other pavement-marking widths are shown in detail on the Contract Drawings.

2.4 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

2.5 ASPHALT MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by MHD Specifications and designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types".
- B. Mix design shall be Superpave 9.5mm Level 2 for top course and Superpave 12.5mm Level 2 for binder course.

2.6 ASPHALT CURB

- A. None

2.7 GRANITE CURB AND EDGING

- A. Granite curb shall conform to MassDOT Standard Specification Section M9.04.0: Curb and Edging.
- B. Granite curb shall be basically light gray in color, free from seams and other structural imperfections or flaws which would impair its structural integrity, and of a smooth splitting appearance. Natural color variation characteristic of the deposit from which the curb is obtained will be permitted.
- C. Whenever curbing is sawed, all surfaces that are to be exposed shall be thoroughly cleaned and any iron rust or iron particles removed by sand blasting or other methods satisfactory to the Owner's Representative and/or Designer and any saw mark in excess of 1/8 inch shall be removed.
- D. Granite Curb. The stones for the granite curb shall be cut to the dimensions and curvature hereinafter stated:

Type	Minimum Length	Width at Top	Depth	Minimum Width at Bottom
VA4	6 ft	6 in.	17 in. to 19 in.	4 in. (for 2/3 length)

- E. Stones used in making closures may be as much as one-third shorter than specified.
- F. On curves with radii greater than 100 ft but less than 500 ft, VA stone may be 4 ft to not more than 6 ft in length.
- G. Type VA stones to be set on a radius of 100 ft or less shall be cut to the required curvature unless otherwise directed and except for making closures shall be of minimum lengths as follows:

Radius	Minimum Length
50 ft to 100 ft	6 ft

25 ft to less than 50 ft	4.5 ft
Less than 25 ft	3 ft

H. The ends of all curved stones shall be cut on radial lines.

I. Finish

1. Granite curb shall have a top surface free from wind, shall be peen hammered or sawed to an approximately true plane, and shall have no projections or depressions greater than 1/8 inch. The front and back arris lines shall be pitched straight and true and there shall be no projection on the back surface for 3 inches down from the top which would exceed a batter of 4 inches to 1 foot.
2. The front face shall be at right angles to the planes of the top and ends and shall be smooth quarry split, free from drill holes and with no projection of more than 1 inch and no depression of more than 1/2 inch measured from the vertical plane of the face through the arris or pitch line for a distance down from the top of 8 inches. For the remaining distance, there shall be no projection or depression greater than 1 inch measured in the same manner.
3. The ends of all stones shall be square with the planes of the top and face so that when the stones are placed end to end as closely as possible, no space shall show in the joint at the top and face of more than 1/2 inch for the full width of the top and for 8 inches down on the face, after which the end may break back not over 8 inches from the plane of the joint. The arris formed by the intersection of the plane of the joint with the planes of the top and exposed faces shall have no variation from the plane of the top and exposed faces greater than 1/8 inch.
4. The ends of all transition curb shall be cut with a power-driven saw to provide a flush vertical joint with adjacent curbing.

J. CEMENT MORTAR

1. Cement mortar shall be composed of one (1) part Portland Cement and two (2) parts sand by volume with sufficient water to form a workable mix. Cement shall be Portland Cement Type II.

2.8 PRECAST CONCRETE CURB

A. None

PART 3-EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING

- A. Existing Hot-Mix Asphalt Pavement: Saw-cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Existing Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
 - 1. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a minimum rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.3 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross-section, and thickness when compacted.
 - 1. Spread mix at minimum temperature of 250 deg F.
 - 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

3.6 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: ASTM D 2041, per MHD Specifications.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 CURBING AND EDGING

- A. Excavating Trench.
 - 1. The trench for curb shall be excavated to a width of 18 inches.
 - 2. The subgrade of the trench shall be a depth below the proposed finished grade of the curb equal to 6 inches plus the depth of the curb unit.
 - 3. Existing pavements shall be sawcut in
- B. Preparing Foundation.
 - 1. The foundation for the curb shall consist of gravel spread upon the subgrade and after being thoroughly compacted by tamping shall be 6 inches in depth.

2. The gravel foundation for edging shall be as shown on the plans and shall be thoroughly rammed or tamped until firm and unyielding.
 3. The foundation for curb inlets shall consist of a full bed of Portland cement mortar on the supporting back wall of the catch basin or gutter inlet and sufficient gravel on each side to support the overhang. The trench for the gravel foundation shall be at least 6 inches in depth and 18 inches in width. This trench shall be filled with gravel thoroughly tamped to the required grade.
 4. The trench for curb corners shall be excavated so that there shall be constructed a foundation of gravel which when thoroughly compacted will be 6 inches in depth and extending 6 inches beyond the front and back of curb corner to the full depths of foundation. Other acceptable material may be used for backing.
- C. Setting Curb and Edging.
1. Curbing, curb corners or edging shall be set on additional gravel spread upon the foundation.
 2. All spaces under the curb, curb corners or edging shall be filled with gravel thoroughly compacted so that the curb, curb corners or edging will be completely supported throughout their length. The curb shall be set at the line and grade required as shown on the plans unless otherwise directed by the Owner's Representative and/or the Designer.
 3. The curbing shall be set on edge and settled into place with a heavy wooden hand-rammer, to the line and grade required, straight and true for the full depth.
 4. Curb, curb corners or edging shall be fitted together as closely as possible.
 5. If granite curb, curb corners, curb inlets or edging of different quarries is used on the same project, curbing of each particular quarry shall be segregated and set to give uniform appearance.
 6. The ends of the granite curb at driveways and intersections shall be cut at a bevel or rounded, as indicated on the Contract Drawings.
 7. Pedestrian ramps and flush curb sections shall be constructed with transition sections, as indicated on the Contract Drawings.
 8. Precast concrete curb units shall be doweled together continuously to the line and grade indicated on the Contract Drawings.
- D. Filling About Trench.
1. After the curb, curb corners, curb inlets, and edging is set, the space between it and the wall of the trench shall be filled with cement concrete as indicated on the Contract Drawings. Care shall be taken in placing the concrete to avoid disturbing the line or grade of the curb.
 2. After the concrete has sufficiently cured, the space between the back of curb and the wall of the trench shall be filled with gravel borrow compacted to the depth indicated on Contract Drawings.
- E. Pointing
1. The joints between curbstones (both front and back) or edging shall be carefully filled with cement mortar and neatly pointed on the top and front exposed portions. After pointing, the curbstones and edging shall be satisfactorily cleaned of all excess mortar.
- F. Removal and resetting of curb
1. Procedures for removal and resetting of existing granite curb, and new granite curb, in

existing pavements shall include the following:

- a) Prior to excavation for existing granite curb removal, the pavement surface shall be cut a minimum of one foot from the face of curb with appropriate pavement cutting equipment.
- b) Existing curb shall be carefully excavated and removed in a manner that protects the curb and existing pavement to remain from damage.
- c) Existing granite curb shall be cleaned by sandblasting as required to remove of bituminous material, paint and concrete from exposed surfaces prior to resetting in the proposed work.
- d) New granite curb shall be set to match the top of existing granite curb remaining in place at abutting sections and, if required, transitioned to the typical section shown on the Contract Drawings within the first section of curb.

3.8 INSTALLATION TOLERANCES

- A. Accessibility: Comply with requirements of Massachusetts Architectural Access Board and ADAAG requirements. Remove and replace paving that does not meet required tolerances when measured with a 2-foot straight edge.
- B. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 1. Base Course: Plus or minus 1/2 inch.
 2. Surface Course: Plus 1/4 inch, no minus.
- C. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within MHD Specification tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas.
- D. PAVEMENT CLEANING AND PROTECTION
 1. The pavement surface and all work areas shall be left in a clean condition.
 2. Vehicular traffic shall not be permitted on the pavement that has been sealed during the dry period. The contractor shall supply all temporary traffic control devices (barricades, cones, signing, etc.) to protect the sealant. Any damage to uncured sealant shall be repaired at the contractor's expense.

3.9 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Designer.
- B. Allow new asphalt surfaces to cure for one (1) to two (2) weeks before application of traffic paint.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.10 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Cooperate with the Independent Testing Agency engaged by Massachusetts State College Building Authority for field quality control activities for the Work of this Section. Refer also to Section 014100 - TESTING LABORATORY SERVICES.
- B. Test the plane of the finished surfaces of base, binder, and surface courses with a 16-foot straightedge, except use a 10-foot straightedge on vertical courses and on the top course of resurfaced streets which contain manhole covers, valve boxes, and the like.
- C. Carefully apply the straightedge immediately after the first compaction by rolling, and from then on as may be necessary until and after the final compaction of the material in place. Hold the straightedge in successive positions parallel to the road centerline and in contact with the road surface; check the entire area from one side of the pavement to the other.
- D. Correct irregularities which vary 3/8 inch from a true finished surface in base and binder courses, and 1/4 inch in top courses.
- E. Irregularities which may develop before the completion of rolling and while the material is still workable may be remedied by loosening the surface mixture and removing or adding material as necessary. Should any unsatisfactory irregularities or defects remain after final compaction, the defective work shall be corrected by removing and replacing with new material to form a true and even surface.

3.11 OPENING TO TRAFFIC

- A. No vehicular traffic or loads shall be permitted on the newly completed pavement until all of the following conditions are met:
 - 1. Adequate stability has been attained.
 - 2. The material has cooled sufficiently to prevent distortion or loss of fines.
 - 3. The pavement has achieved a maximum temperature of 140 degrees F.
- B. If the climatic or other conditions warrant it, the period of time before opening to traffic may be extended at the discretion of the Designer.

3.12 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from the Project site, and legally dispose of them in an EPA-approved landfill.

End of Section

Section 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01, GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Provide all equipment and materials, and do all work necessary to construct the chain link fence and gate and cantilever slide gate, as indicated on the Drawings and as specified.

1.3 RELATED SECTIONS

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
1. Section 033000, CAST-IN-PLACE CONCRETE
 2. Section 312000, EARTH MOVING.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive shall govern:
1. American Society for Testing and Materials (ASTM):

A 53	Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless
A 90	Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
A 123	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
A 153	Zinc-Coating (Hot-Dip) on Iron and Steel Hardware
A 385	High-Quality Zinc Coatings (Hot-Dip)
A 392	Zinc-Coated Steel Chain-Link Fence Fabric
A 569	Steel, Carbon (0.15 Maximum Percent) Hot-Rolled Sheet and Strip, Commercial Quality
B 6	Zinc (Slab Zinc)
F 567	Installation of Chain-Link Fence
F 668	Poly (Vinyl Chloride)(PVC)-Coated Steel Chain- Link Fence Fabric
 2. Chain Link Fence Manufacturers Institute (CLFMI): \
- | | |
|--------|----------------|
| Manual | Product Manual |
|--------|----------------|

1.5 QUALITY ASSURANCE

- A. Galvanized steel chain link fencing shall be manufactured in accordance with the requirements of the CLFMI Manual. Fence manufacturer shall be a CLFMI member.
- B. Fence manufacturer shall have at least ten years of experience in the manufacture of galvanized steel chain link fencing.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
- B. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
 - 1. Each fence fabric type
 - 2. Each size of pipe
 - 3. Each type of hardware and fitting
 - 4. Gates, including latch
 - 5. All rails, bracing, tracks, and guide posts
 - 6. All components for the wheel assemblies, truck assemblies, and any other components for the cantilever slide gate
 - 7. Manufacturer's vinyl coating system
 - 8. The fence contractor shall provide the fence manufacturer's notarized certification to the Owner's Representative that the vinyl-coated chain link fabric is warranted by the manufacturer for a minimum of 15 years against rust and corrosion.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.
 - 1. Provide a complete and detailed layout showing all chain link fence post locations.
 - 2. Submit a complete schedule of all chain link fencing and gates indicating locations of all post and fabric types on the project.
 - 3. Submit a complete welding plan for the cantilever slide gate frame
- D. Samples: Prior to ordering the below listed materials, submit samples to the Owner's Representative for approval. Samples shall be representative of designated items. Do not order materials until Owner's Representative's approval has been obtained. Delivered materials shall closely match the approved samples.
 - 1. One square foot of each chain link fabric type.
 - 2. One sample of each size of post tops
 - 3. One 12-inch length of each size of pipe
 - 4. One sample of each type of hardware and fitting
- E. Construct a representative fence section sample with gate on-site for each size and type of chain link fence construction. Samples shall be constructed prior to the installation of all chain link fencing and as part of the proposed finish work to

facilitate comparisons during construction. The samples shall demonstrate the typical installation of fence posts and footings, framework, vinyl coatings, hardware fittings and miscellaneous materials. The accepted sample, upon approval, shall be maintained as the standard of minimal quality for approval of all proposed chain link fence work required for the project. Unacceptable sample sections shall immediately be removed from the site.

PART 2 - PRODUCTS

2.1 PVC COATED FENCE FABRIC

- A. Polyvinyl Chloride (PVC) Coated Fabric: Fence fabric shall be zinc coated in accordance with ASTM A392 Class-2 or ASTM A491. The color of the fabric shall be black and in accordance with ASTM F934.
- B. Fabric shall be woven into a 2 in. mesh of 9 finished gauge (0.148 in.) galvanized wire with a minimum breaking strength of 1290 lb. in accordance with ASTM F 668, Class 2b. All fabric shall be knuckled at both selvages. Public side of fabric shall be installed in accordance with the Owner's direction.
- C. Privacy Slats: High privacy slats with top-locking mechanism and UV-resistant. Sized to fit specified wire mesh fabric. Material shall be High Density Polyethylene (HDPE). Visibility blockage shall be minimum 90%. Provide (25) years manufacturer's warranty. Color will be selected by the architect from the manufacturer's full list of standard colors.

2.2 CHAIN LINK FENCE POSTS, HARDWARE, AND FITTINGS- GENERAL

- A. General Fence Framework Requirements:
 - 1. Type II, Group IC round steel pipe (electric resistance welded), cold-formed as per ASTM F1043-00 Standard with minimum yield strength of 50,000 psi. The external zinc coating shall be Type B, zinc with polymer film, 0.90 oz./sq.ft., minimum zinc coating with a chromate conversion and a verifiable polymer film. The internal coating shall be Type B, zinc 0.90 oz./sq.ft. minimum or Type D, zinc pigmented, 91% nominal coating with 0.30 mils minimum thickness. Gate framework joints shall be welded and coated in accordance with Practice A780, employing zinc-rich paint.

2.3 END, CORNER AND PULL POST.

- A. Galvanized steel, physical pipe dimensions and weights
 - 1. Up to 12-foot fabric height: 2.875-inch OD pipe, 4.64-lbs. /lin. ft.
 - 2. Maximum Spacing between all posts is 10'- 0" On Center.

2.4 LINE POSTS.

- A. Galvanized steel, physical pipe dimension and weights as follows:
 - 1. Up to 12-foot fabric height: 2.375-inch OD steel pipe, 3.12-lbs. /lin. ft.
 - 2. Maximum Spacing between all posts is 10'- 0" On Center.

2.5 GATE POSTS.

- A. Galvanized steel, single gate widths, physical pipe dimension and weights as follows:

1. Over 6-feet to 13 feet: 4.0 inch OD pipe, 6.56-lbs./ linear ft.
2. Gate frames as per ASTM F 900-94.

2.6 RAILS (TOP, MIDDLE AND BOTTOM RAILS):

- A. Galvanized steel, manufacturer's longest lengths joined by six inch (6") long sleeves, rail shall run continuously along top of fence. Bottom rail shall be joined at line posts with boulevard clamps. Minimum pipe sizes and weights as follows:
 1. 1.660-inch OD pipe, 1.82-lbs. /lin. ft. minimum.
 2. Top, Bottom, Middle and Intermediate rails are required for fencing adjacent to the sports court footprint.

2.7 COUPLINGS:

- A. Expansion types, approximately 6-inch long, install one sleeve for each 500 foot run. Standard couplings are installed at each rail end to form one continuous top rail. City of Worcester Department of Public Works and Parks – WPRC DIVISION 24

2.8 ATTACHING DEVICES:

- A. Provide fittings for attaching top rail securely to each gate corner pull and end post as noted on drawings.

2.9 SLEEVES:

- A. Galvanized steel pipe not less than 6 inches long and with inside diameter not less than 1/2-inch greater than outside diameter of the post pipe. Provide steel plate closure welded to bottom of sleeve of width and length not less than 1-inch greater than outside diameter of sleeve.

2.10 POST BRACE ASSEMBLY:

- A. Manufacturer's standard adjustable braces at end of gateposts and at both sides of corner and pull posts. Provide horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 3/8-inch diameter galvanized steel truss rods and adjustable tightener.

2.11 POST TOPS:

- A. Galvanized steel, weather-tight closure cap for each tubular post. Furnish caps with openings to permit passage of top rail.

2.12 TENSION BARS:

- A. Galvanized steel, one-piece lengths equal to full height of fabric, with minimum cross-section of 3/16 inch x 3/4 inch. Provide tension bar for each gate and end post, and two for each corner and pull post. Stretcher Bar Bands will be manufacturer's standard.

2.13 GATE CROSS-BRACING:

- A. 3/8-inch diameter galvanized steel truss rods and adjustable tightener.

2.14 NON-SHRINK, NON-METALLIC GROUT:

- A. Premixed, factory-packaged, non-corrosive, non-staining, nongaseous, exterior grout approved by the Engineer.

2.15 SLEEVES

- A. Sleeves if required for fence shall be galvanized steel pipe conforming to ASTM F1043 sizing as required to accommodate posts.

2.16 POLYMER COATED FRAMEWORK

- A. Shall meet the above-mentioned specification for materials.
- B. The framework shall be subjected to a complete thermal stratification coating process (multi-stage, high-temperature, multi-layer) including, as a minimum, a six stage pretreatment/wash (with zinc phosphate), an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish.
 - 1. The material used for the base coat shall be a zinc-rich (gray color) thermosetting epoxy; the minimum thickness of the base coat shall be two (2) mils.
 - 2. The material used for the finish coat shall be a thermosetting "no-mar" TGIC polyester powder; the minimum thickness of the finish coat shall be two (2) mils.
- C. Standards
 - 1. The stratification-coated pipe shall demonstrate the ability to endure a salt-spray resistance test in accordance with ASTM B117 without loss of adhesion for a minimum exposure time of 3,500 hours.
 - 2. The coated pipe shall demonstrate the ability to withstand exposure in a weather-ometer apparatus for 1,000 hours without failure in accordance with ASTM D1499 and to show satisfactory adhesion when subjected to the crosshatch test, Method B, in ASTM D3359.
 - 3. The polyester finish coat shall not crack, blister or split under normal use.
- D. Painted framework and accessories are not acceptable, welded joints shall be top-coated to match frame color.
- E. Color of the polymer coated framework and accessories shall be black and in accordance with ASTM F934.

2.17 CHAIN LINK FENCE GATES AND GATE FRAMES

- A. Fabrication: Assemble gate frames by welding connections. Use same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at edges, and fabric ties. Attach stretcher bars to gate frame at not more than 15 in. o.c. Attach hardware with rivets or by other means which will provide security against removal or breakage.
 - 1. Gate Heights:
 - a. Heights for gates shall be in accordance with MSSHB 644.45.

- B. Single and Double Swinging Gate and Hardware: Swing gates and hardware shall be manufactured to meet the requirements of ASTM F900. Unless indicated otherwise, and to meet ADA requirements, the minimum clear opening for all single gates (as measure with gate perpendicular to framework) shall be 36 inches.
 - 1. Hinges. Industrial butt hinges, size and material as required for the gate size. Non-lift-off type, offset to permit 180 degree gate opening. Provide one pair of hinges for each leaf, gates eight feet and taller in nominal height shall have three hinges per leaf. Spot-weld to post and paint (non polymer coated), to prevent rotational movement.
 - 2. Latch (for both single and double gates). Pressed steel, industrial series gate latch, straight fork type, provide latch catch for double gates, designed to permit operation from either side of gate, with padlock eye as integral part of latch catch. Provide two latch and catch for double gates. All gates shall be equipped with one gate stop.

2.18 CAPS

- A. Posts shall have caps which shall be designed to exclude water from post. Caps shall have holes suitable for the through passage of the top rail where necessary.

2.19 FABRIC TIES:

- A. Ties for fastening fabric to top, bottom, middle and brace rails shall be black "band it" ties, stainless steel vinyl coated or approved equal, spaced at 12" on center to form a secure connection.

2.20 GALVANIZED PAINT

- A. Cold galvanized paint for field touch-up shall be one of the following:

Product	Manufacturer
GALVICON	GALVICON CORPORATION
ZINC SHIELD	STANLEY CHEMICAL DIVISION OF THE STANLEY WORKS

2.21 CONCRETE

- A. Concrete shall be air-entrained type, conforming to Section 033000, CAST-IN-PLACE CONCRETE

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Chain link fence installation shall conform to ASTM F 567, except as modified below.
- B. Line posts shall be placed at not more than 10 ft. on center, or as indicated on Drawings.
- C. Fence heights (measured from finish grade to top rail) length, and layout shall be as indicated on Drawings.

- D. Install fabric on security side of fence. Wire fabric shall be attached to frame, and tightly stretched such that it is flat, in uniform tension with no bulges or warping of fence or gate after pulling force is released. Fabric ties shall be spaced at 12 in. on horizontal rails, braces, and posts. Seam of fabric tie shall be hammered flat to member to minimize hazard to person or clothing. Top and bottom of the fabric shall extend on half the height of the "diamond" beyond outer edge of top and bottom of the horizontal rail. The fabric shall also be one (1) inch maximum above finish grade. The fabric shall be tied in accordance with Item 1 below to all line posts, top, middle and bottom rails every six (6) "diamonds" as measured horizontally or vertically. Overlapping fence fabric sections shall overlap one full height of the "diamond" and be centered on the horizontal rail. Top of fence shall approximately follow grade and shall have no abrupt changes in slope. Height of fence shall be constant.
 - 1. All fabric, shall be fastened to all line posts and horizontal rails with fabric ties. All fabric ties shall be pulled tight and raw ends of steel bands shall be secured in buckle by folding ear tabs around steel bands as per manufacturer's recommended installation procedure. No sharp edges shall protrude from band-it buckles.
 - 2. Fasteners: Install nuts for tension band and hardware bolts on side of fence opposite fabric side.
 - 3. Bolts: Used in the construction of fence shall be thoroughly peened.
- E. Stretcher Bars: Extend through fabric and secure to end, corner, pull and gate posts with bands or clips spaced not over 12 in. o.c.

3.2 GATES

- A. Install gates plumb, level, and secure for full opening without interference.
- B. Gate dimension is the center to center spacing of gate posts.
- C. Gates shall work freely and shall have adequate clearance of the bottom. Adjust for smooth operation.

3.3 FOUNDATIONS

- A. General: Unless otherwise indicated on the Drawings, footing diameter shall be four times the largest cross section of the post. The depth shall be as indicated on the Drawings.
- B. Concrete shall be crowned at top to shed water.
- C. Post hole footings shall be allowed to be cured 72 hours prior to any additional work.

3.4 POSTS

- A. Layout:
 - 1. End, corner and pull post: Provide at each termination and change in horizontal or vertical direction of 30 degrees or more.
 - 2. Line Posts: Space uniformly at maximum 10 feet on center.
- B. Concrete Set Posts for site enclosure fence: (Corner, End and Pull Posts) Drill holes (after final grading) in firm, undisturbed or compacted soil. Holes shall

have a diameter equal to four times the diameter of the post, and depths approximately 6 in. deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads.

1. Set post not less than 35 in. below surface when in firm, undisturbed soil.
2. Place concrete around posts in a continuous pour, tamp for consolidation. Trowel finish tops of footings, and slope or dome to direct water away from posts, except at walks.
3. Gate posts and hardware: Set keepers, stops, sleeves and other accessories into concrete.

- C. Posts set in cast in place walls or perimeter curb at sports field: (Corner, End and Pull Posts) Core cast in place concrete to accept post per detail and fill with non-shrink grout to secure post.

3.5 BRACING AND FRAMING

- A. Bracing: Install horizontal pipe brace at mid height for fences 6 ft. and over, on each side of corner posts and at gate, end, and pull posts. Firmly attach with proper fittings. Install diagonal tension rods at these points. Install braces so posts are plumb when diagonal rod is under proper tension.
- B. Top Rail:
1. Random length, averaging not less than 18 feet.
 2. Pressed steel sleeve joints, for rigid connections and expansion/contraction.

3.6 TOUCH UP

- A. Following installation, scratches and marred spots in galvanized surfaces shall be power wire brushed and painted with a cold-applied galvanized paint at a rate of 2.0 oz. zinc per sq. ft. of surface.
- B. Inspect all fencing following installation to check for proper tension, stability, structural integrity and gate function, and adjust, repair or replace as required to establish proper function prior to final review and acceptance.

END OF SECTION