

SECTION 11317

SUBMERSIBLE WELL PUMP

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope

1. Furnish and install one multi-stage vertical turbine submersible well pump for the potable water system water well: SWP-1
2. Provide electric motor, coupling, motor shroud, SWP-1, column pipe, power cable and all other appurtenances
3. Pump to be water lubricated by fluid being pumped

B. Additional Requirements Specified Elsewhere

1. Section 01340: Shop Drawings, Product Data and Samples
2. Section 01400: Quality Control
3. Section 01600: Materials and Equipment
4. Section 01730: Operating and Maintenance Data
5. State Board of Examiners of Water Well Construction and Pump Installation Contractors; "Rules and Regulations for Water Well Construction, Pump Installation, Cistern Installation and Monitoring and Observation Hole/Well Construction" (Water Well Construction Rules), January 1, 2005

C. Related Requirements Specified Elsewhere

1. Section 02670: Well Construction
2. Section 15060: Pipe and Pipe Fittings
3. Section 15410: Miscellaneous Meters
4. Division 16: Electrical

D. Definitions

1. Definitions of terms and other hydraulic considerations as set forth in the Hydraulic Institute Standards

1.2 QUALITY ASSURANCE

A. Design Basis

1. Red Jacket Pumps
2. Goulds
3. Grundfos
4. Equivalent products of other manufacturers may be accepted subject to compliance with design, function, materials and performance of the specified items
5. Design equipment: Grundfos Model 5SQ05-90

B. Reference Standards

1. Hydraulic Institute Standards
2. Colorado State Board of Examiners of Water Well and Pump Installation Contractors
3. Colorado Department of Public Health and Environment
4. Pikes Peak Regional Building Code
5. Should the Contractor observe the Drawings or Specifications are at variance with these regulations and standards, the Contractor should give written notice thereof to the Engineer before proceeding with the Work

C. Contractor Qualifications

1. Must hold current Colorado Pump Installation Contractor's License and Board Certification

1.3 SUBMITTALS

A. In accordance with Section 01340

B. Shop Drawing and Product Data

1. Submit complete fabrication, assembly and installation drawings
2. Submit detailed specifications and data describing materials, parts, devices and accessories
3. Pumps
 - a. Name of manufacturer
 - b. Type and model
 - c. Rotative speed
 - d. Size of discharge nozzle
 - e. Type of bearings
 - f. Net weight of pump only
 - g. Complete performance curves showing capacity versus head, NPSH required, pump and overall efficiency, and brake horsepower
 - h. Type of couplings
 - i. Data on shop painting
4. Motors
 - a. Name of manufacturer
 - b. Type and model
 - c. Rated size of motor (hp)
 - d. Motor service factor
 - e. Type of bearings and lubrication
 - f. Temperature rating
 - g. Full load rotative speed
 - h. Net weight
 - i. Efficiency at full load and rated pump conditions
 - j. Full load current
 - k. Locked rotor current
 - l. Dimensions of motor and pump assemblies

C. Test Reports

1. Submit copies of field test reports
2. Reports shall include
 - a. Test log
 - b. Description of test procedure, equipment and setup
 - c. Performance curves, plotted against capacity
 - 1) Head
 - 2) Brake horsepower
 - 3) Efficiency
 - 4) Net positive suction head available
 - d. Plot curves to be easily read at scales consistent with the performance requirements

D. Certification of Compliance

1. Manufacturer's affidavit of compliance certifying
 - a. All tests have been performed
 - b. All equipment and materials comply with these specifications
 - c. Pumps have been properly installed and are operating within specification tolerances

E. Operating and Maintenance Manuals in Accordance with Section 01730

1.4 JOB CONDITIONS

A. Submersible Well Pump: SWP-1

1. Pumped liquid
 - a. Ground water from water well
 - b. Altitude: 5400' above sea level
 - c. Temperature range: 50° - 80°F
 - d. Solids concentration: Less than 0.1%

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN REQUIREMENTS

A. General

1. Stable and free from cavitation and noise throughout the specified operating head range
2. Design based on a wearing ring diametrical clearance which is the greater of 0.012" or 1 mil/inch of wearing ring diameter
3. Minimum hydrostatic test pressure: 1.5 x shutoff head plus suction pressure
4. Design based on a running clearance between the impeller and the bowl of at least 0.015 inches
5. Performance requirements based on previously reported liquid characteristics and elevation
6. Pumping unit designed so that reverse rotation due to reverse flow at rated head will not cause damage

B. Submersible Well Pump: SWP-1

1. Number of units: 1
2. Configuration: Vertical
3. Rated total head: 90'
4. Capacity at rated head: 5 gpm
5. Minimum shutoff head: 140'
6. Maximum shutoff head: 200'
7. Normal operating head range: 90' - 125'
8. Minimum capacity at high end of operating head range: 2 gpm
9. Maximum capacity at low end of operating head range: 5 gpm
10. Maximum pump operating speed: 3,600 rpm
11. Maximum bhp required at input shaft of pump for any point in the operating head range: 0.5
12. Maximum motor nameplate horsepower: 0.5 hp
13. Maximum required NPSH at the centerline of the lowest impeller at any point in the operating head range: 20'

- C. Final pump performance and design requirements will be based on well test pumping results. Pump requirements will not exceed those specified herein and required pump capacities may be reduced

2.2 MATERIALS

A. Submersible Well Pump: SWP-1

1. Casing: Stainless steel
2. Diffuser: Noryl or polyamide
3. Casing wear ring: Stainless steel
4. Impeller: Noryl or polyamide
5. Shaft: Stainless steel
6. Bearings: Anti-friction, heavy-duty
7. Centralizing spiders: Black rubber

2.3 FABRICATION AND MANUFACTURE

A. Casing

1. Permits removal of the diffuser cartridge from the shell
2. Provides NPT tapped discharge assembly with integral check valve

B. Impeller

1. One piece casting completely machined on all exterior surfaces
2. Statically balanced
3. Enclosed type with at least two ports
4. Keyed and locked to shaft or floating keyed type
5. Uniform sections and smooth surfaces free from obstructions, cracks and porosity on interior water passages

C. Shaft and Shaft Sleeves

1. Shaft completely machined
2. Total shaft runout less than 0.002"
3. Wear ring positively locked in place

D. Wearing Bearings

1. Provide renewable wearing rings in diffuser casing
2. Design clearance at least 1 mil/inch of ring diameter
3. Wear ring positively locked in place

E. Bearings

1. Anti-friction type
2. Rated for maximum shaft speed

F. Coupling

1. Splined stainless steel motor/pump shaft coupling
2. Pump and motor are close coupled

G. Pump/Motor Adapter

1. Adapter between the pump frame and motor shall have registered fits
2. Adapter shall be capable of transmitting motor load to pump support structure

H. Balance

1. Accurately machine all rotating parts
2. Place pump in as near perfect rotational balance as practicable
3. Equipment which vibrates excessively will be rejected
4. The mass of the unit and its distribution shall be such that resonance at any operating speed is avoided
5. Limits
 - a. Maximum peak to peak vibration displacement at any point on the machine:
3.0 mils
 - b. Ratio of rotative speed to critical speed of unit or components: Less than 0.8
or more than 1.3

I. Motor

1. Submersible well pump motor
2. 240 V, 1 phase, 60 Hz, 3 wire
3. Service factor 1.15 minimum
4. Designed and applied in compliance with NEMA, ANSI, IEEE and AFBMA standards
5. Constant speed water lubricated
6. Stators to be hermitically sealed
7. Stator windings: Epoxy resin encapsulated
8. Cable leads

- a. Exit motor by a removable water block lead assembly
- b. Lead assembly field replaceable
- c. Cable leads of sufficient length so the splice with drop cable can be made above pump

J. Check Valve

1. Furnished and installed as part of metering assembly
2. Refer to Specification Section 02641

K. Motor Shroud

1. PVC construction
2. Sealed above the pump intake to force all pumped water by the motor
3. Provide centering device at end of motor

L. Pump Column

1. Fabricated from Schedule 40 galvanized steel pipe or Schedule 80 polyvinyl chloride, size as indicated on the Drawings
2. Column pipe sections no longer than 20'
3. Column pipe and couplings shall be secured to prevent unthreading during normal operation
4. Each connection shall be coated with a thread lubricant approved for use in potable water systems
5. Contractor shall furnish all fittings necessary to adapt the column pipe to the pump discharge and pitless adapter
 - a. Adapters shall be of the swedge type, threaded at both ends and of equal or better steel material than that specified for the column pipe
6. Column pipe centralizing spiders shall be furnished and installed at intervals not to exceed 20'. The first centralizing spider shall be installed approximately 2' above the pipe

M. Submersible Pump Cable

1. One continuous length from pump motor to pitless adapter junction box
 - a. Five additional feet of cable shall be housed in the pitless adapter
 - b. Provide no less than 20 feet of power cable outside of pitless junction box for connection to local control panel with motor starter
2. Power cable shall be properly sized for the installation by the motor manufacturer but shall not be less than No. 14
3. Power cable shall be 3-conductor copper insulated for 600 VAC with rubber, synthetic rubber or acceptable plastic insulation suitable for continuous immersion in water
 - a. All conductors shall be enclosed in an overall jacket material that is impervious to oil and water and made from rubber or synthetic rubber
 - b. Fill material shall be non-hydroscopic; jute or hemp is not acceptable
4. Electrical conductors shall be protected by a stainless steel cable guard where they pass the pump bowl
 - a. The cable guard shall be secured to the pump with stainless steel hardware
5. Only one splice shall be permitted in the power cable

- a. This splice, at the motor terminal connections, shall be completed in a staggered manner so that no individual conductor splice shall be directly opposite another
- b. Conductors shall be joined with rosin core soldered steel butt connectors
- c. Insulating overlay shall be of rubber as manufactured by the 3M Company or Plymouth or shall be of submersible adhesive heat-shrink insulation as manufactured by Sigma Corp.
- d. Insulation shall be a minimum of 12" in length, overlaid with vinyl tape and "Scotch Kote" as manufactured by the 3M Company
- e. The splice shall be banded to the pump column with protected (rubber protector) stainless steel clamps and vinyl tape
6. Termination of the cable in the junction box shall be made with electrical split bolts and rubber tape
 - a. Each surface splice shall be overlaid with vinyl and "Scotch Kote"
 - b. Wire nuts are not acceptable
7. Power cable shall be secured to the pump column with vinyl tape at maximum intervals of 10'

N. Air Line

1. ¼" I.D. nylon air line, (2,000 psi burst pressure) shall be installed from the top of the pump bowl assembly and shall extend to the top of well cap
2. The air line shall be mounted to the air line fitting in the pitless unit
3. A brass Schrader air valve will be attached for access to purge the air line with an air compressor or tire pump
4. A 3½"-diameter pressure gauge will be attached with an accompanying ball valve for measurement of water above the pump bowl
 - a. Pressure gauge range: 0 - 30 feet
5. The air line shall be secured to the pump column pipe with vinyl tape at maximum intervals of 10 feet

O. Submersible Level Control for SWP-1

1. Pressure transducer
 - a. Accuracy: +0.25%
 - b. Diaphragm type: 316 stainless steel housing
 - c. Measurement range: 0-30 feet
 - d. Power/output: 24 VDC, 2-wire
 - e. Set transducer 1'-0" above pump (approximately 27' deep)
 - f. Cable: Minimum 50 feet
2. Meter
 - a. NEMA 4 enclosure, mounted next to well disconnect
 - b. Output: Two relays for well pump start and stop, adjustable settings
 - 1) Pump stop: One (1) foot above transducer
 - 2) Pump reset for pump run: Four (4) feet above transducer
 - c. 4-digit LED display
 - d. 120V supply from well pump panel, control transformer
 - e. Lightning and surge protection for signal/power to transducer
 - f. Lightning and surge protection for 120V power supply
3. Design basis: Ametek/Drexelbrook Well Watcher Model WWF-A-1-1
4. Alternative SWP-1 control

- a. Fixed electrodes for detecting excessive water drawdown requiring pump shutdown and reset relay probe for water level recovery
- b. Design basis: Ametek B/W Controls
 - 1) Wire suspension electrodes: Type E-1P
 - 2) Electrode material: Type 303 stainless steel
 - 3) Type SW suspension wire

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

- 1. Install pumping unit as indicated on the Drawings
- 2. Piping transitions and miscellaneous hardware required to complete the installation to be furnished and installed by Contractor to the satisfaction of the Engineer

B. Manufacturer's Instructions

- 1. Follow procedures and instructions as recommended by pump manufacturer and Hydraulics Institute unless they conflict with the Contract Documents
- 2. In case of conflict, notify Engineer in writing and obtain clarification prior to proceeding

C. Use procedures recommended by pump manufacturer and Hydraulics Institute

D. Level, plumb and align unit into position to fit connecting piping

E. Take special care to maintain alignment of components

F. No strain transmitted to the pump connections

G. Test pump column pipe connections for piping stresses after final alignment and connection to pump and pitless adapter

3.2 FIELD QUALITY CONTROL

A. Provide Manufacturer's qualified representative's field services

END OF SECTION