Bell & Gossett
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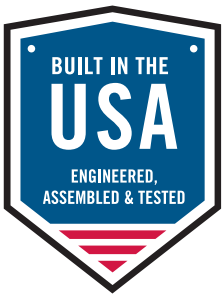
SPECIFICATIONS
BGe-MTV-SP-100023 R1

TECHNOFORCE™ e-MTV

PART 1 **GENERAL**



1.1 SECTION INCLUDES

A. Variable Speed Pumping Package
B. Pump Control Panel
C. Variable Frequency Drive
D. Sensor Transmitters
E. 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 including variable speed pump curves and system curve. The analysis shall also include pump, motor, pump efficiencies, horsepower and kilowatt/hour consumption.
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. The pumping system shall be factory tested to the job specific condition points prior to shipment or standard best efficiency conditions in the absence of job data, or conditions deemed appropriate to the capabilities of the factory testing equipment.

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. 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.

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

H. Control Panel shall be manufactured and listed under UL 508A.

I. 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

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 Variable Speed Booster 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 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%.

D. The control system shall include, as a minimum, the programmable logic station controller, variable frequency drives, a manifold mounted 4-20mA pressure transducer and any additional equipment as specified or as required to properly execute the sequence of operation.

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. 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 Variable Speed Pump Logic Controller

1. The TECHNOFORCE pump logic controller shall be listed by the Underwriter's Laboratory and bear the UL/cUL label, and shall be certified by BACnet Testing Laboratory and bear the BTL label. The controller shall be specifically designed for packaged pressure booster applications.
2. The variable speed pump control logic shall be capable of accelerating a pump to rated speed (Staging) and decelerating pump to a stop or a specific safe speed (De-Staging). It shall employ various methods to perform alternation.
3. The programmable logic controller (PLC) and operator interface shall be one integrated unit capable of controlling from 1-to-3 pumps. The controller interface shall have an environmental operating range of 0-to-50° C (<2000 m or 6666 ft), and a 90% RH rating at 40°C.
4. The Standard 7" color touchscreen shall have a landscape format, WVGA (800x480) resolution, and a LED backlight. Analog input resolution shall be 12-bit minimum. The interface shall have multi-level password protection capability to configure and modify pump and motor parameters. A Quick Start-up Menu screen shall facilitate easy start-up.
5. Interfacing through the color touchscreen display shall be supported with (1) RS485 connection, (1) RS232C connection, (2) Ethernet interfaces, a micro USB-B port, and a USB-A 2.0 port.
6. The pressure booster application software shall be held in non-volatile flash memory with the capability of preventing accidental loss of data and values due to voltage surges and spikes. In the event of a complete power outage, all factory preset, or last saved data values, shall remain stored and available for recall by the operator.
7. The variable speed pump logic program shall provide safeguards against damaging hydraulic conditions including:
   a. End-of-curve protection (requires option Flow Meter)
   b. Low or high system pressure
8. The variable speed pump logic software program ability to detect fault conditions includes:
   a. VFD run failure
   b. VFD trip/failure
   c. Low and high system pressure
   d. Low and high suction pressure
   e. Loss of prime (requires optional loss-of-prime sensor/switch)
   f. Low inlet pressure (requires optional low inlet pressure switch)
9. As a minimum, the controller shall have the Inputs and Outputs:
   a. Eight (8) Digital Inputs (DI)
   b. Three (3) 4-20ma Analog Inputs (AI)
   c. Three (3) analog output, 4-20mA signal
   d. Five (5) relay outputs, 230 VAC/5A rating

10. The pump controller shall be capable of communicating with the Building Management System (BMS) by either (1) hard-wire or (2) a communications protocol.
    a. Hard wire: The following communication features shall be provided to the BAS via digital input:
        i. Remote system start/stop (dry contact supplied by BAS)
    b. Communications Protocol: The followings BMS communication protocols are supported:
        i. MODBUS RTU
        ii. MODBUS TCP
        iii. BACnet MSTP
        iv. BACnet IP
    c. The following communications data points are supported by all available protocols:
        i. System start/stop; input and output (Start/Stop)
        ii. System operation mode (Auto/Manual)
        iii. System sequence alternation (Yes/No)
        iv. System pressure (0-span)
        v. System flow; GPM; Requires optional flow meter (0-span)
        vi. Setpoint
        vii. Individual pump off (Alarm/OK)
        viii. Individual pump enabled (Enabled/disabled)
        ix. Speed (%)
        x. General alarm
        xi. Individual VFD failure (Failure/OK)
        xii. Individual sensor failure
        xiii. System reset request (Yes/No)
    d. The PLC shall support baud rates (kbits/sec) of 9600, 19200, 38400, 76800 and 115,200.

11. Sensors, Transducers
    a. Discharge pressure transducer (Standard default)
    b. A backup redundant discharge pressure transducer shall provide continued operation if the primary transducer fails (Optional). A warning light signal shall be given.
    c. Low suction pressure Switch (optional field installed feature)
    d. Flow meter (Optional)
12. No Flow Shutdown (NFSD)
    a. The pump logic control shall be capable of shutting down the system without the need for a flow meter/switch, once no flow is detected. This system will restart once the system pressure equals a 'restart PSI' set point pressure.
13. Pipe Fill Mode:
    a. On initial start-up, the booster will slowly fill the system with water. Once the controller detects that the system has been filled, the system pressure is built up over a pre-determined ramp-up time.

14. Data Logging
    a. The controller shall log alarms
15. Other Control Features and Functionality is provided:
    a. Time and Date set-up
    b. Optional Flow Meter
    c. Alarm horn
    d. Alarm Status
16. Variable Speed System Sequence of Operation
    a. The system shall consist of a pump logic controller with multi-pump parallel operation control, duty-standby pump selection, automatic alternation and automatic transfer to the standby pump upon pump/VFD failure.
    b. The pumping system shall start upon the closure of customer's contact when the pump logic controller Mode of Operation is in REMOTE.
    c. When the pump logic controller mode in LOCAL, the pumping system shall operate automatically.
    d. Each sensor/transmitter shall send a 4-20mA signal to the pump logic controller, indicative of process variable condition.
    e. When the set point is satisfied by the process variable, the pump speed shall remain constant at the optimum energy consumption level.
    f. When the process variable exceeds the allowable drift from the set point for a set time the pump controller shall automatically start the next lag pump and continue in this fashion as necessary to satisfy system demand. To maintain system set point the controller will operate the pumps synchronously or sequentially to ensure maximum energy conservation.
    g. As demand is satisfied, the controller shall automatically stop lag pumps as necessary to conserve energy.
    h. In the event of a pump failure or a VFD fault, the pump logic controller automatically initiates a timed sequence of operation to start the redundant pump/VFD set in the variable speed mode.
    i. In the event of the failure of a zone sensor/transmitter, its process variable signal shall be removed from the scan/compare program. The redundant zone sensor/transmitters, if available, shall remain in the scan/compare program for control.
    j. PUMP or VFD hard fault shall be flash continuously on the display on the operator interface of the pump logic controller until the fault has been corrected and the controller has been manually reset.
    k. When the system is satisfied, the pump controller shall shutdown the single running lead pump without the need of a flow sensor/switch or hydropneumatic tank and enter energy saving / no flow shutdown mode.
17. Electrical
    a. Pump Logic Controller Enclosure. Main station disconnect shall have a through door operator and shall be sized as shown in the technical data sheet. Individual circuit breakers shall have exterior operators, 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.
    b. Controls and Enclosure. The control panel with controls shall be built in accordance with NEC, and shall comply with UL standards. 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.

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

18. 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 < ±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.

19. Flowmeter, when specified and shown in the plans

a. 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.

B. VARIABLE FREQUENCY DRIVE

1. Description

a. This specification covers complete variable frequency drives (VFDs) designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the VFD panel. The drive hardware shall be manufactured by Schneider Electric.

b. The VFD shall be rated NEMA 1. The VFD shall have been evaluated by UL and found acceptable for mounting in a plenum or other air handling compartment. Manufacturer shall supply a copy of the UL plenum evaluation upon request.

c. The VFD shall be tested to UL 508C and/or UL 61800-5-1. The appropriate UL label shall be applied. When the VFDs are to be located in Canada, C-UL certifications shall apply. VFD shall be manufactured in ISO 9001, 2000 certified facilities.

d. The VFD shall be CE marked and conform to the European Union ElectroMagnetic Compatibility directive.

e. The VFD shall be UL listed for a short circuit current rating of 5kA.

f. The VFD manufacturer shall supply the VFD and all necessary controls as herein specified.

2. Components

a. The VFD shall convert incoming fixed frequency three-phase AC power into an adjustable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for the driven load and to eliminate the need for motor de-rating.

b. When properly sized, the VFD shall allow the motor to produce full rated power at rated motor voltage, current, and speed without using the motor's service factor. VFDs utilizing sine weighted/ coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

c. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental (displacement) power factor near unity regardless of speed or load.

d. The VFD's full load output current rating shall meet or exceed NEC Table 430.250. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 120% of rated torque for up to 0.5 second while starting.

e. Output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD.

f. Galvanic isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete digital I/O shall include additional isolation modules.

g. VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency The carrier frequency shall be automatically adjusted to optimize motor and VFD operation while reducing motor noise. VFDs with fixed carrier frequency are not acceptable.

3. Protective features

a. Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults.

b. Protect VFD from input phase loss. The VFD should be able to protect itself from damage and indicate the phase loss condition. During an input phase loss condition, the VFD shall be able to be programmed to either trip off while displaying an alarm, issue a warning while running at reduced output capacity, or issue a warning while running at full commanded speed. This function is independent of which input power phase is lost.

c. Protect from under voltage. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output, without faulting, with an input voltage as low as 70% of the nominal voltage.

d. Protect from over voltage. The VFD shall continue to operate without faulting with a momentary input voltage as high as 130% of the nominal voltage.

e. VFD shall catch a rotating motor operating forward or reverse up to full speed without VFD fault or component damage.

f. Selectable over-voltage control shall be provided to protect the drive from power regenerated by the motor while maintaining control of the driven load.

g. VFD shall include current sensors on all three output phases to accurately measure motor current, protect the VFD from output short circuits, output ground faults, and act as a motor overload. If an output phase loss is detected, the VFD will trip off and identify which of the output phases is low or lost.

h. In order to ensure operation during periods of overload, it must be possible to program the VFD to automatically reduce its output current to a programmed value during periods of excessive load. This allows the VFD to continue to run the load without tripping.

i. The VFD shall have temperature controlled cooling fan(s) for quiet operation, minimized losses, and increased fan life. At low loads or low ambient temperatures, the fan(s) may be off even when the VFD is running.

4. Interior Features

a. A red FAULT light and a green POWER-ON light shall be provided.

b. The VFD's PID controller shall be able to actively adjust its setpoint based on flow. This allows the VFD to compensate for a pressure feedback sensor which is located near the output of the pump rather than out in the controlled system.

c. A run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation.

The run permissive circuit shall also be capable of initiating an output "run request" signal to indicate to the external equipment that the VFD has received a request to run.

5. Standard Inputs and Outputs
   a. Four dedicated, programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
   b. Two terminals shall be programmable to act either as digital outputs or additional digital inputs.
   c. Two programmable relay outputs, (1) Form A and (1) Form C 240 V AC, 2 A, shall be provided for remote indication
      of VFD status.
      i. Each relay shall have an adjustable on delay / off delay time.
   d. Two programmable analog inputs shall be provided that can be either direct-or-reverse acting.
      i. Each shall be independently selectable to be used with either an analog voltage or current signal.
      ii. The maximum and minimum range of each shall be able to be independently scalable from 0 to 10 V dc and 0 to 20 mA.
      iii. A programmable low-pass filter for either or both of the analog inputs must be included to compensate for noise.
   e. One programmable analog current output (0/4 to 20 mA) shall be provided for indication of VFD status. This output shall be programmable to show the reference or feedback signal supplied to the VFD and for VFD output frequency, current and power. It shall be possible to scale the minimum and maximum values of this output.
   f. It shall be possible through serial bus communications to read the status of all analog and digital inputs of the VFD.
   g. It shall be possible to command all digital and analog output through the serial communication bus.
   h. It shall be possible through serial bus communications to control the status of all optional analog and digital outputs of the VFD.
   i. The VFD shall be able to store load profile data to assist in analyzing the system demand and energy consumption over time.
6. Adjustments
   a. The VFD shall have a manually adjustable carrier frequency that can be adjusted in 0.5 kHz increments to allow the user to select the desired operating characteristics. The VFD shall also be programmable to automatically reduce its carrier frequency to avoid tripping due to thermal loading.
   b. Three Configuration shall be provided for set of 15 parameters.
   c. Sixteen preset speeds shall be provided
   d. Each setup shall have two programmable ramp up and ramp down times. Acceleration and deceleration ramp times shall be adjustable over the range from 1 to 6,000 seconds.
   e. Each setup shall be programmable for a unique current limit value. If the output current from the VFD reaches this value, any further attempt to increase the current produced by the VFD will cause the VFD to reduce its output frequency to reduce the load on the VFD. If desired, it shall be possible to program a timer which will cause the VFD to trip off after a programmed time period.
   f. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: external interlock, under-voltage, over-voltage, current limit, over temperature, and VFD overload.
   g. The Automatic restart is performed by a series of automatic attempts separated by increasingly longer waiting periods: 1 s, 5 s, 10 s, then 1 minute for the following attempts. Maximum restart time shall be selectable from 5 min through 3 hours or infinitely.

h. Three programmable skip frequency ranges to prevent the VFD from operating the load at a speed that causes vibration in the driven equipment shall be provided. Semi-automatic setting of skip frequency ranges shall simplify the set-up.

7. Service Conditions

a. Ambient temperature, continuous, full speed, full load operation:

(i) -10 to 45°C (14 to 113°F) through 125 HP @ 460 and 600 volt, through 60 HP @ 208 volt

(ii) -10 to 40°C (14 to 104°F) 150 HP and larger

b. 0 to 95% relative humidity, non-condensing.

c. Elevation to 3,300 feet without derating.

d. AC line voltage variation, -10 to +10% of nominal with full output.

e. No side clearance shall be required for cooling.

f. All power and control wiring shall be done from the bottom.

8. Quality Assurance

a. To ensure quality, the complete VFD shall be tested by the manufacturer. The VFD shall drive a motor connected to a dynamometer at full load and speed and shall be cycled during the automated test procedure.

9. VFD shall utilize a full wave rectifier to convert three phase AC to a fixed DC voltage. Power factor shall remain above 0.98 regardless of speed or load. VFD's employing power factor correction capacitors shall not be acceptable.

10. The VFD shall be suitable for elevations to 3300 feet above sea level without derating. Maximum operating ambient temperature rating shall not be greater than 104°F. VFD shall be suitable for operation in environments up to 95% non-condensing humidity.

11. The VFD shall be capable of displaying the following information in plain English via an alphanumeric display:

a. Output Frequency

b. Output Voltage

c. Motor Current

d. Kilowatts per hour

e. Fault identification with text

f. Percent torque

g. Percent power

h. RPM

C. 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. Stainless Steel Vertical Multistage Pumps

a. Bell & Gossett's e-SV vertical multi-stage pump, compliant to ANSI/NSF-61 Annex G, premium efficient motor - standard NEMA design 56C, JM, or TC frame.

b. AISI 304 wetted components
c. Impeller: AISI 304
d. Diffuser: AISI 304
e. Shaft: AISI 316 (sizes 1 – 22SV) • Duplex ASTM-A182 (sizes 33-92SV)
f. External sleeve: AISI 304
g. Pump body: AISI 304
h. Seal housing: AISI 304
i. Mechanical seal: all material options NSF/ANSI-61 compliant

3. Isolation Ball Valves
   a. Isolation ball valves shall be certified to NSF-61 for use with potable drinking water.
   b. Isolation ball valves shall be certified as low lead having wetted surface area with a weighted average lead content<0.25%.
   c. 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".
   d. 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.
   e. Valves shall be 2-piece full port design.
4. Isolation Grooved Butterfly Valves
   a. Valves shall be certified to NSF-61 for use with potable drinking water.
   b. Valve bodies shall be nylon coated ductile iron conforming to ASTM A536 with integral neck and ISO mounting top.
   c. The disc shall be encapsulated with Gr. E EPDM for cold and hot water services.
   d. Valves shall be rated for 300 psi CWP
5. Isolation Lug Style Butterfly Valve
   a. Valve shall be certified to NSF-61 for use with potable drinking water.
   b. 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.
   c. Disc shall be made of ASTM A-351 stainless steel. Shaft shall be made of 316SS.
   d. Bushing shall be made of a Teflon®-Darcon inner liner bonded to fiberglass-epoxy resin outer shell.
   e. Seat shall be EPDM.
   f. 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. NSF/ANSI 61 & 372 certification
   e. 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.
   f. 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.

g. 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.

h. 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.

i. 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.

j. 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.

k. 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 < ±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.

9. Flowmeter (Optional)

a. 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 to 30 fps and shall withstand a static pressure of 200 PSI with negligible change in output.

10. Pressure Gauges

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

b. Accuracy shall be ±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.

11. Flange Bolts

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

12. Paint

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

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

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. (Power wiring is to be copper wire ONLY)

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 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.

For more information on how Xylem can help you, go to www.xylem.com

Xylem Product Cybersecurity
Xylem values your system security and the availability of your critical services. For more information on Xylem cybersecurity practices or to contact the cybersecurity team please visit xylem.com/security.

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Let's Solve Water

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