

## **Queens Gap Water System Booster Pump Station Specifications**

### SCOPE OF WORK

The contractor shall furnish and install four (4) factory built, above ground water booster pump skids, with all the necessary piping, controls and appurtenances as shown on the plans and as specified herein. The manufacturer of this equipment shall be Mechanical Equipment Company, Canariis Corporation, or QuantumFlo, Inc.

Substitution of equipment by alternate manufacturers will be considered for pre-approval if the equipment proposed for substitution is demonstrably equal to or superior in quality and efficiency to the standards established in the specifications and this is demonstrated to the complete satisfaction of the Engineer and Owner. The manufacturer shall be one recognized and established in the design and production of water booster pump stations, shall maintain regular production facilities at their place of business and must be able to label the entire skid with a UL QCZJ-3UH2 packaged pumping system nameplate. The manufacturer's facilities shall be open for inspection by a representative of the engineer/owner/contractor at any time during the construction and testing of the equipment covered under these specifications.

Alternate manufacturers may be submitted for pre-bid approval in accordance with the pre-approval requirements listed in this specification. A pre-approval request must be made of the Engineer at least 10 days in advance of the bid date. A minimum of 5 days prior to the bid date, the Engineer will issue an addendum listing any manufacturers that have been pre-approved. The final bid form issued by addendum shall provide a blank space for contractors, at their option, to enter the amount of add/deduct that would result from the substitution of any of the allowed alternate manufacturer's equipment. Requests for post-bid approvals of alternate equipment will not be considered. The base bid will be calculated using equipment from Mechanical Equipment Company, Canariis Corporation or QuantumFlo, Inc., regardless of whether or not alternate manufacturers are pre-approved and eligible to be listed.

Acceptance, for bid purposes of the base bid manufacturers and any alternate manufacturers as pre-approved, in no way relieves any manufacturer of strictly adhering to the specification and submittal requirements.

### PRE-BID SUBMITTAL - ALTERNATE EQUIPMENT SUBSTITUTION

The pre-bid submittal shall be provided up to ten (10) days before the bid and shall include all necessary information to properly determine the acceptability of the proposed substitution and shall not necessarily be limited to the following:

- A. Pre-bid submittals will include a complete description of the equipment, system, process, or function, including a list of system components and

features, drawings, catalog information and cuts, manufacturer's specifications, including materials description.

- B. Pump material data, performance curves, horsepower requirements at design, and selected motor horsepower.
- C. Outside utility requirements, such as water, power, air, etc.
- D. Functional description of internal instrumentation and control supplied including list of parameters monitored, controlled, or alarmed.
- E. Addresses and phone numbers of nearest service centers and a listing of the manufacturer's or manufacturer's representatives services available at these locations, including addresses and phone numbers of the nearest parts warehouses capable of providing full parts replacement and/or repair services.
- F. A list of installation references where similar equipment by the manufacturer is currently in potable water service.
- G. Detailed drawings, full size 11" by 17" only, including plan and sectional views illustrating a design specific to this project and including, architectural, structural, mechanical, plumbing, electrical, control and instrumentation details necessary to adapt the equipment or systems to the arrangement shown and/or functions described on the drawings and technical specifications prepared for this project. The drawings shall be to scale and illustrate electrical NEC Code 110-26 clearances, pump centerlines, and minimum clear space between pumps.
- H. All differences between the specifications and the proposed substitute equipment shall be clearly stated in writing under the heading of "DIFFERENCES".

### SUBMITTAL

Equipment submittals shall be two (2) bound hard copies and two (2) CDs. The submittals shall contain a minimum of two (2) full size drawings, size 11" x 17"; one (1) each covering the booster pump station and the electrical control schematic. The booster pump station drawing shall be specific to this project, in at least three (3) different views, be to scale and illustrate the National Electrical Code (NEC) clearances per Section 110-26 of the Code. The submittal booklets will be complete with data sheets covering all individual components that make up the booster pump station.

## PUMP STATION REQUIREMENTS

Each pump station shall utilize one duplex booster pump skid as follows:

### PUMP STATION 1

Rated Capacity (per pump): 300 gpm at 381' total dynamic head  
Minimum Pump Efficiency at Rated Capacity: 68%  
Pump Manufacturer/Model/Size: Aurora 423 2.5x3x12A  
Pump Operating Speed: 3500 rpm, constant  
Maximum Motor Size: 60 hp  
Power Supply: 60 hz, 3-phase, 460 Volts

### PUMP STATION 2

Rated Capacity (per pump): 150 gpm at 270' total dynamic head  
Pump Manufacturer/Model/Size: Aurora 413 2x2.5x9  
Minimum Pump Efficiency at Rated Capacity: 59%  
Pump Operating Speed: 3500 rpm, variable, using variable frequency drive  
Maximum Motor Size: 30 hp  
Power Supply: 60 hz, 1-phase, 230 Volts

### PUMP STATION 3

Rated Capacity (per pump): 100 gpm at 440' total dynamic head  
Pump Manufacturer/Model/Size: Aurora PVM 16-100D  
Minimum Pump Efficiency at Rated Capacity: 61%  
Pump Operating Speed: 3500 rpm, variable, using variable frequency drive  
Maximum Motor Size: 20 hp  
Power Supply: 60 hz, 1-phase, 230 Volts

### PUMP STATION 4

Rated Capacity (per pump): 50 gpm at 462' total dynamic head  
Pump Manufacturer/Model/Size: Aurora PVM 8-130D  
Minimum Pump Efficiency at Rated Capacity: 66%  
Pump Operating Speed: 3500 rpm, variable, using variable frequency drive  
Maximum Motor Size: 10 hp  
Power Supply: 60 hz, 1-phase, 230 Volts  
Variable Frequency Drive: Eaton Power XL DG1, or approved equal

## LEAD-FREE REQUIREMENTS

All pumps, valves, instrumentation and other wetted components must comply with the federal lead-free requirements described in ANSI/NSF 372.

## MOTORS

Pump drivers shall be premium efficient, totally enclosed fan cooled, AC induction motors. Motors shall be sized so that the nameplate horsepower rating, without consideration of the service factor, shall not be exceeded at any point along the pump performance profile. Pump motors shall be complete with a 1.15 service factor.

Motor bearings are ball bearing type, designed to carry all radial and thrust loads, and are installed in sealed housings which retain lubricant and exclude dirt and moisture. Motors shall be open drip proof.

## PIPING

Piping 3" – 14" shall be minimum class 53 Thickness Cement lined ductile iron pipe for potable water service NSF-61 Certified and in accordance with AWWA C151/A21.51, with flanges screwed on faced and drilled according to AWWA C110/A21.10. Flanges may be cast on with metal thickness of the body conforming to AWWA C110, at the option of the manufacturer. Cast iron or ductile iron fittings, cement lined for potable water service, shall be made in strict accordance with ANSI/AWWA C110 and shall be adequate for water pressures up to 250 PSI. Gaskets shall be 1/16" red rubber, flange bolting shall be Grade B7 ASTM A193, with 2H A194 Nuts.

Welded Piping 1"-3" may be Schedule 40 304 SA312 Stainless Steel Piping. Butt-weld fittings shall be schedule 40 304 SA403 WPW. Socket weld fittings shall be Schedule 40 304 SA182. Forged fittings and flanges shall be schedule 40 304 SA182. Cast fittings shall be Schedule 40 304 SA312. Flanges shall conform to the dimensional tolerances of ANSI standards B16.5 for Class 150 and Class 300 flanges.

Piping less than 1" may be schedule 40 threaded 304 SS with threaded 304 SS, or 304 SS Pro-Press compression fittings.

## WELDING

All welds shall be performed by certified welders employed by the pump station manufacturer. Welders must be certified by an independent outside ASCM certified welding inspector. Copies of the Welding operator performance Qualifications (WPQ) must be provided in the submittal for each welding procedure used.

Stainless Steel pipe (M-8/P-8/S-8, Group 1) 1/16" through 1-1/2" thick, ER3XX, shall be welded per AWS B2.1 1-8-212:2001 welding standard for Gas Tungsten Arc welding.

Carbon Steel Pipe (M-1/P1/S1, Groups 1 and 2), 1/8" through 1-1/2" thick, shall be welded per AWS B2.1-1-234:2006 Welding standard for Argon plus 25% Carbon Dioxide Shielded flux cored arc welding or AWS B2.1-1-207-96 (R2007) Welding standard for Gas Tungsten Arc Welding.

Stainless Steel Plate and structural welding, (M-8/P-8/S-8, Group 1) 1/16" through 1-1/2" thick shall be welded Per AWS B2.1 1-8-024:2001 welding standard for Gas Tungsten Arc Welding.

Carbon steel plate and structural welding shall be performed by welders certified in both of the above procedures used for carbon steel pipe.

## FRAME

Pumps, control panel, piping and valves must be preassembled on a painted carbon steel frame with a minimum of four lifting lugs.

## PIPE SUPPORTS

Pipe supports shall be installed to adequately support the piping during shipment and operation. Pipe supports shall be installed to minimize the transmission of piping stresses from the field connections to the pumping station. Pipe supports shall be installed to minimize piping stress loads on pumps and other stress sensitive equipment in the pumping station.

Seismic bracing if required will be indicated on the plans. Seismic calculations will be supplied and will be stamped by a registered professional engineer, registered in the state of manufacture for the pumping station.

## SERVICE CONNECTIONS ON INTERNAL PIPING

All plumbed devices within the station eventually requiring service, such as meters, control valves, pumps and like equipment, shall be easily removed from the piping by the presence of appropriately placed and sufficient quantity of adaptors and couplings as shown on the drawings; no less than the quantity of couplings and adaptors shown shall be allowed.

## EXPANSION JOINTS

The booster station piping shall include expansion joints on the pump suction to prevent binding and facilitate removal of associated equipment where shown on the plans for this item.

All expansion joints shall include a minimum of two (2) control joint rods with appropriate restraining points.

## PRESSURE GAUGES

Pressure gauges shall have 4" minimum diameter faces, stainless steel with a clear glass window with gasket. The movement shall be rotary; the sensing element shall be stainless steel tube. The gauge shall have a 1/2" MNPT lower mount process connection.

All gauges to be mounted complete with isolating valves.

Gauges shall be Bourdon Sedeme Model Mex5, or approved equal.

## BALL VALVES

Ball valves will be of a 2-piece design, full port. The valve body is to be Lead Free brass. The ball is to be Lead free brass. Ball seal and packing are to be of PTFE. The valves will be NPT threaded pattern complete with lever operators. Maximum working pressure shall be 600 psi. Valves shall be NSF-61 Certified.

Ball Valves shall be Milwaukee Valve Model Ba-475b, or approved equal.

## BUTTERFLY VALVES

Butterfly valves shall be of the full lug style design with lever handle. The valves shall be rated for 200 PSI and meet specifications MSS SP-67 & API-609.

The valve body is to be constructed of ASTM A126 CL B cast iron. Disc material is to be 316 SS. Bottom and top stems are to be 416 stainless steel. Seal, liner, & stem seal are to be EPDM.

## CHECK VALVE

The check valve shall be a wafer style Dual bronze disk design with A ductile iron body, Buna-N Seat, NSF 61 Certified.

The Check Valve shall be a Val-Matic Series 1400, or approved equal.

## PRESSURE TESTING

When the station plumbing is completed, the pressure piping within the station (including valves, pumps, control valves, and fittings), connections as make up the entire system shall be hydrostatically tested at a pressure of 150 psi or a pressure equal to the lowest test pressure rating of the equipment within the tested system, whichever is lesser pressure. The test pressure shall be applied for a minimum of 20 minutes, during which time all joints, connections and seams shall be checked for leaking. Any deficiencies found shall be repaired and the system shall be retested.

## ELECTRICAL APPARATUS - DESIGN, ASSEMBLY & TEST

Motor and power wiring shall be megohm tested prior to shipment.

## CONFORMANCE TO BASIC ELECTRICAL STANDARDS

The manufacturer of electrical control panels and their mounting and installation shall be done in strict accordance with the requirements of UL Standard 508A and the National Electrical Code (NEC) latest revision so as to afford a measure of security as to the ability of the eventual owner to safely operate the equipment. No exceptions to the requirements of these codes and standards will be allowed; failure to meet these requirements will be cause to remove the equipment and correct the violation.

## U.L. LISTING

All service entrance, power distribution, control and starting equipment panels shall be constructed and installed in strict accordance with Underwriter's Laboratories (UL) Standard 508A "Industrial Control Equipment." The panels shall be shop inspected by UL, or constructed in a UL recognized facility. All panels shall bear a serialized UL label indicating acceptance under Standard 508A and under Enclosed Industrial Control Panel or Service Equipment Panel.

## EQUIPMENT GROUNDING

Each electrical equipment item in the station shall be properly grounded per Section 250 of the National Electrical Code. Items to be grounded include, but are not limited to, pump motor frames, control panel, transformer, convenience receptacles, dedicated receptacle for heater, air conditioner, dehumidifier, lights, light switch, exhaust fans and pressure switches.

All ground wires from installed equipment shall be in conduit and shall lead back to the control panel to a copper ground buss specific for grounding purposes and so labeled. The ground buss shall be complete with a lug large enough to accept the installing electrician's bare copper earth ground wire. The bus shall serve as a bond between the earth ground and the equipment ground wires.

## PANEL MOUNTING HARDWARE

Metal framing channel shall be used exclusively for mounting of all electrical panels and electrical components except for those specifically designated otherwise.

## **CONTROL PANELS**

### SEQUENCE OF OPERATION

In automatic Pumps will be controlled by an external telemetry system provided by others. Telemetry system will provide normally open contacts that will close to run each pump. Each pump will continue to run as long as its contact remains closed. Pumps will be prohibited from running in automatic if the low pressure switch indicates that there is a low suction pressure condition. The low suction pressure switch shall be provided with a 20 sec. delay on operate and shall require a manual reset to clear the alarm.

### ENCLOSURE

The control enclosure shall be a NEMA 4X Thermoplastic enclosure.

### DISCONNECT

The control enclosure shall be provided with a door or flange mounted main disconnect operating handle for the main circuit breaker sized per the current requirements of the National Electrical Code. This disconnect shall be interlocked with the door and be capable of being locked in the open position.

## POWER DISTRIBUTION

Power distribution circuits within the control panel shall be individually protected by circuit breakers or fuses. Control panel shall be provided with a 115V transformer for supplying control power within the panel.

## MOTOR STARTERS

Unless otherwise indicated, motor starters shall be an IEC rated soft start & stop (pump station 1) with 3 pole, class 10 overloads.

## ELAPSED TIME METERS

Door mounted six digit (non reset type) elapsed time meters shall be provided for each individual pump to indicate total pump running time in hours and tenth's of hours.

## INDICATOR LIGHTS

Green door mounted indicator lights shall be provided for each individual pump run. A red indicator light shall be provided to indicate low suction pressure

## HOA SWITCHES

A door mounted Hand – Off – Automatic switch shall be provided for each pump.

## TELEMETRY OUTPUT CONTACTS

The control panel will provide normally open dry contact outputs brought down to a terminal strip for the following:

- Low suction pressure

- Typical SCADA outputs (control panel input)

  - Lead pump run

  - Lag pump run

- Typical SCADA inputs (control panel output)

  - Pump 1 run

  - Pump 2 run

  - Pump 1 in auto

  - Pump 2 in auto

  - Pump 1 fault

  - Pump 2 fault

  - High suction pressure

  - High system pressure

## MARKING

Panel shall be provided with the manufacturer's standard name plate. Switches, indicators, and door mounted devices shall be labeled to indicate position, function etc. Labels shall be adjacent to or above the device. Control components shall be permanently marked using the same identification keys as found on the control diagram. All panel wiring shall be numbered on each end, using the same numbers as found on the control diagram.

## CONTROL DIAGRAM

Control diagrams shall be provided showing all control panel wiring and components with a maximum paper size of 11 x 17. Diagram shall include: A complete bill of materials showing the item number, description, manufacturer, Manufacturer's part number and the quantity. A page with general notes and a key of the symbols used. A front panel layout including enclosure dimensions. A backplane layout, complete circuit diagrams, a terminal strip drawing that identifies all of the telemetry contacts. Technical data sheets shall be provided for the enclosure and all of the components listed on the bill of material.

## ELECTRICAL APPARATUS - CONDUIT AND WIRING

All wiring within the equipment enclosure and outside of the control panel or panels shall be run in conduit except for the watertight flexible conduit and fittings properly used to connect pump drivers, fan motors, solenoid valves, limit switches, etc., where flexible connections are best utilized.

FLEXIBLE CONNECTIONS - Where flexible conduit connections are necessary, the conduit used shall be liquid-tight, flexible, totally nonmetallic, corrosion resistant, nonconductive, U.L. listed conduit sized to handle the type, number and size of equipment conductors to be carried - in compliance with Article 351 of the National Electrical Code.

MOTOR CIRCUIT CONDUCTORS - Sized for load. All branch circuit conductors supplying a single motor of one (1) horsepower or more shall have an ampacity of not less than 125 percent of the motor full load current rating, dual rated type THHN/THWN, as set forth in Article 310 and 430-B of the National Electrical Code, Schedule 310-13 for flame retardant, heat resistant thermoplastic, copper conductors in a nylon or equivalent outer covering.

CONTROL AND ACCESSORY WIRING - Sized for load, type MTW/AWM (Machine tool wire/appliance wiring material) as set forth in Article 310 and 670 of the National Electrical Code, Schedule 310-13 and NFPA Standard 79 for flame retardant, moisture, heat and oil resistant thermoplastic, copper conductors in compliance with NTMA and as listed by Underwriters Laboratories (AWM), except where accessories are furnished with a manufacturer supplied UL approved rubber cord and plug.

## FACTORY START-UP SERVICE

1. Start-up service technician shall be a regular employee of booster station manufacturer.

2. As part of the submittal covering this equipment, list the factory service manager, his telephone number with extension.
3. One (1) full day at job site for start-up and training.
4. Start-up service to include two (2) bound O&M manuals.
5. Start-up service report attested to by start-up technician and representative of owner or engineer.

#### MANUFACTURER'S WARRANTY

The warranty is the sole responsibility of the station manufacturer and that manufacturer's warranty shall be provided in written form for inclusion with both the submittal covering the specified equipment and the O&M manuals provided with that equipment.

Said manufacturer's warranty shall at a minimum cover:

1. A period of one (1) year commencing upon successful start-up, after authorized manufacturer's start-up, not to exceed eighteen (18) months from the date of shipment.
2. The one (1) year period shall be inviolate regardless of any component manufacturer's warranty for equipment and components within the station.
3. The manufacturer's warranty shall cover all equipment, components and systems provided in or with the station by the manufacturer of the station, exclusive of those components supplied by and/or installed by others independent of the manufacturer of record for this station.
4. The manufacturer's warranty policy is amended only by the items considered consumables, i.e., light bulbs, pump seals, pump packing, lubricants and other maintenance items consumed by usage.
5. No assumption of contingent liabilities for any component failure during manufacturer's warranty is made.