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**SPECIFICATIONS** BGTECHCSSPEC R1

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TechnoForce Constant Speed

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

A. Variable Speed Pumping Package

B. Pump Control Panel

C. Sensor Transmitters

D. Sequence of Operation

**1.2 REFERENCES**

A. AWWA - American Water Works Association

B. ANSI - American National Standards Institute

C. ASTM - American Standards for Testing Materials

D. HI - Hydraulic Institute

E. ASME - American Society of Mechanical Engineers

F. UL - Underwriters Laboratories

G. ISO - International Standards Organization

H. NEMA - National Electrical Manufacturers Association

I. ETL - Electrical Testing Laboratories

J. CSA - Canadian Standards Association

K. NEC - National Electrical Code

L. IEC - International Electrotechnical Commission

M. NSF - NSF International

**1.3 SUBMITTALS**

A. Submittals shall include the following:

1. System summary sheet

2. Sequence of operation

3. Shop drawing indicating dimensions, required clearances and location and size of each field connection

4. Power and control wiring diagrams

5. System profile analysis. The analysis shall also include pump, motor, job specific load profile, staging points.

6. Pump data sheets

B. Submittals must be specific to this project. Generic submittals will not be accepted.

**1.4 QUALITY ASSURANCE**

A. The pumping package shall be assembled by the pump manufacturer. An assembler of pumping systems not actively engaged in the design and construction of centrifugal pumps shall not be considered a pump manufacturer. The manufacturer shall assume "Unit Responsibility" for the complete pumping package. Unit responsibility shall be defined as responsibility for interface and successful operation of all system components supplied by the pumping system manufacturer.

B. The manufacturer shall have a minimum of 30 years experience in the design and construction of packaged pumping systems, and over 50 years in active design/ production of centrifugal pumps.

C. Bidders shall comply with all sections of this specification relating to packaged pumping systems. Any deviations from this specification shall be bid as a voluntary alternate clearly defined in writing. If no exceptions are noted, the supplier or contractor shall be bound by these specifications.

D. A copy of manufacturer's certificate of insurance shall be made available upon request showing as a minimum, general liability coverage of $1,000,000, and an excess liability coverage of $10,000,000.

E. The pumping package shall be certified by an approved independent testing and certification organization as being compliant with the requirements of NSF/ANSI 61 for potable drinking water and NSF-61 Annex G for low lead content.

F. Manufacturer shall be listed by UL as a manufacturer of packaged pumping systems under UL/cUL category QCZJ.

G. Manufacturer shall be listed by UL as a manufacturer of control panels under UL 508A.

H. The manufacturer's production facility shall be certified by an approved independent testing and certification organization as being compliant with the requirements of NSF/ANSI 61 and NSF-61 Annex G. The manufacturing facility shall be subjected to periodic inspections and audits.

**PART 2 PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

A. Subject to compliance with these specifications, the following manufacturers shall be acceptable:

1. Bell & Gossett

2. Pre-approved equal

**2.2 MANUFACTURED UNITS**

A. Furnish and install as shown on the plans a Constant Speed System model number

 as manufactured by Bell & Gossett or approved equal. System shall be capable of delivering gpm

 at psi g with a psi g minimum suction pressure. Suction and discharge headers shall be

 in and constructed of 304 series stainless steel.

B. Manufacturer shall be listed by Underwriters Laboratories as a manufacturer of packaged pumping systems.

C. The entire pumping package shall be NSF/ANSI/NSF-61 certified for potable drinking water and NSF-

 61 Annex G for a wetted area, weighted average lead content =0.25%.

E. System shall require only suction, discharge and drain connections and single point power connections from a service entrance disconnect.

F. All components shall be mounted and shipped as a single unit. G. Pumps shall be manufactured by Xylem.

H. The discharge of each pump shall be fitted with a control valve appropriate for station operation. Each pump and discharge valve assembly shall also be equipped with isolation valves so that the pump can be serviced while system is still filled.

I. Pressure gauges shall be installed on the suction and discharge headers.

J. Piping shall be sized so that water velocity shall not exceed 10.0 ft/sec in either the branches or, manifolds.

K. Pumps shall be protected from thermal accumulation via individual thermal relief mechanisms.

**2.3 COMPONENTS**

A. TechnoForce Constant Speed Pump Logic Controller

1. The TechnoForce CS pump logic controller assembly shall be listed by and bear the label of Underwriter's Laboratory, Inc. (UL/cUL) and certified by the BACnet Testing Laboratories (BTL). The controller shall be specifically designed for packaged pressure booster applications.

2. The pump logic controller shall be microcomputer based and hold its software in non-volatile memory. On-line field modified data entries, such as stage point, alternation, serial communication, sensor setup, and method of staging, shall be stored in flash memory with capability to prevent accidental loss of data due to voltage surge or spike. In the event of a complete power outage, all factory preset data values remain stored and available for recall by the operator.

3. The staging of pumps shall be user-selectable based on kilowatts (kW), current (Amps), flow (GPM), temperature (°F)
|| pressure (PSI).

4. kW readings shall be true power derived from a Xylem power transducer. Amps shall be RMS from the kW transducer. Both kW and Amps shall be microcontroller calibrated with calibration held in non-volatile memory. PSI shall be derived from a pressure transducer with a 4-20mA analog input. Flow shall be derived from an optional B&G supplied and calibrated transducer with a 4-20 mA analog input.

5. The control enclosure shall conform to NEMA 1 requirements and it shall include motor starters, overloads, control power transformer and microprocessor with NEMA 4 rated operator interface.

6. The Technologic1500 controller shall have off line and on line diagnostic software. Off line diagnostics shall consist of CPU, non-volatile memory and RAM memory test. The controller shall have digital input diagnostics, display test, program test and all analog and digital I/O user-tests. Fault information may be accessed by interrogating the pump logic controller through its HELP and log keys.

7. A data logging feature provides historical information of 40 key events with date and time stamps. Log information includes alarms, pump run timers, system on/off times and pump cycle counters. The data log displays the minimum, maximum and average values of temperature, pressure and flow. It is also capable of displaying kilowatt-hours.

8. The pump controller shall be capable of operation in ambient conditions of 32º F to 122º F and a humidity range of 5% to 95%, non-condensing.

9. All external sensors/transmitters and switches shall be powered by the pump logic controller through its integral 24VDC power supply. Over voltage and short circuit protection shall be on-board. All analog circuits shall be protected from up to 575V with a fast-acting fuse and sacrificial input resistors.

10. The pump logic controller shall operate the pump(s) in a pre-determined manner as indicated in the sequence of operation.

11. The controller's user interface shall contain a 4 line x 20 character liquid crystal display with 0.25 in characters.

12. The pump logic controller shall be capable of operating in automatic, manual or off-line diagnostic modes. One level
 of password and software security shall be provided for protection of field modifiable data.

13. The pump controller shall be capable of communication with the Building Automation System (BAS) by both hard
 wired and serial communications. The following communication features shall be provided to the BAS in hard wired
 form via digital outputs:

a. Remote system start/stop input b. System alarm output

c. Pump on/off indication

d. Auto/manual status indication

14. The following communication features shall be provided to the Building Automation System via an RS-485 port
 utilizing BACnet MS/TP, Johnson Controls Metasys N2, or Modicon Modbus protocols. LonWorks shall be provided
 through RS-232 port:

a. Individual analog inputs.

b. Individual pump failure

c. Individual pump on/off status

d. Start/stop command and status

e. System flow when optional flow meter is provided

f. Pressure, temperature and power measurement

g. General alarm indication

h. No flow shut down status

i. Pump alternation

15. The pump logic controller shall provide the following standard user selectable features:

a. Low suction pressure alarm and cut out

b. High suction pressure alarm and cut out

c. Low system pressure alarm

d. High system pressure alarm and cut out e. Visual alarm messages

f. No-flow shut down

g. Pump failure alarm

h. High temperature alarm and cut out i. Low level alarm and cut out

j. Overload failure alarm

k. Automatic or manual alternation

16. The system shall utilize the QuickStart feature to simplify programming and startup of the pump control system. The feature shall be specific to pump systems and use suitable pump terminology.

17. Constant Speed System Sequence of Operation

a. The system shall consist of a Technologic 1500 controller with parallel pump operation, duty- standby pump selection, automatic alternation and automatic transfer to the standby pump upon pump failure.

b. In the "AUTO" mode, the lead pump shall start upon initiation of the system either by activation of the "START" button or by digital input from the Building Automation System (BAS).

c. The lead pump shall operate at the point on its curve where system demand is satisfied. If the lead pump is unable to satisfy demand, the lag pumps shall be started as required.

d. As demand decreases, the lag pumps shall be destaged to minimize energy consumption.

e. The lead pump shall continue to run except for the following instances:

(i) Low suction pressure (automatic reset)

(ii) High suction pressure (automatic reset) (iii) High system pressure (manual reset)

(iv) High temperature (automatic reset)

(v) No flow (automatic reset)

(vi) Motor overload (manual reset)

f. In the event of a failure due to motor overload, the next pump in sequence shall be started.

g. When the system is satisfied, the Technologic 1500 controller shall shut down the single running lead pump and enter energy saving / no flow shut down mode.

B. Electrical

1. Pump Logic Controller Enclosure. Main station disconnect shall have a through door operator, individual motor fuse blocks, overloads, starters, and shall be sized as shown in the technical data sheet. Station disconnect panel shall be housed in a NEMA 1 enclosure with integral latches. The control enclosure shall be constructed of 14-gauge steel and the back plate assembly shall be constructed of 14-gauge steel.

2. Controls and Enclosure. The control panel with controls shall be built in accordance with NEC, and shall comply with UL standards. Pump station manufacturer shall be authorized under UL508A to manufacture its own control panels. All equipment and wiring shall be mounted within the enclosure and each device shall be labeled with 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.

3. Station shall have a short circuit current rating (SCCR) OF 5000A

C. Sensor / Transmitters

1. 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 < ±0.5% BFSL and constructed of 316 stainless steel. Transducer shall be rated for a pressure of 300 psi 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 10-28 VDC supply range shall utilize a packard type connector to prevent moisture intrusion and include surge protection against voltage spikes.

D. Flowmeter, when specified and shown in the plans

1. Provide a Bell & Gossett ST-104 field mounted flow sensor transmitter as indicated on the plans.

 Unit shall transmit an isolated 4-20 mA dc signal indicative of process variable to the pump logic controller via standard two wire 24 VDC system. Unit shall consist of an insertion probe and separately mounted transmitter. The unit shall be accurate to within 1% of flow rate from 1.0 ft/sec to 30.0 ft/sec and shall withstand a static pressure of 200.0 psi g with negligible change in output.

E. Station Frame.

1. The pump station frame shall be designed and fabricated to provide 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.

2. All piping shall be constructed from 304 stainless steel, schedule 10 or heavier pipe as required to maintain a 3 to 1 pressure safety factor (including 0.062 in corrosion allowance).

F. Isolation ball valves.

1. Isolation ball valves shall be certified to NSF-61 for use with potable drinking water.

2. Isolation ball valves shall be certified as low lead having wetted surface area with a weighted average lead content < 0.25%.

3. Valves shall be rated for 600.0 psig WOG / 150.0 psig WSP for valves 0.25 in to 2.0 in and 400.0 psig WOG / 125.0 psig WSP for valves 2.5 in to 4.0 in.

4. Seats and stem packing shall be virgin PTFE. Stem shall be bottom loaded blowout proof design with fluorocarbon elastomer O-ring to prevent stem leaks.

5. Valves shall be 2-piece full port design.

G. Isolation Grooved Butterfly Valves.

1. Valves shall be certified to NSF-61 for use with potable drinking water.

2. Valve bodies shall be nylon coated ductile iron conforming to ASTM A536 with integral neck and ISO mounting top.

3. The disc shall be encapsulated with Gr. E EPDM for cold and hot water services.

4. Valves shall be rated for 300.0 psig CWP

H. Isolation lug style butterfly valve.

1. Valve shall be certified to NSF-61 for use with potable drinking water.

2. Valve body shall be made of ASTM 536 ductile iron and will be coated with an FDA approved epoxy.

Valve face to face dimensions shall comply with API 609 and MSS-SP-67.

3. Disc shall be made of ASTM A-351 stainless steel. Shaft shall be made of 316SS.

4. Bushing shall be made of a Teflon®-Darcon inner liner bonded to fiberglass-epoxy resin outer shell.

5. Seat shall be EPDM.

6. Valve shall be rated to 200.0 psig WOG.

I. Threaded check valves.

1. All valve metallic components shall be 316SS.

2. Seat shall be Viton.

3. Valve shall be rated for 400.0 psig WOG.

J. Wafer Style Silent Check Valve.

1. The valve body shall be constructed of ASTM A126 Class B cast iron for Class 125/250 (lead free).

2. The seat and double guided disc shall be ASTM B584, C87600 silicon bronze.

3. The compression spring shall be ASTM A313 Type 316 Stainless Steel with ground ends.

4. NSF/ANSI 61 & 372 certification

5. The valve design shall incorporate a center guided, spring loaded disc, guided at opposite ends and having a short linear stroke that generates a flow area equal to the nominal valve size.

6. The operation of the valve shall not be affected by the position of installation. The valve shall be capable of operating in the horizontal or vertical positions with the flow up or down.

7. All component parts shall be field replaceable without the need of special tools. A replaceable guide bushing shall be provided and held in position by the spring. The spring shall be designed to withstand 100,000 cycles without failure and provide a cracking pressure of 0.5 psig.

8. The valve disc shall be concave to the flow direction providing for disc stabilization, maximum strength, and a minimum flow velocity to open the valve.

9. The valve disc and seat shall have a seating surface finish of 16 micro-inch or better to ensure positive seating at all pressures. The leakage rate shall not exceed the allowable rate for metal seated valves allowed by AWWA Standard C508 or 1 oz (30 ml) per hour per inch (mm) of valve diameter.

10. The valve flow way shall be contoured and unrestricted to provide full flow areas at all locations within the valve. Cv
 flow coefficients shall be equal to or greater than specified below and verified by an independent testing laboratory.

|  |  |
| --- | --- |
| **Valve Size**Inches (mm) |  **Wafer Style Cv** |
| 2 (50) | 43 |
| 2.5 (65) | 88 |
| 3 (80) | 130 |
| 4 (100) | 228 |
| 5 (125) | 350 |
| 6 (150) | 520 |

11. The valves shall be hydrostatically tested at 1.5 times their rated cold working pressure and seat tested at the
 valve CWP.

K. Control Valve.

1. The control valve automatically reduces a higher inlet pressure to a steady lower downstream pressure, regardless of changing flow rate and/or varying inlet pressure. It is a pilot-operated regulator capable of holding downstream pressure to a pre-determined limit. The main and pilot valves close when downstream pressure exceeds the pressure setting of the control pilot.

2. The valve components shall be NSF 61, NSF 61 Annex G and AB1953 approved.

3. Ratings

a. The maximum water temperature allowed is 180º F.

b. The maximum suggested continuous flow shall be per no greater than 10.0 ft/sec.

c. The end connections are NPT for 2.0 in or smaller valves. The end connections are flanged for 2.5 in or bigger valves.

4. Materials

a. Trim material shall be bronze. Trim is comprised of a disc guide, seat and cover bearing.

b. The body and cover shall be ductile iron to ASTM A536.

c. The disc shall be Buna-N® rubber.

d. The diaphragm shall be nylon reinforced Buna-N® rubber.

e. The stem, nut and spring shall be stainless steel.

f. There is KC epoxy coating on all wetted areas (3 mils average.)

5. Features:

a. The piloting shall include an X46A flow clean strainer, which prevents passage of foreign particles larger than 0.015 in.

b. The piloting shall include a check valve

c. The disc guide is of the contoured type to permit smooth transition of flow and holds the disc firmly in place.

d. The disc retainer withstands opening and closing shocks. Its straight edge sides and radius at the top edge prevents excessive diaphragm wear as the diaphragm flexes across the surface.

e. The diaphragm can withstand a Mullins Burst Test of a minimum of 600.0 psi g per layer of nylon fabric, and it is cycle tested 100,000 times to insure longevity.

f. The lower bearing of the valve stem is contained concentrically within the seat, and is exposed to the flow on all sides to avoid deposits.

g. The valve body and cover are machined with a locating lip to insure proper alignment of the valve stem.

h. All necessary repairs and/or modifications other than replacement of the main valve body are possible without removing the valve from the pipeline.

L. Pressure Gauges.

1. Gauges shall be provided for the suction and discharge manifold.

2. Accuracy shall be ±1.5%

3. Bourdon tube and connection shall be constructed of 316SS.

4. Case, bezel and internals shall be constructed of 316SS.

5. Gauge shall be filled with glycerin in order to dampen pulsation and vibration and to provide lubrication to the internal parts.

6. Gauge range shall be selected to cover the largest operating range for the specific conditions and pump selected.

M. Flange Bolts.

1. Bolts shall be zinc plated and shall meet ASTM Grade A193 B7.

N. Paint.

1. The finish coat shall be acrylic enamel to a thickness of no less than 3 mils.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

A. Install equipment in accordance with manufacturer's instructions.

B. The contractor shall align the pump and motor shafts to within the manufacturer's recommended tolerances prior to system start-up.

C. Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal and local codes.

D. Control wiring for remote mounted switches and sensor / transmitters shall be the responsibility of the controls contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal and
local codes.

**3.2 DEMONSTRATION/TRAINING**

A. The system manufacturer's factory qualified representative shall be capable of providing optional start-up of the packaged pumping system. This start-up shall include verification of proper installation, system initiation, adjustment and fine tuning. Start-up shall not be considered complete until the sequence of operation, including all alarms, has been sufficiently demonstrated to the owner or owner's designated representative. This job site visit shall occur only after all hook-ups, tie-ins, and terminations have been completed and signed-off on the manufacturer's start-up request form.

B. The system manufacturer's factory qualified representative shall be capable of providing on-site training for owner's personnel. This training shall fully cover maintenance and operation of all system components.

C. The system manufacturer must have an optional complete pressure booster training program available for owner's personnel. The training sessions shall take place at the manufacturer's facility and cover all aspects of pressure booster system design, service and operation.

**3.3 WARRANTY**

A. 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.

**3.4 START-UP SERVICE**

A. Owner start up assistance will be provided by a manufacturer qualified representative and will be limited to one
8-hour day, unless previously negotiated by the factory representative. When discharge piping, electrical connections, and electrical inspection have been completed, the pump station representative shall be contacted for start up. A minimum two-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.



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