The City *of* Worcester

Department of Public Works

John K. Westerling, Commissioner

REQUEST FOR BIDS

WATER FILTRATION PLANT

ELECTRICAL GEAR MAINTENANCE AND TESTING

PROJECT SPECIFICATIONS

November 4, 2025

DIVISION 26 – ELECTRICAL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Conditions of the Contract and Division 01, General Requirements, shall be made part of this Division.

B. Refer to the drawings for further definition of location, extent, and details of the work described herein.

C. Where referred to, standard specifications of technical Societies, Manufacturer's Associations, and Federal Agencies shall include all amendments current as the date of issue of these Specifications.

1.2 WORK INCLUDED

A. Examine all Drawings and other Divisions of Specifications for requirements that affect work of this Division 26.

B. Perform work and provide materials and equipment as specified herein. Work shall include, but not be limited to, all labor, materials, tools, equipment, insurance, transportation, temporary protection, supervision, and incidental items required for a complete testing.

C. Provide all labor, equipment, material, implements and materials required to perform all Electrical work, complete as shown on the drawings and noted herein. The following are major items of work included:
1. Premium Time: The project requires work to be completed on premium time (outside normal business hours).
2. Maintain temporary electrical system throughout building during construction.
3. Submittals.
4. Short Circuit and Coordination Study.
5. Electrical Tests.

1.3 EXAMINATION

A. Before submitting bid, visit and examine the site where work is to be carried out and become familiar with all features and characteristics that affect the work of this DIVISION.

B. Report in writing, any discrepancies or deficiencies which may adversely affect the work, at least six days prior to close of bid.

C. No allowance will be made for any difficulties encountered due to any features of the building, site or surrounding public and private property that existed up to the time of bid.

1.4 SUBMITTALS

A. Refer to DIVISION 01 - Submittals and specifications for shop drawing requirements. Without limiting the generality thereof, the Electrical Contractor shall also submit the additional information noted herein.

B. Submit for review either electronically or in hard copy format to comply with the requirements of Division 01 and the agreed upon submittal process at project kickoff. Submit all shop drawings and certified submittals for equipment, materials, equipment wiring, diagrams, motors, starters, controls and schedules. Ensure that shop drawings have adequate clear space for all stamps. When requested, resubmit drawings promptly.
1. If submitting electronically, provide email notification to ftconadmin@f-t.com with submittal file(s) attached in industry standard ".pdf" file format. Ensure that shop drawings with native page size larger than 8 ½" x 11" are included at their native size and legible. If the submittal file(s) are too large for email transfer, provide hyperlink to files allowing both download and upload of files over internet connection without requiring use of usernames or passwords.
2. For hard copy format, submit full size copies of each Shop Drawing larger than 8 ½" x 11" and seven (7) copies of smaller certified Shop Drawings.

1.5 SHORT CIRCUIT, COORDINATION, AND ARC FLASH STUDY

A. General: A study incorporating the following items shall be performed and submitted for review and approval, prior to purchase and installation of equipment.
1. Short Circuit Study
2. Overcurrent Protective Device Coordination and Evaluation Study
3. Arc Flash Hazard Study
4. Load Flow Analysis

B. Description of Work
1. This project requires that a study be performed on existing electrical equipment and electrical distribution equipment modified. The contractor shall coordinate with the Owner for existing base building reports for information on the existing electrical distribution system.
2. The study shall include all portions of the electrical distribution system from the normal incoming primary and/or secondary sources, the emergency and/or standby power sources, down to and including all panels and electrical distribution equipment in the distribution system. The study shall include all existing equipment affected by the scope of the project work.
3. The studies shall be prepared to demonstrate that all electrical equipment is supplied with adequate ratings. The study shall demonstrate that the protective device system is properly coordinated calibrated, adjusted, set and tested.
4. The contractor shall be responsible for coordinating and implementing all recommendations and labeling identified by the study.

C. Qualifications
1. The study shall be prepared in conformance with industry practices, standards, and with other technical data approved by the Engineer.
2. The study shall be performed by a firm specializing in power system studies and analysis.
3. The study shall be performed by a registered professional electrical engineer in accordance with ANSI/IEEE Standard 242-2001, "Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems." The study engineer shall be a full-time employee of the firm and shall have a minimum of five (5) years experience in power system studies and analysis. The study engineer shall be licensed in the state in

which the project is being performed, and the study shall include the engineer's stamp, signature and qualifications.

4. The analysis shall be performed with software complying with the latest applicable IEEE and ANSI standards. Acceptable programs are SKM System Analysis Power Tools or EasyPower.

D. Submittals
1. Submit the study as a shop drawing in compliance with all the requirements identified in these specifications. The study shall be submitted as a hard copy or electronic copy in compliance with the project requirements
2. The study shall be submitted in color, with full size prints of all one-line diagrams.
3. The final study shall be provided in electronic and hard copy format as part of the project Operations & Maintenance manuals as defined elsewhere in these specifications.

E. Data Collection
1. The Contractor shall be responsible for obtaining all data required to complete the study.
2. The Engineer performing the study for the Contractor shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.
3. The Contractor shall coordinate with the power/utility company for site specific data required to complete the study.
4. The studies shall utilize actual conductor lengths and transformer impedances.

F. Short Circuit Study
1. Perform a study to verify the ratings of all equipment in the system. The calculations shall verify that all components of the electrical distribution system are adequately rated to withstand and interrupt the assumed fault for all source combinations.
2. Calculate the short circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:
    a. Electric utility's termination point
    b. Incoming switchgear
    c. Unit substation primary and secondary terminals
    d. Low voltage switchgear and switchboard
    e. Motor control centers
    f. Emergency/standby generator(s) and automatic transfer switch(es)
    g. Distribution panels and branch circuit panelboards
    h. All other electrical distribution equipment throughout the system
3. Provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, tabulations of calculation quantities and results, conclusions, and recommendations.
4. The fault impedance diagram shall be prepared to reflect the system impedance of power sources available to supply the building or facility. The short circuit current available at each fault location shall be shown in tabular form on the diagram for a bolted line-to-line fault and a line-to-ground fault.
5. For grounded systems, calculate the bolted line-to-ground fault for all applicable buses defined for the three-phase bolted fault calculation.
6. Evaluate the protective device and equipment and compare to the short circuit ratings. Evaluate the adequacy of all distribution equipment bus bars to withstand short circuit stresses.
7. Notify the Owner in writing of any existing devices and equipment in the system that are improperly rated for the calculated fault current.

G. Protective Device Coordination Study

1. The study shall demonstrate the coordination achieved by the system of protective devices.
2. Selective Coordination
    a. Normal Power System: All overcurrent protective devices in the normal power system shall be selectively coordinated for a duration of 0.1 seconds and longer.
    b. Emergency Power System: All overcurrent protective devices in the emergency power system shall be selectively coordinated. The first overcurrent device in the normal system that serves a branch of the emergency system shall be included in this evaluation and shall be selectively coordinated. The selective coordination shall be in compliance with the National Electric Code, and shall include all emergency and elevator distribution systems.
    c. If a mis-coordination exists, the study engineer shall evaluate the manufacturer's laboratory test data for the specific overcurrent device combination. The study engineer shall identify any remaining mis-coordination and shall recommend the correct overcurrent device or system topology for that manufacturer to provide the required level of coordination.
3. Calculation guidelines and requirements
    a. Provide protective device time-current curves (TCC) as follows:
        1) TCC's displayed on log-log scale graphs.
        2) On each TCC, include a title, and partial one-line diagram identifying the specific portion of the system covered by the graph, with each device labeled, corresponding with the overall one-line diagram.
        3) Identify the device associated with each curve by manufacturer, type, function, and if applicable, the tap, time delay and instantaneous settings recommended.
        4) Provide adequate time margins, as identified by IEEE Std. 242, between device characteristics such that the specified level of selective coordination is demonstrated, while maintaining proper protection.
        5) Where ground fault protection is specified in the design, provide TCC graphs demonstrating coordination and setting recommendations for ground fault devices.
        6) The following characteristics shall be plotted on the TCC graphs, as applicable.
            a) Electric utility's overcurrent protective device.
            b) Medium voltage equipment overcurrent relays
            c) Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
            d) Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
            e) Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
            f) Medium voltage conductor damage curves
            g) Ground fault protective devices, as applicable
            h) Pertinent motor starting characteristics and motor damage points, where applicable
            i) Pertinent generator short-circuit decrement curve and generator damage point
            j) The largest feeder circuit breaker in each motor control center and applicable panelboard.
4. The study shall include all data related to protective devices proposed as such data relates to the nameplate data, time-current characteristics, and the fixed or adjustable features of the protective devices. These data shall include:
    a. The time-current characteristic curves published by the manufacturer of the protective devices or equipment having adjustable time-current characteristics.
    b. Data published by the manufacturer of circuit breakers or protective relays which contain installation, operation and maintenance instructions for calibration, adjustment, setting, and testing of the specific protective device.

c. Composite time-current characteristic curves for primary, secondary and other related devices, as required to ensure coordinated power system protection between protective devices or equipment.

H. Arc-Flash Hazard Study
1. Perform an arc-flash hazard analysis in accordance with requirements and recommendations of IEEE 1584 and NFPA 70E.
2. Calculate the flash protection boundaries and incident energy for all equipment in the electrical distribution system as defined for the studies above. This shall include 208V systems served from transformers smaller than 125kVA.
3. Calculation guidelines and requirements
   a. Safe working distances shall be based on IEEE 1584 AND NFPA 70E, with the more stringent requirements applied. The calculated arc flash protection boundary shall be determined using those working distances and considering an incident energy of 1.2 cal/cm^2.
   b. 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 relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.
   c. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation shall assume that the utility contribution is at a minimum. Conversely, the maximum calculation shall assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.
   d. The incident energy calculations must 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 should be decremented as follows:
      1) Fault contribution from induction motors should not be considered beyond 5 cycles.
      2) Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each.
   e. For each piece of equipment (ANSI-rated) with an enclosed main device, calculations shall be made on both the line and load side of the device. For all other non-ANSI rated equipment, only one calculation shall be required, and it shall be based on a device located upstream of the equipment to clear the arcing fault.
   f. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
   g. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
   h. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584-2002 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 event, a maximum clearing time based on the specific location shall be utilized.

i. Perform a calculation iteration for “maintenance mode” that identifies results when all protective devices are set to their minimum instantaneous settings.

4. Provide samples of all arc-flash hazard labels as part of the study. The final labeling and calculations shall be based on any modifications to the distribution system as a result of these studies or as a result of modifications to the system during construction.
5. Based on all final information from the Contractor, provide arc-flash hazard labels in accordance with NFPA 70E and the following.
   a. Provide labels for all equipment and devices analyzed as part of the study.
   b. Labels shall be 4” x 5” thermal transfer type labels manufactured of high adhesion, UV resistant polyester.
   c. Labels shall be machine printed, with no field markings.
   d. Labeling shall be based on the device settings recommended in the study provided the contractor has confirmed in writing that all recommended settings have been implemented.
   e. At a minimum, labels shall include the following information.
      1) Equipment/location identification
      2) Voltage
      3) Flash protection boundary
      4) Arc flash incident energy value
      5) Personal protective equipment category
      6) Limited, restricted, and prohibited approach boundaries
      7) Study/report identification and final issue date.

I. Study Report
1. The report shall include, but not be limited to, the following sections and components.
2. Executive summary, introduction, and description of the scope of work.
3. Demonstration of qualifications, including firm and engineer experience, professional engineering stamp and software analysis tools used.
4. All input data used for the study, including utility company equipment information.
5. Description of short-circuit analysis, results and recommendations.
6. Short-circuit device and equipment evaluation table.
7. Description of coordination analysis, results and recommendations.
8. Protective device TCC graphs.
9. Protective device setting recommendation table identifying settings for all adjustable device parameters.
10. Arc flash hazard methodology, analysis, results and recommendations. Description shall include explanation of incident energy and flash protection boundary calculations, boundary distances, working distances, incident energy values, and personal protective equipment (PPE) requirements.
11. Arc flash calculation results in tabular format.
12. Proposed arc flash labeling for all equipment. Note that the contractor shall not utilize the arc flash labeling until the final study has been approved and the study engineer has provided final arc flash labels.
13. One-line diagram identifying all equipment buses, bus labels used in study, and cable and bus connections. The diagram shall include the short-circuit analysis results for each device and/or bus location.
14. The study shall state in plain language that the system is code compliant or is not code compliant.
15. If the system is not code compliant, the study engineer shall include recommendations in the report that, when implemented, make the system code compliant.

J. Implementation
1. The contractor shall adjust relay and protective device settings in accordance with the recommendations of the studies.
2. Arc-flash hazard labeling shall be applied as instructed by the study, and in accordance with NFPA 70E.

3. The contractor shall submit a letter certifying that all settings and labels have been implemented.

K. Documentation to the Owner: The Owner shall be provided with an electronic and hard copy of the full, final study in accordance with the Division 1 requirements for O&M manuals. The Owner shall be provided with a copy of the electronic study file; in a format compatible with the Owner's software preference (SKM or Owner's designated acceptable equivalent).

PART 2 - PRODUCTS

A. MATERIAL

B. The Contractor shall be responsible for all equipment and materials required to perform all tests as specified herein. All test equipment shall be in first-class condition, correctly calibrated and shall be operated by qualified personnel experienced in the use of the equipment.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate utility service outages with Utility Company, owner, owner's representative

B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment, feeders or branch circuits, use personnel experienced in such operations.

C. Existing Electrical Service: Obtain permission from or notify Owner at least 24 hours before partially or completely disabling system. Minimize outage duration.

3.2 SWITCHGEAR

A. Field Quality Control
1. Testing Agency: Engage a qualified independent testing agency to perform field quality-control testing.

B. Tests and Inspections:

1. Comply with provisions of "Testing and Test Methods" Chapter in NFPA 70B and NETA ATS.
2. Perform visual and mechanical inspections and electrical tests stated in NETA ATS. Certify compliance with test parameters.
3. Visual and Mechanical Inspection:
   a. Inspect bolted electrical connections for high resistance using one of the following two methods:

      1) Use low-resistance ohmmeter to compare bolted-connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.
      2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels must be in accordance with

manufacturer's published data. In absence of manufacturer's published data, use NETA ATS, Table 100.12.

b. Confirm correct operation and sequencing of electrical and mechanical interlock systems.

1) Attempt closure on locked-open devices. Attempt to open locked-closed devices.
2) Make key exchange with devices operated in off-normal positions.

c. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
d. Inspect insulators for evidence of physical damage or contaminated surfaces.
e. Verify correct barrier and shutter installation and operation.
f. Exercise active components.
g. Inspect mechanical indicating devices for correct operation.
h. Perform visual and mechanical inspection of instrument transformers in accordance with "Instrument Transformer Field Tests" Paragraph.
i. Inspect control power transformers.

1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
2) Verify correct functioning of drawout disconnecting and grounding contacts and interlocks.

4. Electrical Tests:

a. Perform DC voltage insulation-resistance tests on bus sections, phase-to-phase and phase-to-ground, for one minute. If bus temperature is other than plus or minus 20 deg C, adjust resulting resistance as provided in NETA ATS, Table 100.11.

1) Insulation-resistance values of bus insulation must be in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Investigate and correct values of insulation resistance less than manufacturer's published instructions or NETA ATS, Table 100.1.
2) Do not proceed to dielectric withstand voltage tests until insulation-resistance levels are raised above minimum values.

b. Perform dielectric withstand voltage test on bus sections, phase-to-ground with phases not under test grounded, in accordance with manufacturer's published data. If manufacturer has no recommendation for this test, it must be conducted in accordance with NETA ATS, Table 100.2. Apply test voltage for one minute.

1) If no evidence of distress or insulation failure is observed by end of total time of voltage application during dielectric withstand test, test specimen is considered to have passed test.

C. Circuit-Breaker Field Tests:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, and grounding.
c. Verify that maintenance devices are available for servicing and operating breaker.

d. Verify unit is clean.
e. Inspect moving and stationary contacts for condition and alignment.
f. Verify that primary and secondary contact wipe and other dimensions vital to satisfactory operation of breaker are correct.
g. Perform mechanical operator and contact alignment tests on both breaker and its operating mechanism in accordance with manufacturer's published data.
h. Verify cell fit and element alignment.
i. Verify racking mechanism operation.
j. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
k. Record as-found and as-left operation counter readings.

2. Electrical Tests:

a. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to ground with switch closed, and across open poles. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS, Table 100.1. Insulation-resistance values must be in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Values of insulation resistance less than Table 100.1 or manufacturer's published instructions must be investigated.
b. Measure contact resistance across power contacts of circuit breakers. Drop values for μΩ or mV(dc) may not exceed high levels of normal range as indicated in manufacturer's published data. In absence of manufacturer's published data, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
c. Determine long-time pickup and delay by primary current injection. Long-time pickup values must be as specified, and trip characteristic may not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors. If manufacturer's curves are unavailable, trip times may not exceed value shown in NETA ATS, Table 100.7.
d. Determine short-time pickup and delay by primary current injection. Short-time pickup values must be as specified, and trip characteristic may not exceed manufacturer's published time-current tolerance band.
e. Determine ground-fault pickup and delay by primary current injection. Ground-fault pickup values must be as specified, and trip characteristic may not exceed manufacturer's published time-current tolerance band.
f. Determine instantaneous pickup value by primary current injection. Instantaneous pickup values must be as specified and within manufacturer's published tolerances. In absence of manufacturer's published data, comply with NETA ATS, Table 100.8.
g. Test functions of trip unit by means of secondary injection. Pickup values and trip characteristic must be as specified and within manufacturer's published tolerances.
h. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of shunt trip and close coils must comply with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.20.
i. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
j. Verify correct operation of auxiliary features, such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free operation, antipump function, and trip-unit battery condition. Reset trip logs and indicators. Auxiliary features must operate in accordance with manufacturer's published data.
k. Verify operation of charging mechanism. Charging mechanism must operate in accordance with manufacturer's published data.

D. Collect, assemble, and submit test and inspection reports. Record as-left set points of adjustable devices.

E. Infrared Inspection: Perform survey during periods of maximum possible loading. Remove covers prior to inspection.

1. Instrument: Inspect distribution systems with imaging equipment capable of detecting minimum temperature difference of 1 deg C at 30 deg C.
2. Record of Infrared Inspection: Prepare certified report that identifies testing technician and equipment used and that lists results as follows:

    a. Description of equipment to be tested.
    b. Discrepancies.
    c. Temperature difference between area of concern and reference area.
    d. Probable cause of temperature difference.
    e. Areas inspected. Identify inaccessible and unobservable areas and equipment.
    f. Identify load conditions at time of inspection.
    g. Provide photographs and thermograms of deficient area.

3. Act on inspection results in accordance with recommendations in NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.
    a. Follow-up Infrared Scanning: Perform additional follow-up infrared scan of switches 11 months after date of Substantial Completion.

3.3 DRY-TYPE TRANSFORMERS

A. Field Quality Control
1. Testing Agency: Engage a qualified independent testing agency to perform field quality-control testing.
2. Test Objectives: To ensure transformer is operational within industry and manufacturer's tolerances, is installed according to the Contract Documents, and is suitable for energizing.
3. Test Labeling: On satisfactory completion of tests for each transformer, attach a dated and signed "Satisfactory Test" label to tested component.
4. Schedule tests and provide notification at least 7 days in advance of test commencement.
5. Report: Submit a written report of observations and tests. Report defective materials and installation.
6. Tests: Include the following minimum inspections and tests according to manufacturer's written instructions. Comply with IEEE C57.12.91 for test methods and data correction factors.
    a. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.
    b. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, if not available, those specified in UL 486A and UL 486B.
    c. Insulation Resistance: Perform megohmmeter tests of primary and secondary winding to winding and winding to ground.
        1) Minimum Test Voltage: 1000 V, dc.
        2) Minimum Insulation Resistance: 500 megohms.
        3) Duration of Each Test: 10 minutes.
        4) Temperature Correction: Correct results for test temperature deviation from 20 deg C standard.

7. Test Failures: Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements.

B. Cleaning
1. On completion of installation, inspect components. Remove paint splatters and other spots, dirt, and debris. Repair scratches and mars on finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.4 PANELBOARDS

A. Field Quality Control
1. Prepare for acceptance tests as follows:
   a. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuits.
   b. Make continuity tests of each circuit.
2. Testing Agency: Provide services of a qualified independent testing agency to perform specified testing.
3. Testing: .
   a. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
4. Infrared Scanning: Perform an infrared scan of each panelboard. Remove fronts to make joints and connections accessible to a portable scanner.
   a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scanning of each panelboard 11 months after date of Substantial Completion.
   b. Instrument: Use an approved infrared scanning device designed to measure temperature or detect significant deviations from normal values. Provide calibration record for device used.
   c. Record of Infrared Scanning: Prepare a certified report identifying panelboards checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

B. Cleaning
1. Inspect interior and exterior of panelboards. Remove dirt, and debris.

3.5 ENCLOSED DISCONNECTS AND CIRCUIT BREAKERS

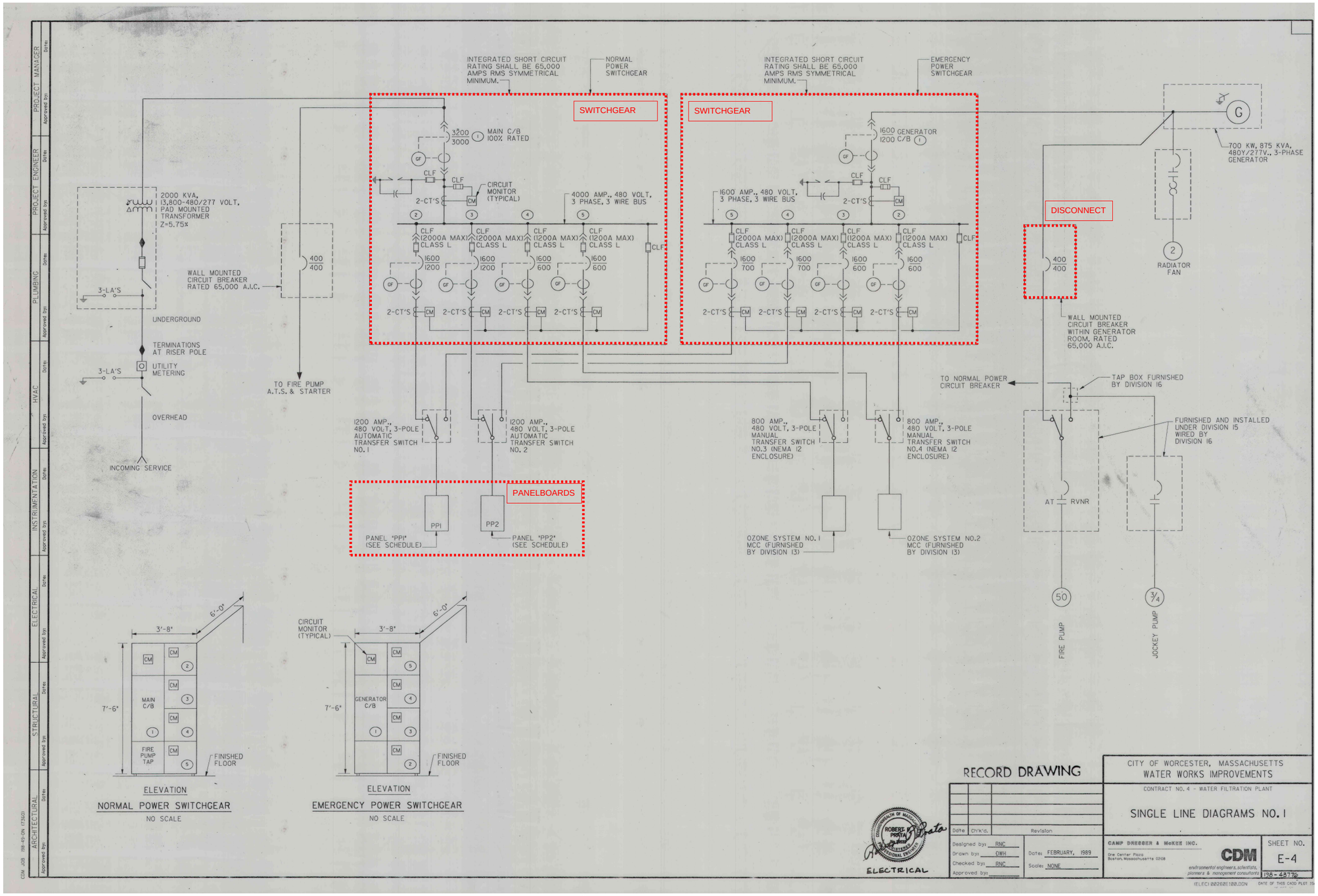
A. Field Quality Control
1. Testing Agency: Provide the services of a qualified independent testing agency to perform specified field quality-control testing.
2. Testing.
   a. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for disconnect switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

B. Cleaning
1. Inspect exposed finish. Remove dirt, and debris.

APPENDIX

SKE-01 EXISTING ELECTRICAL DIAGRAM

SKE-02 EXISTING PANEL SCHEDULES



FITZEMEYER & TOCCI ASSOCIATES, INC
300 Unicorn Park Drive, 5th Floor
Woburn, Ma 01801
(P) 781.481.0210 (F) 781.481.0203

Owner:

CITY OF WORCESTER

Project Name:

Worcester-MA Filtration Plant
Electrical Testing

Worcester, MA

Rev.	Description	Date

Reference drawing

Drawing Title:

Existing Electrical Riser

Project Number	210538.14	Drawing No.	SKE-01
Date	01/10/2025		
Drawn By	LL		
Checked By	MP	Scale	NTS

LOCATION: ELECTRICAL RM. 116
ENCLOSURE: NEMA 1

PANEL PP2

SERVICE: 480 VOLT, 3 PH., 3 WIRE — 1200 A. MAINS
MOUNTING: SURFACE — LUGS ONLY

CKT. NO.	EQUIPMENT	LOAD FLA	LOAD HP	CKT. BKR. POLES	CKT. BKR. TRIP	REMARKS
1						OMITTED
2	MOTOR CONTROL CENTER NO.2	323		3	600	
3	MOTOR CONTROL CENTER NO.4	35		3	100	
4	FLOCCULATOR PANEL 'FPB'	10		3	30	
5	DUPLEX SUMP PUMPS NO.2		2@¾	3	15	
6	MOTOR CONTROL CENTER NO.6	83		3	200	
7	SILO AND CHUTE VIBRATORS		1	2	20	
8	SLAKER NO.2	1.5	½&¼	3	20	
9	ENGINE HEATER	4.8		3	15	4 KW
10	HEAT PUMP NO.5			3	30	8.5 KW
11	MOTOR CONTROL CENTER NO.8	115		3	200	
12	HEATER "EUH-1"			3	20	5KW, ST ON ATS-2
13	WATER BOOSTER PUMPS	84	4@15	3	100	
14	UNINTERRUPTIBLE PWR. SUPPLY	16		3	20	UPS
15	30 KVA TRANSFORMER "T3"	36		3	45	LPC
16	37.5 KVA TRANSFORMER 'T5'	45		3	60	LPF
17	15 KVA TRANSFORMER "T7"	18		3	25	LPH
18	30 KVA TRANSFORMER "T9"	36		3	45	LPJ
19	50 KVA TRANSFORMER "T11"	60		3	80	LPL
20	9 KVA TRANSFORMER "T13"	18		3	25	LPN
21	15 KVA TRANSFORMER "T15"	18		3	25	FP2
22	SHOP HOIST		½&½	3	20	
23	SPARE			3	20	
24	SPARE			3	20	

NOTE: THIS PANEL SHALL CONSIST OF TWO I-LINE TYPE PANELS, EACH WITH 63 INCHES OF BKR. MTD. SPACE

ST - SHUNT TRIP

LOCATION: ELECTRICAL RM. 116
ENCLOSURE: NEMA 1

PANEL PP1

SERVICE: 480 VOLT, 3 PH., 3 WIRE — 1200A. MAINS
MOUNTING: SURFACE — LUGS ONLY

CKT. NO.	EQUIPMENT	LOAD FLA	LOAD HP	CKT. BKR. POLES	CKT. BKR. TRIP	REMARKS
1						OMITTED
2	MOTOR CONTROL CENTER NO. 1	328		3	600	
3	MOTOR CONTROL CENTER NO.3	43		3	100	
4	FLOCCULATOR PANEL "FPA"	10		3	30	
5	DUPLEX SUMP PUMPS NO. 1		2@¾	3	15	
6	MOTOR CONTROL CENTER NO.5	69		3	200	
7	LIME FILL PANEL		3&½	3	20	
8	SLAKER NO. 1	1.5	½&¼	3	20	
9	ELEVATOR	21	15	3	40	
10	HEAT PUMP NO.4			3	20	6.6 KW
11	MOTOR CONTROL CENTER NO.7	61		3	200	
12	DUPLEX SUMP PUMPS NO.3		2@¾	3	15	
13	GLYCOL CHILLER "CH-1"			3	30	14KW, ST ON ATS-1
14	LABORATORY AIR COMPRESSOR		1	3	15	
15	HOLDEN RESERVOIR	11.5		3	100	
16	NONIONIC POLY MIX SYSTEM	5		3	20	
17	37.5 KVA TRANSFORMER "T2"	45		3	60	LPB
18	30 KVA TRANSFORMER "T4"	36		3	45	LPD
19	15 KVA TRANSFORMER "T6"	18		3	25	LPG
20	30 KVA TRANSFORMER "T8"	36		3	45	LPI
21	15 KVA TRANSFORMER "T10"	18		3	25	LPK
22	15 KVA TRANSFORMER "T16"	18		3	25	FPI
23	AIR COMPRESSOR		1	3	30	
24	SPARE			3	30	

NOTE: THIS PANEL SHALL CONSIST OF TWO I-LINE TYPE PANELS, EACH WITH 63 INCHES OF BKR. MTD. SPACE

ST - SHUNT TRIP

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Owner: CITY OF WORCESTER

Project Name: Worcester-MA Filtration Plant
Electrical Testing

Worcester, MA

Rev.	Description	Date

Reference drawing

Drawing Title: Existing Panel Schedules

Project Number	210538.14
Date	01/10/2025
Drawn By	LL
Checked By	MP

Drawing No. SKE-02

Scale NTS