**SECTION 11200 - DOMESTIC WATER PACKAGED BOOSTER PUMPS**

# GENERAL

## SUMMARY OF WORK

### The contractor shall furnish and install two single-stage, double suction, horizontal split case pumping units as specified herein and shown on the contract drawings.

### The term "pumping unit" or "units" shall be defined as a pump complete with base plate, coupling, coupling guard, motor, and variable frequency drives if applicable.

### The pump manufacturer shall be responsible for supplying the complete pumping unit as defined above and shall assume complete system responsibility.

## RELATED WORK

### (Insert applicable sections of specifications and or drawings)

## CODES AND STANDARDS

### HI (Hydraulic Institute)

### ANSI (American National Standards Institute)

### ASTM (American Society of Testing and Materials)

### ISO 9001 (International Organization for Standardization)

### AFBMA (Antifriction Bearing Manufacturer's Association)

### NSF 61/372 National Sanitation Foundation

## SUBMITTALS

### Product Data

#### Prior to fabrication, pump manufacturer shall submit a digital copy of submittal data for review and approval.

#### Submittal shall include shop drawings, electrical ladder logic drawings, warranty information, and support data as follows: Catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and drive data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), net positive suction head required (NPSHr), and hydraulic brake horsepower (BHP). Electrical components used in the motor branch and SCADA System shall be fully described.

### Shop drawings shall provide layout of mechanical equipment and anchor bolt locations for equipment baseplate. The electrical ladder logic drawings shall illustrate motor branch and SCADA System circuits to extent necessary to validate function and integration of circuits to form a complete working system.

## QUALITY ASSURANCE

### To ensure unity of responsibility, the complete pump unit shall be supplied, tested, and warranted by the pump manufacturer.

### The equipment specified under this section is to be standard pumping equipment manufactured by a company with no less than fifteen year’s experience in the manufacture of such equipment. Upon request by the engineer, the manufacturer shall provide proof of such experience by providing installation lists, brochures, catalog cuts, etc.

### The manufacturer of the pump units shall have a quality management system in place and shall be ISO 9001 certified.

### Pumping units shall be manufactured by Patterson Pump Company or approved equal.

# PRODUCTS

## GENERAL

### The centrifugal double suction pumping units provided under this section shall be supplied by one manufacturer. The pump shall be Patterson 4x3 ME-A or approved equal. The motor shall be Weg NEMA three phase TEFC 50 HP motor or approved equal.

### Each pumping unit shall be provided with a stainless steel nameplate, which shall contain the following information:

#### Manufacturer's name, address, and telephone number

#### Model number

#### Serial number

#### Head, capacity and rpm at rated condition

#### Motor horsepower, rpm and frame size

### Pumping units within each type of service shall be identical in every respect with all parts being interchangeable.

### Pump rotating assemblies shall be balanced in accordance with the requirements of ANSI S2.19, G6.3.

### Vibration, when measured at the pump bearing housing shall not exceed the limitations specified by the Hydraulic Institute Standards.

## HYDRAULIC DESIGN CRITERIA

### Rated Condition:

#### Capacity = 601 US gpm

#### Head in Feet = 181 ft

#### Minimum Efficiency = 77%

#### Maximum NPSHr = 9 ft

### Secondary Condition

#### Capacity = 240 US gpm

#### Head in Feet = 199 ft

#### Minimum Efficiency = 54%

#### Maximum NPSHr = 2.93 ft

### Operating Characteristics

#### Shut-off Head = 201 ft

#### Maximum Brake Horsepower = 59 hp

#### Maximum Operating Speed = 1770 rpm

## DETAILS OF CONSTRUCTION

### Pump Casing

#### Pump casing shall be of close grain cast iron type ASTM A48, class 40, designed for heavy-duty service. The casing shall be horizontally split; single volute type with the suction and discharge flanges cast integrally with the lower half in order that the upper part may be removed for inspection of the rotating element without disturbing pipe connections or pump alignment. Pump mounting feet are to be cast integrally into the lower half casing with the mounting surface completely machined. The joint between halves of the casing shall be heavily flanged and bolted, and provided with dowel pins to insure accurate alignment. The upper half-casing flange shall have tapped holes for jackscrews. The interior shall be smooth and free from surface defects.

#### Thickness, diameter, and drilling dimensions of suction flanges shall be Class (125) ANSI standard. Discharge flanges shall be Class (125) ANSI standard. Pump casings shall have a minimum 4" suction and a 3" discharge. Casings shall be drilled and tapped for vertical priming, gauge, and drain connections. Suitable lifting lugs or eyebolts shall be provided.

### Impeller

#### Impeller shall be of the double suction enclosed type made entirely of ASTM B148 uns gr 95800 Nickel Aluminum bronze finish smooth all over and of ample strength and stiffness for maintaining the maximum capacity of the unit. Diameter of the impeller shall be 13.6875".

#### It shall be statically and dynamically balanced and shall be keyed to the shaft and securely held in axial position on the shaft by means of ASTM B505-954 bronze sleeves extended through the stuffing box. Rotation of the shaft sleeves shall be prevented by the impeller key, which shall extend beyond the impeller hub and into the shaft sleeve on both sides of the impeller. Shaft sleeves shall be held in position by a locking shaft sleeve nut located outside of the stuffing box and shall have an O-ring seal between the sleeve and the nut to prevent entrance of air or liquid between the shaft and sleeve. Sleeves, which are threaded on to the pump shaft, are not acceptable.

### Wear Rings

#### At the running joint between the suction and discharge chambers, there shall be provided wear rings on both the casing and impeller.

#### The casing rings shall be of ASTM A276 type 304 stainless steel, positioned in the casing and locked against rotation by the upper half of the case.

#### Impeller rings shall be of ASTM A276 type 304 stainless steel, so fastened that they cannot rotate or become loose when the pump is subjected to reversed rotation. The rings shall be made to limit gauges, so that they may be renewed without fitting.

### Pump Shaft

#### The shaft shall be of AISI 1141 and of such dimensions that the maximum combined stress due to bending and torsion shall not exceed 8,000 pounds per square inch under the most severe conditions of operation.

#### The shaft shall be accurately machined over its entire length. The first critical speed of the rotating assembly shall occur at not less than 150% of the rated speed.

#### Threads on the pump shaft shall be located outside of the stuffing box.

### Stuffing Boxes (Mechanically Sealed)

#### Stuffing boxes shall be provided with mechanical shaft seals.

#### Stuffing boxes shall accept packing or mechanical seals without modification to the stuffing box.

#### Mechanical seals shall be furnished with a carbon seal ring, ceramic mating ring, viton elastomers and 316 stainless steel metal parts.

#### Mechanical seals shall be rated for 250 PSIG pressure. The elastomers shall be rated for temperatures ranging from -20 degrees F to 400 degrees F.

#### Pump shaft sleeves shall be furnished with a pre-machined groove designed to accept a setting ring, which shall eliminate the need for set collars or stop collars. Seals requiring stop or set collars with set-screws are not acceptable.

#### The rotating seal ring shall be provided with a 360 degree rubber encasement to provide a positive drive for the seal face without the need for metal drive notches which may cause face distortion or notch wear. The seal rings shall be permanently fixed in place and full flatness maintained by a precision crimp in the outer seal case.

#### The mechanical seal shall be of a convoluted design which permits free movements providing constant adjustment for shaft endplay and seal face wear. Positive face contact with the stationary seat shall be maintained at all times.

#### To insure positive sealing by free movement of the seal head, the seal shall feature a hex style outer shell and drive band which shall absorb start-up and running torque and shall eliminate in stress on the diaphragm. Metal components shall freely engage and shall not be subject to lock down due to friction wear.

#### Suitably valved connecting lines or passages shall be provided on the upper half casing leading from the discharge volute to the stuffing box for lubricating the stuffing boxes with the liquid being pumped.

### Bearings

#### Bearings shall be of the anti-friction type grease lubricated ball.

#### The bearing configuration shall consist of one single row deep grooved anti-friction bearing on the inboard side and two single row deep grooved anti-friction bearings mounted back to back on the outboard side. The inboard bearing shall be designed to take the radial thrust loads. The outboard bearings shall be designed to take a combination of loads, both radial and axial; and hold the rotor in axial alignment.

#### Bearings shall have a minimum rated service life of 40,000 hours in accordance with the standards of the Bearings Manufacturers Association throughout the specified operating range. Bearings shall be mounted in dust tight housings shall be rigidly supported by suitable brackets, which shall be cast with integrally with the lower half or the pump casing. Bearing housings or bearing housing supports, which are bolted to the side of the pump casing, are not acceptable.

#### A deflector made of Aluminum shall be provided on the inboard and outboard ends of the pump shaft to prevent product from entering either bearing housing.

### Pump Base

#### The pump and motor shall be mounted on a common base of fabricated ASTM A36 steel. Bent metal or formed bases are not acceptable.

#### The base shall be provided with a coupling guard, and ample grout holes. (Drip lip rim available on request.)

#### All mounting surfaces shall have a machined finish.

### Couplings

#### The coupling shall be Martin Quadra-flex or approved equal with type S flanges and elastomeric sleeves of Hytrel, EPDM or similar material.

#### Sized to transmit the maximum required horsepower with a 1.5 service factor.

### Motor

#### The motor shall be a heavy-duty squirrel cage induction type, inverter duty rated, minimum NEMA Class F insulation, 1,800 RPM horizontal hollow shaft motor, equipped with Martin quadra-flex coupling sleeve to protect shaft in the event of reverse rotation. A thrust bearing of ample capacity to carry the weight of all rotating parts plus the maximum hydraulic thrust load under all conditions of operation shall be provided. The calculated L10 life shall be no less than 8,800 hours. Provision shall be made for momentary upthrust equal to 30% of the rated down thrust. The motor shall be premium efficiency, 1.15 service factor, power factor greater than 0.8, and suitable for use on 460 volt, three phase, 60 Hz electric service. The stator winding and lead shall be insulated with moisture-resistant Class H insulation for inverter duty in 40°C. The motor shall be designed as inverter duty rated capable of ten starts per hour. Automatic reset, normally closed thermal overloads shall be imbedded in the motor winding to provide overheating protection. Motor winding thermostats must be connected to an electric controller per local and state codes and the NEC.

#### Motor shall be equipped with a motor over temperature switch embedded in the motor windings.

#### Each motor shall meet the following requirements:

##### Rating

###### Voltage - 460V, for operation in a variable frequency drive arrangement. The motor shall be capable of operating in a nominal 460 volt, 3 phase, 60 hertz system.

###### Size - 50 horsepower, inverter duty rated, at 1800 rpm nominal full load speed

###### Maximum Full Load Current at rated voltage: 59 Amperes

###### NEMA Design - B

###### Insulation - Class F

###### Service Factor - 1.15

###### Power Factor - minimum 80% at full load

###### Premium Efficiency Design - in accordance with IEEE Standard 112 testing method B

###### Frame - 326T

## FACTORY TESTING

### Each pump shall undergo a certified hydrostatic test at 150% of the pressure developed at shut-off head.

### A certified performance test shall be performed on each unit utilizing its specified drive. If variable frequency drives are specified, one drive of each rating shall be shipped to the pump manufacturer's plant for testing as a complete unit.

### All tests shall be performed in accordance with the Hydraulic Institute Test Standards for Centrifugal Pumps - 1.6 (1988).

### Six evenly spaced test points shall be taken and shall include conditions at shut-off (zero flow) and the operating points specified herein. Preliminary test data must be submitted to the owner seven days prior to the actual test date.

### The engineer and/or a representative of the owner shall be given sufficient notice of the testing dates and shall have the opportunity to witness these test.

## WARRANTY

### The manufacturer of the pumping units shall provide a written warranty covering the entire pumping unit.

### The warranty shall be in effect for a period of one year after substantial completion. Components failing to perform as specified by the engineer, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer, and shall be acceptable to the Owner.

# EXECUTION

## EXAMINATION

### Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Manufacturer shall provide written instruction for proper handling. Immediately after off-loading, contractor shall inspect pumping unit for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all serial numbers and parts lists with shipping documentation. Notify the manufacturer's representative of any unacceptable conditions noted with shipper.

## INSTALLATION

### Install, level, align, and lubricate motor. Use shims and provide non-shrink grout packing of frame to achieve and maintain level and alignment. Contractor shall perform a laser alignment of motor to align shaft with the new pump shaft. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery. The horizontal and vertical tolerances for laser alignment shall be 0.003”.

### Pump and motor assembly shall be mounted on concrete block as specified in the drawings. Contractor shall furnish and install all piping and connections necessary. The Contractor shall be responsible for ensuring material compatibility and proper alignment of all connections.

### Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to station control panel.

### The pump and motor assembly shall be connected to the motor control center (MCC). Refer to electrical specifications for suggested sequence of construction.

### Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation with-out binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.

## FIELD TEST

### Prior to acceptance by owner, the contractor shall perform an operational test of new motor and pump by operating the motor and pump assembly for a period of 72 hours. During the 72-hour operational test, current and voltage of all phases shall be monitored and recorded, and the results presented to the owner for acceptance. The new motor shall also go through at least 6 start-stop iterations to ensure proper operation of all controls.

### Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

## FACTORY FIELD SERVICE

### The manufacturer of the pumping unit shall provide, at no additional cost to the owner, the services of a field service representative for a period of 2 days.

### The time specified shall require at least two trips to the project site. One trip for supervision during the installation of the units and one trip for operator training shall be provided.

END OF SECTION