



TECHNOFORCE HVAC PACKAGE SYSTEM

PART 1 **GENERAL**

1.1 SECTION INCLUDES

- A. Variable Speed Pumping Package
- B. Pump Control Panel
- C. Variable Frequency Drive Programmed with Sensorless Control
- 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 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. The pumping system shall be factory tested to the job specific condition points prior to shipment.
- D. 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.
- E. 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.
- 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 TechnoForce HVAC Package System as manufactured by Bell & Gossett or approved equal. Suction and discharge headers shall be constructed of 304 series stainless steel.
- B. Manufacturer shall be listed by Underwriters Laboratories as a manufacturer of packaged pumping systems.
- C. The control system shall include, as a minimum, the programmable logic station controller, variable frequency drives programmed with sensorless control, and any additional equipment as specified or as required to properly execute the sequence of operation.
- D. System shall require only suction, discharge and drain connections and single point power connections from a service entrance disconnect.
- E. All components shall be mounted and shipped as a single unit.
- F. Pumps shall be manufactured by Xylem.
- G. 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.
- H. Pressure gauges shall be installed on the suction and discharge headers.
 - I. Piping shall be sized so that water velocity shall not exceed 10.0 ft/sec in either the branches or manifolds.
- J. Pumps shall be protected from thermal accumulation via individual thermal relief mechanisms.

2.3 COMPONENTS

A. TECHNOLOGIC PPS PARALLEL PUMP CONTROLLER

1. Mechanical and Electrical Details

- a. The parallel pumping system pump logic controller shall be the Bell & Gossett Technologic PPS parallel pump controller. The PPS controller shall be specifically designed for the control of multiple pump HVAC hydronic and/or chilled/heated water systems that involves up to 8 variable speed pumps in parallel, staged, sequenced, and standby configurations. The PPS controller can be used with either sensed or sensorless closed-loop hydronic systems.
- b. The Technologic PPS controller shall include a 5.7" TFT touch-screen for all necessary user interface functions. Keypad based interfaces, LCD readouts, and LED displays will not be accepted. The PPS controller shall perform online self-diagnostic testing of the CPU(s), RAM, and flash memory. No data shall be lost during power supply interruptions.
- c. The Technologic PPS controller shall have a Type 1 rated cabinet. The PPS controller shall have three levels of password security: one level for user monitoring parameters; a second for supervisor monitor and adjust setup parameters; and a third level to allow technician adjust all the parameters.
- d. The Technologic PPS controller shall be listed by and bear the label of Intertek (ETL) and certified per Underwriter's Laboratory, Inc. (UL) and the CSA safety standards.
- e. The Technologic PPS controller should be able to connect up to 8 pumps and up to 16 analog inputs from VFD
- f. The Technologic PPS controller shall be capable of accepting and processing appropriate signals (DP, Temperature, or Flow) for the following connection in parallel pumping and VFD terminal blocks:
 1. Up to 16 analog inputs (AI; connection is in the VFD) for zone DP or analog input signals 4-20 mA
 2. AI for flow sensor for end of curve protection,
 3. Up to 7 digital inputs (DI), to connect to DP switch for pump protection for the standard configuration
 4. 1 DI for remote connection for start/stop
 5. General system alarm
 6. 1 serial port for communication with the BMS
 7. 1 serial port for communication with the VFDs
 8. 2 USB ports
 9. 1 Ethernet ports
 10. 1 Powerlink Interface
 11. 1 X2X Link Interface
 12. 1 terminal block for 24VDC power supply
 13. Input voltage options available 208/230, 460, or 575VAC 60/50Hz
- g. Technologic PPS Controller should display the following parameters status:
 1. Total sensorless flow
 2. Sensorless pump head
 3. Total power
 4. Speed of individual pumps
 5. Alarm status
 6. Wire to water efficiency (calculated)
 7. Number of pumps running (max eight)
 8. Lead pump number

- h. Technologic PPS Controller should display individual pump and VFD status
 - 1. Speed Ref (% and Hz)
 - 2. Run time (hrs)
 - 3. Pump/VFD fault
 - 4. Run status (running/stopped in graphic animation)
 - 5. Current (Amps)
 - 6. Volts (VAC)
 - 7. Power (kW)
 - 8. Pump head (Graphic in real time)
 - 9. System flow (Graphic in real time)
 - 10. System curve/pump (Graphic in real time)
 - 11. Control curve (Graphic in real time)
 - 12. Pump speed curve (Graphic in real time)
 - 13. Pump efficiency and power curve
 - i. The Technologic PPS controller shall allow field adjustments of control parameters as described below.
2. Sequence of Operation for Technologic PPS Controller
- a. The system shall consist of a Technologic PPS Controller, multiple pump/VFD sets with manual and automatic alternation and pump staging.
 - b. When the PPS controller Mode of Operation selector switch is in the REMOTE position, the parallel pumping system shall start upon the closure of customer's contact.
 - c. When the selector switch is in the LOCAL position, the pumping system shall operate automatically.
 - d. The Technologic PPS controller shall compare each process variable to the independent, engineer/user determined set-points when the PPS controller runs in sensor operation mode.
 - e. When all set-points are satisfied by the process variable, the pump speed shall remain constant at the optimum energy consumption level. If the pump feedback from the pumps indicates that the operating pumps are approaching the end of curve point, the PPS controller shall automatically stage on lag-pumps as required to bring all pumps back to an acceptable operating point.
 - f. The PPS controller shall continuously update and compare each process variable to its individual set-point.
 - g. If the set-point cannot be satisfied by the designated lead pump, the PPS controller shall initiate a sequence of operation to stage a lag pump.
 - h. The lag pump shall accelerate until lead pump(s) and lag pump equalize in speed.
 - i. Further change in process variable shall cause the pumps to change speed together.
 - j. When the set-point criteria can be safely satisfied with fewer pumps, the PPS controller shall initiate a destage sequence and continue variable speed operation.
 - k. As the worst case zone deviates from set-point, the Technologic PPS controller shall send the appropriate speed signal to the VFD to speed up or slow down the pump/motor.
 - l. In the event of a system feedback failure due to a pump or VFD fault, the PPS controller shall automatically start the next variable speed pump/VFD set in sequence and continue variable speed operation.
 - m. In the event there is no feedback signal from a pump, its process variable signal shall be removed from the scan/compare program. Alternative pump feedback, if available, shall remain in the scan/compare program for control.
 - n. The pump number corresponding to the failed feedback signal shall be displayed on the operator interface of the PPS controller.

- o. In the event of failure to receive all feedback signals, all VFDs shall maintain a pre-determined speed and per-determined of pumps. Reset shall be automatic upon correction of the zone failure.
- p. PUMP or VFD fault shall be continuously scrolled through the display on the operator interface of until the fault has been corrected and the controller has been manually reset.
- q. The Technologic PPS controller shall be capable of serial communications with BACnet, Modbus, and Metasys protocols. The PPS controller shall offer the option of gateways for both LonWork and TCP/IP protocol connection for communication over the internet.

3. Alarms

- a. General alarm
- b. Pumps running fault alarms
- c. Drive fault alarms
- d. Zone/sensor alarm
- e. Drive communication alarm

B. MECHANICAL

1. Pump Station Frame and Piping

- a. Framing 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.
- b. 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 1/16" corrosion allowance).

2. Centrifugal Pumps

- a. Bell & Gossett e-1531 Pumps
- b. Stainless steel fitted
- c. TEFC Motors JM Frame

3. Isolation Ball Valves

- a. Isolation ball valves shall be certified as low lead having wetted surface area with a weighted average lead content <0.25%.
- b. Valves shall be rated for 600 psi WOG / 150 psi WSP for valves ¼" to 2" and 400 psi WOG / 125 psi WSP for valves 2-1/2" to 4".
- c. 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.
- d. Valves shall be 2-piece full port design.

4. Isolation Grooved Butterfly Valves

- a. Valve bodies shall be nylon coated ductile iron conforming to ASTM A536 with integral neck and ISO mounting top.
- b. The disc shall be encapsulated with Gr. E EPDM for cold and hot water services.
- c. Valves shall be rated for 300 psi CWP

5. Isolation Lug Style Butterfly Valve

- a. Valve body shall be made of ASTM 536 ductile iron and will be coated with an FDA approved epoxy.
- b. Disc shall be made of ASTM A-351 stainless steel. Shaft shall be made of 316SS.
- c. Bushing shall be made of a Teflon®-Darcon inner liner bonded to fiberglass-epoxy resin outer shell.
- d. Seat shall be EPDM.
- e. Valve shall be rated to 200 psi WOG.

6. Threaded Check Valves

- a. All valve metallic components shall be 316SS.
- b. Seat shall be Viton.
- c. Valve shall be rated for 400 psi WOG.

7. Wafer Style Silent Check Valve

- a. The valve body shall be constructed of ASTM A126 Class B cast iron for Class 125/250 (lead free).
- b. The seat and double guided disc shall be ASTM B584, C87600 silicon bronze.
- c. The compression spring shall be ASTM A313 Type 316 Stainless Steel.
- d. 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.
- e. 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.
- f. 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 psi.
- g. 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.
- h. 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.
- i. 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.
- j. The valves shall be hydrostatically tested at 1.5 times their rated cold working pressure and seat tested at the valve CWP.

8. Sensor / Transmitters

- a. 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 $< \pm 0.5\%$ 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 to protect against voltage spikes.

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

9. Pressure Gauges

- a. Gauges shall be provided for the suction and discharge manifold.
- b. Accuracy shall be $\pm 1.5\%$
- c. Bourdon tube and connection shall be constructed of 316SS.
- d. Case, bezel and internals shall be constructed of 316SS.
- e. Gauge shall be filled with glycerin in order to dampen pulsation and vibration and to provide lubrication to the internal parts.
- f. Gauge range shall be selected to cover the largest operating range for the specific conditions and pump selected.

10. Flange Bolts

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

11. Paint

- a. Standard 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. The contractor shall determine the appropriate method for mounting, securing and plumbing the package in accordance with applicable state, federal and local building and plumbing codes. Isolation valves are required by the manufacturer on suction and discharge lines, valves by others.
- B. The contractor shall align the pump and motor shafts to within the manufacturer's recommended tolerances prior to system start-up.
- C. Power supply wiring, as required, as well as installation methods, shall be the responsibility of the electrical contractor. All wiring shall be performed per 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. Start-up and training of the packaged pumping system shall be the responsibility of the distributor.

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 shall be arranged by the distributor. The duration of start-up assistance as well as testing parameters and package capabilities shall be confirmed to the owner by the distributor.

Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services settings. Xylem also provides a leading portfolio of smart metering, network technologies and advanced analytics solutions for water, electric and gas utilities. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

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