SECTION 11306
WELL PUMP AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Provide and test well pump, motor, variable frequency motor controllers and appurtenances as indicated and specified.

1.02 REFERENCES:

A. American Bearing Manufacturers Association (ABMA):

1. 9-1990 (R2000): Load Ratings and Fatigue Life for Ball Bearings.
2. 11-1990 (R1999): Load Ratings and Fatigue Life for Roller.

B. American National Standards Institute (ANSI):

1. HI 1.6: Centrifugal Pump Tests.
2. HI 9.8: Pump Intake Design
3. S1.11: Standard Octave-Band and Fractional-Octave-Band and Digital Filters.

C. American Society for Testing and Materials International (ASTM):

1. A36: Standard Specification for Carbon Structural Steel.
2. A48: Standard Specification for Gray Iron Castings.
3. A53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
4. A743: Standard Specification for Castings, Iron-Chromium, Iron-Chromium Nickel, Corrosion Resistant, for General Application.
5. B148: Standard Specification for Aluminum-Bronze Sand Castings

D. Hydraulic Institute: Current Standards.

E. National Electrical Manufacturers Association (NEMA):

1. MG1: Motors and Generators.

1.03 SUBMITTALS:

A. Submit the following shop drawings:

1. Data regarding pump and motor characteristics and performance:

a. Prior to fabrication and testing, provide guaranteed performance curves based on actual shop tests of mechanically duplicate pump, showing it meets indicated and specified requirements for head, capacity, horsepower, efficiency and NPSHr.

(1) For units of same size and type, provide curves for a single unit only.

b. Provide catalog performance curves at maximum pump speed indicated and specified for each service showing maximum and minimum impeller diameters available, acceptable operating range (AOR) and preferred operating range (POR).

c. Results of shop performance tests as specified.

d. Submit curves for guaranteed performance, and shop performance tests on 8-1/2-inch by 11-inch sheets, one curve per sheet.

2. Characteristic curves for variable speed pumps for maximum pump speed and for speeds required to obtain minimum pump flow and head conditions specified and indicated. Identify curves by speed and provide all curves on one sheet. Provide $NPSH_r$ curve for each speed.

3. Shop drawing data for accessory items.

4. Manufacturer's literature as needed to supplement certified data.

5. Operating and maintenance instructions and parts lists.

6. Shop and field inspection reports.

7. Pump shop test results.

8. Motor shop test results.

9. Qualifications of field service engineer.

10. Shop and field testing procedures, pump and piping set up, equipment to be used and ANSI/HI testing tolerances to be followed.

11. Material Certification:

a. Provide certification from the equipment manufacturer that the materials of construction specified (or proposed if different) are recommended and designed for the service conditions specified and indicated.

B. A copy of the contract drawings, with addenda that are relative to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with "No changes required" or provide a statement that no changes are required.

C. A copy of this specification section check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.

1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.

1.04 SPARE PARTS:

A. Provide all manufacturer's recommended spare parts for equipment supplied.

1.05 QUALITY ASSURANCE:

A. Pump shall be manufacturer's standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.

B. Welding: In accordance with latest American Welding Society Code or equivalent.

C. Shop tests as specified.

D. Contractor shall obtain the pump, motors, discharge column, discharge head, suction can and appurtenances from the pump manufacturer, as a complete and integrated package to insure proper coordination and compatibility and operation of the system.

1. Variable frequency motor controller can be supplied by Contractor or the pump manufacturer at the Contractor's option. The pumping system must be a complete and integrated package to insure proper coordination and compatibility and operation of the system.

E. Provide services of qualified Service Technician, specifically trained on type of equipment specified for up to 3 person-days of field services related to the following:

1. Service Technician must have a minimum of five (5) years of experience, all within the last seven (7) years, on the type and size of equipment.

2. Installation: Inspect grouting, location of anchor bolts; setting, leveling, alignment, field erection; coordination of piping, electrical and miscellaneous utility connection:

3. Functional/Performance Testing: Calibrate, check alignment and perform a functional test with water. Tests to include all items specified.

4. Vendor Training: Provide field operation and maintenance instruction to Owner's staff including all materials and preparation.

5. Any additional time required of the factory trained service technician to assist in placing the equipment in operation, or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to Owner.

F. Manufacturer of pumps shall have a minimum of five (5) operating installations with pumps of the size specified and in the same service as specified operating for not less than five (5) years.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION:

A. Pump capacities and operating data are indicated in the Pump Schedule.

2.02 PUMP MANUFACTURERS:

A. Submersible Well Pumps:

1. Franklin Electric.

2. Or Engineer approved equal.

2.03 PUMP CONSTRUCTION:

A. Pumps: Submersible well pumps, driven as indicated in the Submersible Pump Schedule.

B. Pump configuration as indicated in the Submersible Pump Schedule.

C. Design and proportion all parts of pump for the service specified and indicated.

D. Pumping assemblies, including pump, and motor, to operate within vibration and bearing temperature limits specified over the full operable range of the pump performance.

E. Provide room for inspection, repair and adjustment.

F. Equip pumping assemblies with all specified and required accessories, including lifting attachments and pressure gauges.

G. Apply a never seize compound to all bolts.

H. Pump Features:

1. Schaefer E-series
2. Pump Shaft: Stainless steel splined shaft
3. Windings: hermetically sealed windings
4. Stainless steel discharge and motor bracket
5. Ceramic bearing sleeve

I. Discharge Pipe:

1. Material: Steel ASTM A53 Grade B.
    a. Provide section lengths no longer than 10 feet-0 inches. Provide number of sections to allow pump settings as specified.
2. Provide pipe thickness in accordance with AWWA standard wall pipe.
3. Shaft coupling ASTM Type 416 stainless steel.
4. Hardware: Type 316 stainless steel.

2.04 PUMP MOTOR:

A. Provide as specified and indicated.

B. Horsepower rating of motors: Not less than maximum brake horsepower requirements of pump under any condition of operation specified and indicated without operating in the motor service factor.

C. Motor enclosure and motor speed: As indicated in the Pump Schedule.

D. Pump Motor Features:

1. Pump Shaft: Stainless steel splined shaft
2. Windings: hermetically sealed windings
3. Thrust bearing: Kingsbury-type thrust bearing
4. Exterior: Corrosion-resistant Stainless steel
5. Built in lighting arrestor
6. Pressure equalization diaphragm
7. CSA certified
8. Nema standard mounting dimensions
9. UL 778 recognized North American voltages

E. Provide bearing with a minimum B-10 life of 100,000 hours.

F. Operate without overheating at the speeds specified and indicated.

G. Service Factor: 1.5, with 1.0 inverter duty rating for pumps equipped with variable frequency motor controllers.

H. Premium efficiency with nominal and minimum efficiencies per NEMA MG1.

I. Rating: 230 Volt, 60 Hertz.

J. Site Altitude: Less than 3,300 feet above sea level.

K. Motor Construction:

1. Submersible type to drive the specified pump continuously over the complete operating range of head capacity without the pump load exceeding the motor nameplate rating.

2. Winding wire: Copper conductors. Only re-windable motor designs will be accepted.

3. Provide motor designed to include the capability to carry continuously, the total sum of the weight of the rotating components of the pump and motor, and the hydraulic thrust that the pump may develop.

a. Motor thrust bearing to be Kingsbury style with stainless steel shoes running against a carbon graphite, steel encased disc.

b. Bearing to be capable of running in either direction.

c. Rotor Radial bearings will be of carbon graphite or cutless rubber design.

4. Power cable assembly:

a. Pump/motor manufacturer to supply a power cable assembly sized in accordance with NEC specifications. Provide sufficient length of cable from the pump to a junction box as indicated.

b. Motor leads: Assembly directly connected to the motor windings. Plug-in leads are not acceptable.

5. Provide pumps and motors with written 5-year manufacturer's warranty against defects in materials and workmanship for all equipment supplied, including specific schedule of the manufacturer's terms, covering both parts and labor.

2.05 PUMP HARDWARE:

A. Material: Type 316 stainless steel.

2.06 SHOP TESTING:

A. Pump Tests:

1. Provide certified performance tests as specified herein.

2. Certified performance testing.

a. Test pumps assembled with a nominal minimum of 10 feet of column.

b. Run pump at full speed rating point for 60 minutes prior to start of any testing.

c. Full speed tests:

(1) Test pumps at the conditions specified and indicated and take not less than seven operating points between shut-off and run out. Test points must be at the conditions specified and indicated.

(2) Take readings to determine flow, differential pressure, rpm, horsepower, and efficiency.

(3) Operate each pump for not less than one hour and take readings to determine that the pump will operate as specified and indicated without cavitation at the specified minimum head condition with not more than the specified NPSH available. Test with the job submergence as indicated.

d. Variable speed tests:

(1) Conduct tests as specified above for full speed at reduced speeds except that tests for cavitation at run out are not required.

(2) Run one speed test at speed required to discharge the minimum rating point specified and indicated with one point of test at the minimum rating point.

(3) Run a second test at a speed approximately midway between full and minimum speed.

(4) Run addition tests for each reduced speed operating condition specified and indicated.

e. Factory tests on pumps:

(1) Use factory calibrated test drives.

3. Run all tests in accordance with the latest standards of the Hydraulic Institute and as specified.

4. Testing Tolerances

a. ANSI/HI 1.6 Acceptance Level A.

b. Tolerance: Pump test results shall be judged at rated rate of flow and rpm with designed total head and efficiency as defined by ANSI/HI 1.6 for the pump conditions specified and indicated.

5. Correct or replace promptly all defects or defective equipment revealed by or noted during tests at no additional cost to Owner.

2.07 FLEXIBLE DROP PIPE

A. The flexible 2-inch drop pipe shall be a Boreline type as manufactured by Hosesoultions Inc. of Scottsdale Arizona.

2.08 VARIABLE FREQUENCY MOTOR CONTROLLERS (VFD)

A. Variable Frequency Motor Controller shall be a P-series Titan Large Drive Model Number C4/1ED000GYX-F-001 as manufactured by Franklin Electric compatible with the well pump.

B. Contractor shall coordinate with Variable Speed Controller manufacture to provide the correct size VSC for this application.

C. VFD shall be installed in a NEMA 4X enclosure inside the valve vault.

2.09 INSERTION MAGMETER

A. Insertion Magmeter shall be manufactured by Global Water of Gold River California.

B. Insertion Magmeter features shall be Order Number EX81P for pipe 1 inch to 4inch

C. The installation fittings shall be Order Number EF81T-S-200 302 SS tee for 2 inch pipe diameter.

D. Insertion Magmeter shall have Pulse to 4-20 mA Output and Wall Mounted Display.

E. The Magmeter shall be provided with a flow volume totalizer capable of reporting flow data in a range of time intervals, as required by the Owner, including; gallons per minute, gallons per day, gallons per week, and gallons per month.

2.10 SUBMERSIBLE PRESSURE TRANSDUCER

A. Submersible pressure transducer shall be model WL400 Water Level Sensor as manufactured by Global Water (a xylem brand) and have a specified water level range of 30 inches and shall be provided with a WLEXC Extra Cable Option to facilitate a non-spliced cable. Contractor to coordinate length of cable with manufacture of Transducer. Splices of the transducer cable is not acceptable.

2.11 WELL PUMP CONTROLS

A. Control Description

1. The pump controls shall be located in the Pump Control Panel and shall operate the pump to maintain the well liquid level between adjustable operating limits.

2. Starting and stopping of the well pump shall be accomplished by the level sensor for primary start and stop levels.

3. A Hand-Off-Auto (HOA) switch shall be used to energize the pump control panel. In Hand mode the pumps will start, overriding the level control device. This mode is for pump operation testing only. The Off mode will disable the pump controls. The Auto mode will allow the pump to operate if the level sensor indicates the water level is above a pre-set level that will be set during pump start-up operations.

4. The pump controller will have an operation timer in the range from 1- hour to 999 hours to enable the pump to run on automatic mode while the water level in the wells is within the acceptable range. Once the timer has run down to zero time remaining the pump will be deenergized until the timer is reset.

2.12 WATER METER VALVE VAULT

A. Water meter vault shall be sized as indicated on the drawings.

B. Vault to have a non-draining J-AL style double leaf hatch sized 36 inch by 60 inch cast into the top section of the vault as manufactured by the Bilco Company.

C. Vault to have aluminum ladder meeting OSHA requirements and mounted to the inside of the vault with stainless steel expansion anchors as recommended by the manufacture of the ladder in coordination with the vault precaster.

2.13 WATER LINE AIR CONNECTION FITTING

A. The Contractor shall install an air line fitting as approved by the City in the Valve vault on the water line where indicated on the contract drawing to facilitate winterization of the water line.

2.14 PITLESS WELL ADAPTER

A. Install weld-on pitless well adapter to be fixed to the 8-inch diameter well casing at a depth of approximately five feet below the ground surface.

2.15 HIGH-DENSITY POLYETHYLENE WATE PIPE

A. The High-Density Polyethylene water pipe shall be DR-9 (200psi) I.P.S. meeting the requirements of AWWA C901 and the City of Worcester standards as manufactured by JM Eagle.

2.16 COPPER WATER PIPE

A. Copper water pipe shall by type k meeting the requirements of ASTM B88 and AWWA C800.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install items in accordance with shop drawings, manufacturer's printed instructions and as indicated.

3.02 FIELD TESTING:

A. Test piping connections to prove the discharge nozzle are installed with the pipe in a free supported state and without need to apply vertical or horizontal pressure to align piping with pump nozzles. This must be performed and the piping acceptable prior to any field performance testing.

B. Field testing will not be conducted without an accepted procedure, calibration certificates for all testing equipment, gauges and flow meters and a completed and signed pretesting check list.

C. After installation of pumping equipment, and after inspection, operation, testing and adjustment have been completed by the manufacturer’s field service technician, conduct running test on pump in presence of Engineer to determine its ability to operate within the

vibration and temperature limits specified, and to deliver its rated capacity under specified conditions.

1. During tests, observe and record head, capacity, pump bearing housings and motor bearing temperature, noise and vibration and motor inputs.
    a. Provide vibration signature test data for each pump and drive assembly.
        (1) Limit: 50% of ANSI/HI allowable limits.
    b. Bearing Temperature: Bearing temperature not to exceed 180 degrees F.
    c. Test Duration: Determined by Engineer but not less than three (1) hours of continuous operation at each condition specified and indicated.
2. Immediately correct or replace all defects or defective equipment revealed by or noted during tests at no additional cost to Owner.
3. Repeat tests until specified results are obtained.
4. Contractor to provide all water labor, piping, equipment, flow meters and test gauges for conducting tests.
    a. Contractor shall provide calibrated test gauges for all permanently installed gauges and portable calibrated flow meters for all pumping systems even in those cases where permanent flow meters are installed.
    b. All calibrations must be within 30 days of the field testing.
    c. The testing will not be started and will not be accepted until the calibrated testing equipment stated above is operational and all certifications have been submitted.

D. Make all adjustments necessary to place equipment in specified working order at time of above tests.

E. Remove and replace equipment at no additional cost to Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to the satisfaction of Owner that equipment will perform the service specified, indicated and as submitted.

END OF SECTION
SEE ATTACHED SUBMERSIBLE PUMP SCHEDULE

# SUBMERSIBLE PUMP SCHEDULE

## PUMP DESIGN

| PUMP TAG NO. | DESIGN CAPACITY (GPM) | FULL SPEED DESIGN RATING POINT HEAD (FT.) | FULL SPEED SECOND RATING POINT HEAD (FT.) | FULL SPEED THIRD RATING POINT HEAD (FT.) | MINIMUM SHUTOFF HEAD, (FT.) | BASIS OF DESIGN |
|---|---|---|---|---|---|---|
| WELL TW-1 | 60 | 45 @ 60 GPM | 55 @ 50 GPM | 62 @ 40 GPM | 92 | Schaefer E-Series 60LE07S4-PE |

## MOTOR

| PUMP TAG NO. | HP | SPEED | ENCLOSURE | DRIVE TYPE | BASIS OF DESIGN | REMARKS |
|---|---|---|---|---|---|---|
| WELL TW 1 | 3/4 | 3450 | Hermetically Sealed | DIRECT | Franklin. Model: 234 512 92--S | VARIABLE FREQUENCY DRIVE CONTROLLER |

END OF SECTION