
**Pumping Station
Typical Specifications****I. General****1.01 Product(s) Supplied**

The authorized factory trained representative shall provide one prefabricated, completely integrated, variable speed pumping station designed to provide constant pressure, at required flow rates with automatic lead/lag capability. The pumping station shall be the AquaForce™ variable speed pumping station by Goulds Pumps, G&L Pumps or approved equal. The pumping station will include complete duplex or triplex stainless steel pumps, with appropriate variable speed (pump specific) variable speed controllers. It is the successful vendor's responsibility to include all necessary appurtenances to provide for a complete, automatic, smooth operating and reliable pumping system. The manufacturer shall supply a complete set of general arrangement drawings, electrical power schematics and control schematics in the operations and service manual, to include the complete pump and variable speed controller instruction manuals. All equipment shall be supplied by a single supplier (unitary source) to ensure system component compatibility.

1.02 References

- A. American Water Works Association (AWWA)
- B. American National Standards Institute (ANSI)
- C. American Standards for Testing Materials (ASTM)
- D. Hydraulic Institute (HI)
- E. American Society of Mechanical Engineers (ASME)
- F. Underwriters Laboratories (UL)
- G. International Standards Organization (ISO)

1.03 System Description

- A. The pump station shall utilize 2 (duplex) or 3 (triplex) stainless steel G&L Pumps, end suction or vertical multistage in conjunction with the Aquavar® variable speed pump controller as manufactured by G&L Pumps, A Goulds Pumps Company. Appropriate check and shutoff valves, pressure transducers, suction/discharge piping, pump and electrical protection shall be integrated into the pump controller package. Options shall be made for (if chosen): Input line rectors, lightning protection, low suction pressure switch, temperature relief, flexible suction/discharge flanged connection. (Other options may be offered at the discretion of the manufacturer based on the specific project needs.)


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The pump station shall provide flows from (minimum) _____ GPM to (maximum) _____ GPM at _____ PSIG to the pump station discharge with a minimum suction pressure of 0 PSIG (flooded) and a maximum suction pressure of _____ PSIG.

FLOODED

The pump station shall provide _____ GPM at _____ PSIG with a suction pressure of 0 PSIG (flooded suction).

BOOST

The pump station shall provide _____ GPM at _____ PSIG with a suction pressure of _____ PSIG min and _____ PSIG max.

LIFT

The pump station shall provide _____ GPM at _____ PSIG with a lift of _____ ft. Pumps shall have NPSH requirements no greater than the lift + suction line friction losses for the operating range of the pump.

AquaForce™ Pumping station model shall be _____.

Total pumping station system friction loss shall not exceed 5 psig.

C. Sequence of Operation

The station shall receive a 4-20mA signal from each pressure transducer, as provided by the pumping station manufacturer. A pressure transducer shall be provided for each pump controller. This will provide a complete lead/ lag system coupled with a true back-up control. The pressure transducer will monitor system discharge pressure and provide an analog signal (4- 20mA) to the pump control software, and allow the variable speed pump controller, (Aquavar) to provide a variable Volts/ Hz output to the motor. Once the pressure drops below the set system pressure, the pump will start and provide system pressure (as determined by the station operator), if this pressure cannot be maintained by one pump, the next pump in sequence shall operate in a lead/lag capacity to provide the extra flow and pressure automatically **without** the use of additional panels or alternators. The sequence of the pumps shall be field adjustable, and completely automatic **without** additional panels or alternator controls. The variable speed pump controller shall be completely integrated with the VFD. Special type motors will not be allowed (see motor section). Pumps shall alternate based on elapsed run time. All program settings shall be based on centrifugal pump language and centrifugal pumps. Program settings must be field adjustable to provide on site adjustments. When the system experiences low demand, the variable speed pump controllers will reduce the speed of each pump, until demand has stopped. Pump controllers will stop each pump at zero demand, without the use of external switches or controls.


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Submit _____ copies of the following for approval:

- A. General elevation drawings, wiring diagram, pump curves, operating and maintenance manuals and parts list.
- B. Written certifications for listing with Nationally Recognized Testing Laboratory (NRTL) for the complete pumping system
- C. Operation and Maintenance Manuals for pumps, controllers and complete pumping station.

1.05 Quality Assurance

- A. The pump station shall be furnished by a single supplier entity, who shall have responsibility for the complete pumping station.
- B. The pumping station manufacturer shall be ISO9001 certified and shall design, test and assemble pumping stations on a regular basis.

C. Qualifications

- 1. Manufacturer shall have minimum 20 years experience building pump stations, and over 50 years in active design, production and marketing centrifugal pumps.
- 2. Manufacturer must demonstrate proof of financial responsibility with respect to pump station delivery and performance.
- 3. Upon request from the engineer the manufacturer must provide proof or evidence of facilities, equipment and capabilities required to produce the specified station.
- 4. Provide pumping station certified testing as an option.
- 5. Manufacturer shall provide a tour of their production and test facility at the request of the customer or engineer.

1.06 Scheduling

- A. The pump station manufacturer shall provide the following:

Estimated FOB delivery

Estimated NET weights

Unloading instructions

Acceptance at site procedures

Onsite storage and protection information
and complete instruction manuals.

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The manufacturer shall warrant the water pumping system to be free of defects in material and workmanship for one year (12 months) from date of authorized start-up, not to exceed eighteen (18) months from date of manufacturer's invoice. Complete terms and conditions will be provided upon request.

1.08 Start-Up Service

When discharge piping, electrical connections, and electrical inspection have been completed, the pump station representative shall be contacted for start up. A minimum one-week notice shall be given to manufacturer representative prior to scheduled start up date. During start up, the complete pumping system shall be given a running test of normal start and stop, and fully loaded operating conditions. During this test, each pump shall demonstrate its ability to operate without undue vibration, or overheating, and shall demonstrate its general fitness for service. All defects shall be corrected and adjustments shall be made to the pumping station for satisfactory operation. System problems or concerns will be corrected by the general contractor or site station staff, in conjunction with the appropriate factory representative. Testing shall be repeated until satisfactory results are obtained, as determined by the engineer. Start up assistance will be provided but will be limited to one 8-hour day, unless previously negotiated by the factory representative.

II. Products**2.01 Station Manufacturer**

The pumping system shall be manufactured by G&L Pumps, A Goulds Pumps, ITT Industries company, or equal. All systems shall be approved by the engineer prior to bid opening. The station shall be of the model number and capacities as shown in the attached technical data sheet. For consideration of a proposed equal system, the contractor shall furnish the following data to the engineer at least 10 days prior to the date of the bid opening:

- A. A complete specification for the pumping system proposed as an equal.
- B. A statement of full conformance to the following specifications signed by a corporate officer of the manufacturer.
- C. A general arrangement drawing showing overall dimensions and all piping layouts.
- D. Complete submittal data for all major equipment (pumps, motors, valves, electrical controls, etc.).
- E. An electrical schematic, that provides power and control wiring.
- F. A copy of the appropriate Instruction Operation Manual (IOM) for the pump, pump controller and pumping station.

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- G. Location of closest factory trained service centers.
- I. Manufacturer's system UL (or equal) file number.
- J. ISO9001 certificate

If, in the opinion of the engineer, the data submitted shows the pumping system to be an equal to the system specified, the bidding contractors shall be notified not less than 5 days prior to the bid opening date.

2.02 Station Components

A. Pumps

Pumps shall be constructed of 304 or 316L stainless steel and be of centrifugal, vertical multi-stage or end suction design. Pumps shall be the manufactured product of a US manufacturer, producing and selling pumps for a minimum of 125 years. Pump case, impellers, diffusers, seal spring, inner bowls, seal spring, shaft sleeve and retainer clip shall all be manufactured from stainless steel. Shaft bushing (if needed) shall be from ceramic. Mechanical seal assembly shall be constructed of Carbon/ Silicon Carbide/ Viton as standard. Seat elastomers and casing o-rings shall be from Viton. Shaft sleeve shall be from stainless steel. Tie rods and nuts shall be from zinc coated steel. Pump curve shall rise continuously to shut off head. Best efficiency point of pump shall lie between 70% and 80% of maximum flow capacity of the pump. Pump connections shall be NPT or ANSI flanged, either class 150 or class 300. Maximum pressure rating for class 150 flanges shall be 200 psi and for class 300 shall be 360 psi. Pump shall accept a standard NEMA C-face motor, or JM frame and **shall not** require a specialty motor with special thrust bearings or integrated VFD. Vertical multi-stage pumps shall have thrust balanced within the pump. All pumps used will have a standard NEMA frame motor, and be readily available from manufacturer.

B. Station Base

The pump station base shall be designed and fabricated to provide proper structural support for all attached equipment, and provide anchor bolt support. The base shall supply sufficient rigidity to withstand the stresses of reasonable and competent transportation to site, off loading, installation, and operation. Main structural members shall be constructed from heavy weight 1/4 " or 3/8" flat steel with a reinforcing channel for larger stations. Steel base shall be shot blasted, primed, then painted as per paint specification (see PART 4, Finishes). Provisions shall be made in the station base for off-loading and handling the station at the site of installation. Base shall include steel plate mounted under pump and motor and shall be of compact design for most standard doorways.

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All piping shall be constructed from 304 stainless steel, schedule 40 type or heavier pipe as required to maintain a 3 to 1 pressure safety factor (including 1/16" corrosion allowance). All piping shall be hydrostatically tested to a minimum 150% of maximum shutoff pressure generated by the pumping station. Suction and Discharge manifolds shall be designed and constructed for minimal friction loss and compact design for most standard doorways.

D. Valves

Pump isolation valves 2" and below shall be full-port ball valves. Full-port ball valves shall have a brass body, ball shall be chrome plated brass with brass stem. Valves shall be pressure rated to 600 psi WOG. Valves shall conform to MSS-SP-110. Ball valves shall be Watts® model FBV-3.

Valves 2½" and above shall be either lug-type butterfly valves or grooved-end butterfly or ball valves. Butterfly valves body shall be constructed of ductile iron with a polyphenylene sulfide coating. Butterfly valves disc shall be aluminum bronze with a 416SS shaft. Butterfly valves shall have lever operators. Butterfly valve face-to-face dimensions shall comply with MSS-SP-67. Butterfly valves shall be pressure rated to 200 psi. Butterfly valves shall be Watts model BF-03. Grooved-end butterfly valves shall be constructed of ductile iron with an elastomer coated ductile iron disc. Grooved-end butterfly valves shall be pressure rated to 300 psi. Grooved-end butterfly valves shall be Victaulic® model VIC-300. Grooved-end ball valves shall be constructed of ductile iron with a nickel-plated ball and stem. Grooved-end ball valves shall be pressure rated to 1000 psi for sizes 2½" - 3" and 800 psi for sizes 4" - 6". Grooved-end ball valves shall have lever operators and shall be Victaulic Series 721.

Pump Check Valves:

Each pump discharge shall be equipped with a spring-loaded non-slam silent check valve, appropriately sized to allow no greater than 5 psi of head loss at full station rated capacity. Check valves 2" and below shall have a brass body and PTFE Teflon seat. Check valves 2" and below shall be pressure rated to 400 psi WOG. Check valves 2" and below shall be WATTS Series 600. Wafer style valves shall be provided in sizes from 2½ to 10" for installation between ANSI B16.5 class 150 or class 300 steel flanges. Wafer check valves shall be Val-Matic® Series 1440 or 1800 and conform to AWWA standard C508 for leakage rates. The operation of the valve shall not be affected by the position of installation. When pump is retired, valve shall function to close tightly before flow is reversed, and reducing the possibility of water hammer or shock.

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Pressure gauges shall be liquid filled, bourdon tube type. Gauges shall be supplied for both the suction and discharge manifolds. All gauges shall be bottom mounted and shall be glycerin filled to reduce wear due to vibration. Accuracy shall be within $\pm 1.5\%$. Gauge diameter shall be 2½". Range shall be at least 30% higher than the highest pressure attainable from the pumps at shutoff head conditions. Gauges shall include stainless steel back and copper alloy internals. Pressure gauges shall be manufactured by WIKA® or Equal.

F. Bolts

All bolts used in the assembly of the pumping system shall be zinc plated to retard corrosion and shall be the proper size and gauge for rigid construction.

G. Motors

Motor(s) for the main pump(s) shall be of United States manufacture, C-face or JM frame type open drip proof or TEFC enclosures 1.15 service factor, Min class F insulation. Motors shall be wound for the starting configuration as called out in the technical data sheet. Design pump brake horsepower shall not exceed 100% of motor horsepower exclusive of service factor. The motor shaft shall be high-strength steel. Motors shall be as manufactured by Baldor®. Motors shall be wound with ISR (Inverter Spike Resistant) wire for use with VFD's. Motor manufacturer must provide letter of compatibility of motor with another type of variable frequency or variable speed drive.

III. Electrical**3.01 Scope**

To provide complete main fusible disconnect, variable speed pump controller, pressure transducers, NEMA motors, instrumentation and controls to automatically start, stop and modulate pump speed. To smoothly, efficiently and reliably provide pump variable flow rates at a constant discharge pressure. Pumping station shall provide full pump, motor and drive safety features needed to protect the equipment and piping system.

A. Main fusible Disconnect Enclosure

Individual fusible disconnects shall be provided to completely isolate individual motors starting equipment from incoming power. Individual disconnects shall have a through door operator, and shall be sized as shown in the technical data sheet. Motor fusible disconnect panel shall be housed in a NEMA 4 enclosure with integral latches. The control enclosure shall be constructed of 12-gauge steel and the back plate assembly shall be constructed of 12-gauge steel.

All indicating lights, reset buttons, individual selector switches and the operator interface device shall be mounted

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on enclosure door and also be rated NEMA 4. All internal components shall be mounted and secured to the removable back plate assembly with rigid steel brackets. Disconnects shall be manufactured by ABB Control Inc or Allen Bradley.

B. Lightning and Surge Arrester Option

All electrical equipment shall have an option to be protected by a UL approved Category C and Category B surge arrester, which shall suppress excessive voltage surges on incoming power. The device shall withstand an impulse of 10Kv/10Ka under IEEE C62.41 Category C and shall withstand a ringwave of 6Kv/500a and an impulse of 6Kv/3Ka under Category B. Pass voltage for a 480v device to the end equipment shall not exceed 1800V when subjected to an 8 x 20 microsecond waveshape, resulting in the following performance statistics: 3720 joules minimum dissipation at 82,500,000VA and 1800V maximum voltage. Response time shall be less than 5 nanoseconds.

C. Variable Frequency Drive

The pump controller shall be the Goulds Pumps Aquavar® or Aquavar CPC variable speed pump controller. The Aquavar shall provide an adjustable carrier frequency with IGBT power switching, and utilize PWM technology. The drive shall provide noiseless operation of the driving motor, short circuit and ground protection, and work with controlled sinusoidal current synthesis and dynamic over current limitations. The Aquavar controller shall be one complete integrated unit including the variable frequency drive, programmable pump control logic, and include a NEMA 1 (CPC) or NEMA 4 (motor mount version) enclosure. Additional control panels, PLC's or other external devices, shall NOT be necessary to accomplish complete pump programming and variable speed control of pump and motor. Standard variable frequency drives that do not incorporate pump control logic as the primary control software; programming and features directly applicable to centrifugal pump applications shall not be considered equal.

The pumping station controller shall provide a LCD two line display with 16 characters per line and programming keypad for data entry. Unit(s) shall utilize user-friendly front panel programming in three languages that displays pump and motor language in clear text. Three colored LED's shall signal 'power on', 'pump running' and 'fault'. Program settings shall be changeable and stored in non-volatile memory. Program settings shall be retained in memory in the event of loss of power to the controller, without the use of a backup battery. System operating pressure shall be clearly displayed in PSI or feet of head for ease of use and to provide an operator friendly interface. Additional parameters, where applicable, shall be displayed in units consistent with pumping systems.

Generic control systems adapted from other applications shall not be considered equal.

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The settings and program in whole or part may be locked out with the use of an operator selectable password. Standard system hydraulic settings shall include **at a minimum** the following functions: loss of suction, lack of NPSHa, pump run-out protection, “dead-head” protection, constant pressure setting with variable flow capability, constant flow with variable TDH (pressure) capability, quadratic differential flow calculation, system curve compensation, multiple pump operation with alternation, pump starting point with allowable, adjustable pressure drop, minimum speed with time delay, pressure of flow sensor error, overpressure shutdown, and low flow shutdown.

D. Pressure Transducer

Pressure transducer shall be utilized for providing all pressure signals for the pump control logic. Pressure transducer shall be a solid-state bonded strain gage type with an accuracy of plus/minus 0.20% and constructed of 17-4 pH stainless steel. Transducer shall be rated for station discharge pressure as shown on technical data sheet, and shall provide gauge pressure output, rather than an absolute. Pressure transducer constructed of plastic is not acceptable. Pressure transducer shall be 4-20mA analog type with 7- 33 VDC supply range and utilize a packard type connector to prevent moisture intrusion. Transducer shall be manufactured by Texas Instruments.

G. Controls and Enclosure

The control panel with controls shall be built in accordance with the NEC, and shall comply with UL standards. Pump station manufacturer shall be authorized under UL508A to manufacture its own control panels, and the control panel shall be manufactured by the pump station manufacturer. All equipment and wiring shall be mounted within the enclosure and each device shall be labeled for proper identification. All adjustments and maintenance shall be accessible from the front of the control enclosure. A complete wiring circuit diagram and legend with terminals, components, and wiring completely identified shall be provided. Main disconnect shall be interlocked with door.

Panel face switches and lights:

- Reset—Acknowledges pump station alarms (Alarm package option).
- Individual pump disconnects.
- Individual pump run and alarm lights (Alarm package option).
- Alarm horn (Alarm package option).
- Low suction pressure reset (Low suction switch option, boost only).

The pump station, including electrical components and enclosure, shall be UL labeled as a completed assembly with manufacturer’s UL label applied to the pump station.

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Steel base and main disconnect panel stand shall be grit-blasted with #50 steel grit per SSPC-10 to a near white metal condition. The cleaned steel surfaces shall immediately thereafter be primed with an industrial grade primer to a thickness of 2½ to 3 mils epoxy primer. The finish coat shall be acrylic enamel to a thickness of no less than 3 mils. The control panel shall be dip cleaned, acid etched and neutralized, iron phosphate coated and painted with a finish coat of 1½ to 2 mils of polyurethane.

V. Installation**5.01 General**

Other contractors or entities shall be responsible for providing equipment, and labor necessary to unload and set the pump station according to acceptable laws and practices. Parts, additional equipment, and labor necessary to complete the installation of the pump station shall be provided by selected contractors or arranged by the factory authorized representative. All contractors or persons shall hold a license to procure and operate the needed equipment to safely unload and install the complete pumping station.

5.02. Unloading and Setting Supervision.

Setting of the pump station is the responsibility of others, not the manufacturer. Equipment required to off-load and set the pump station is to be provided by others.

5.03 Start up and Training

After the station startup has been completed, but before the technician leaves the job site, a training session shall be given to the owner or to the owner's representative, familiarizing that person (operator) with the pumping system operation, maintenance and adjustments(if needed).

5.04 Warranty Requirements

Provided that proper maintenance has been performed by the operator or user during warranty period, and a component failure occurs, the manufacturer shall provide the replacement part or component. Repairs done at manufacturer's expense must be pre-authorized. The start-up certificate must be on file with manufacturer to activate warranty. Manufacturer shall support a wide network of technical service agents who shall be utilized for service work.



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Victaulic is a registered trademark of ??????????.

Baldor Motor is a registered trademark of Baldor Electric Co.

WIKA is a registered trademark of WIKA Instrument Corp.

Watts is a registered trademark of Watts Industries, Inc.

Val-Matic is a registered trademark of Val-Matic Valve and Mfg. Corp.

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