CTO BOOSTER SPECIFICATION

SECTION 22 11 23.13 - DOMESTIC WATER PRESSURE BOOSTING SYSTEMS

1 GENERAL

1.1 SUMMARY

A. This section includes variable speed, packaged pump station for domestic water applications.

B. Sequence of operation

1.2 REFERENCES

A.	UL	Underwriters Laboratory
B.	ASTM	American Standards for Testing Materials
C.	ASME	American Society of Mechanical Engineers
D.	NSF	National Sanitary Foundation
E.	NEC	National Electrical Code aka NFPA 70
F.	NFPA	National Fire Protection Association
G.	HI	Hydraulic Institute
H.	NEMA	National Electrical Manufacturers Association
I.	ANSI	American National Standards Institute

1.3 SUBMITTALS

A. Pumps curves with condition point and pump operating capacities shall be supplied.

B. Drawings

1. System outline drawing(s) including elevation, plan and detail views shall be provided.
2. Drawings shall include system connection and bolt-down sizes and locations as well as recommended NEC clearances.
3. System drawings/models CAD files in AutoCAD (.dwg), ACIS (.sat) or Revit compatible (.adsk) formats shall be supplied upon request.
4. Wiring diagrams in .pdf format shall be provided.
5. Installation, Operation and Maintenance manuals (IO&M's) shall be provided for the pump station.
6. A copy of the manufacturer's certificate of insurance showing as a minimum, general liability coverage of $1,000,000 and an excess liability coverage of $5,000,000.

1.4 QUALITY ASSURANCE

A. Manufacturers seeking authorization to furnish their product shall be a registered ISO9001:2008 manufacturer, and shall hold a current Quality Management Certificate for the assembly of custom packaged pumping systems and controls for use in commercial, irrigation, municipal, industrial, and fire applications.

B. The pump station shall be listed UL/cUL under category QCZJ for Packaged Pump Stations.

C. The manufacturer shall be listed under UL508 for the manufacturer of control panels.

D. The manufacturer shall have a minimum of 30 years' experience in the fabrication of packaged pump station.

E. The station shall be certified under NSF/ANSI Standard 61, Drinking Water System Components and NSF/ANSI 372 Lead Content Compliance.

F. The pump station shall be hydrostatically tested to maximum working pressure (MWP) the station is rated at for a minimum of 1 hour. Maximum working pressure is rated 125psig, 175psig, 230psig or 300psig based on the pump selected.

G. The pump station shall be factory run tested to insure condition point is maintained at the expected power draw.

H. The pump station test facility instrumentation shall be NIST traceable and have current calibration certificates.

I. Piping shall be built in compliance with ASME B31.1. Piping shall be fabricated by ASME Section IX certified welders.

J. Structural steel weldments shall we fabricated by AWS D1.1 certified welders.

K. Welder's certifications shall be available upon request.

2 PRODUCT

2.1 ACCEPTABLE MANUFACTURERS

A. **TIGERFLOW** Systems, LLC ("TIGERFLOW")

B. Preapproved equal

2.2 STATION

A. The station shall provide varying water flow rate at a constant pressure or ASHRAE 90.1 compliant pressure profile through the use of a PID PLC controller and variable speed drives.

B. The packaged pump station shall consist of:

1. One to four pumps
2. Check valves located on the discharge branch of each pump
3. Ball valve or lug or grooved butterfly isolation valves for each set of pumps and check valves
4. Common suction and discharge manifolds.
5. 4-20 mA transducer(s) located on the station discharge manifold
6. A 4-20 mA transducer shall be provided on the suction manifold for applications where the water source is pressured city water. Float switches shall be provided for applications where the water source is an adjacent tank. The float switches shall be installed by others.
7. Controls consisting of a TIGERFLOW Mark V controller and dedicated variable frequency drives for each pump
8. A common base or frame for components listed above.

2.3 COMPONENTS

A. Pumps shall be ANSI / NSF Standard 61 and ANSI / NSF 372 approved. Pumps shall be a model **ENTER_PUMP_MODEL** with a **Select HP** HP, **Select Voltage** , **Select Motor Enclosure** , motor.

B. Valve, check, wafer type, 1-1/2"

1. Body, spring retainer, spring, and disc shall be constructed of 316 stainless steel. The valve shall have a maximum working pressure of 600 psig.
2. The check valve shall be non-slam type that begins to close as the forward flow diminishes and fully closes at zero velocity preventing flow reversal and resultant water hammer.
3. The valve shall be ANSI/NSF Standard 61 listed and have a weighted average lead content of <=0.25%.

C. Valve, check, wafer type, 2" and larger

1. The Check Valve shall be of the silent operating type that begins to close as the forward flow diminishes and fully closes at zero velocity preventing flow reversal and resultant water hammer.
2. The valves used in potable water service shall be certified to NSF/ANSI 61, Drinking Water System Components – Health Effects, and certified to be Lead-Free in accordance with NSF/ANSI 372.
3. Manufacturer shall have a quality management system that is certified to ISO 9001 by an accredited, certifying body.
4. The valve design shall incorporate a center guided, spring loaded disc and having a short linear stroke that generates a flow area equal to the nominal valve size.
5. 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. Heavy duty springs for vertical flow down installations shall be provided when specified on 14 in. and larger valves.
6. All component parts shall be field replaceable without the need of special tools. Wafer and Globe styles shall be provided with a replaceable guide bushing 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.
7. The wafer and globe disc shall be concave to the flow direction providing for disc stabilization, maximum strength, and a minimum flow velocity to open the valve.
8. 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.
9. Wafer-style valve seats shall be fully retained with full size threads, and sealed with an o-ring.

D. Valve, butterfly, lug-type

1. Body shall be one-piece lug design with extended neck to allow for 2" of piping insulation. A non-corrosive bushing and a self-adjusting stem seal shall be provided. No field adjustment shall be necessary to maintain optimum field performance.
2. Disc edge and hub on metal discs shall be spherically machined and hand polished for minimum torque and maximum sealing capability.
3. Stem shall be one-piece design. Disc to stem connection shall be and internal double "D" design with no possible leak paths in the disc-to-stem connection. External disc-to- stem connections such as disc screws or pins are not allowed. Stem shall be mechanically retained in the body neck and no part of the stem shall be exposed to the line media.
4. Seat shall be tongue-and-groove bonded seat with a primary hub seal and a molded flange O-ring suitable for weld-neck and slip-on flanges. The seat shall totally encapsulate the body isolating it from the line media and no flange gaskets shall be required.
5. Valve shall have a maximum working pressure of 250 psig. Valve shall be tested to 110% of the rated pressure.

E. Valve, ball, 1-1/4” and smaller

1. Ball valves shall be 2-piece full port design constructed of forged copper silicon alloy brass body and end adapter.
2. 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.
3. Ball valve shall have chrome plated brass ball and adjustable packing gland.
4. Valve sizes 1⁄4" – 2" shall be rated to 600psig (41 bar) WOG non-shock. Valves shall be certified to NSF/ ANSI standard 61/8.
5. Valve shall have a weighted average lead content of <=0.25% with respect to wetted area.

F. Piping

1. Manifolds shall be constructed of either 304 or 316 stainless steel. Manifolds shall have a maximum working pressure of 300 psig.
2. Manifolds shall be grooved at both ends to allow change of suction and discharge connection geometry in the field.
3. Main and branch piping shall be sized for a maximum velocity of 10 ft/s.

G. HYDRO-PNEUMATIC TANK (OPTIONAL)

1. Provide a Section VIII, ASME Code, National Board stamped, hydro-pneumatic tank. Tank shall be provided complete with a NSF approved replaceable bladder, bottom connection, air fill valve, tank drain valve and gauge. Tank shall be: (Model TF-132E, 132 gallon, 150 PSI) (Model TF-185E, 185 gallon, 200 PSI).
2. The hydro-pneumatic tank shall be mounted adjacent to system with a minimum 1” feed line and full port ball valve on the pump station discharge header or shall be remote mounted as shown per drawings. * If the tank is adjacent mounted, it shall be the responsibility of the installing contractor to provide the feed line between the system tank feed valve and tank connection. If the tank is remote mounted, it shall be the responsibility of the installing contractor to provide the feed line, isolation valves, and any other necessary appurtenances between the tank and building piping.

H. Controls

1. The control panel shall be a **TIGERFLOW** Tiger’s Eye Mark V. The control panel shall consist of:
    a. Single point power connection
    b. Through door control power disconnect with safety interlock to prevent door from being opened while in ON position
    c. A solid-state programmable logic controller (PLC) with non-volatile memory (battery backup not required)
    d. Fused 120 V AC control voltage transformer
    e. Fused 24 V DC power supply, 1 Watt
    f. Operator interface: 6-inch color scale touch screen Human Machine Interface (HMI, Tier I) including but not limited to the following:
        (i) Main Screen with the following features:
            1. Individual pump HOA (Hand – Off – Auto) virtual switches
            2. Pump run indication, including current % speed
            3. Pump Failure indication
            4. Current pressures readings in psig (suction and system)
            5. Current flow in GPM (if flowmeter specified)
            6. Adjustable manual (hand) speed setting
            7. Direct access to menu screen

(ii) Menu screen providing direct access to all system settings and status screens
1. Pump settings screen displays current settings and allows user changes
2. Lead and lag pump start and stop pressures, psig.
3. Lead and lag pump ON and OFF delay times, seconds

(iii) Alarm settings screen displays current settings for all alarms and allows user changes.
1. Low suction alarm settings
a. Low suction pressure, psig
b. ON and OFF delays, seconds
c. Manual or automatic reset
2. Low system alarm settings
a. Low system pressure, psig
b. ON and OFF delays, seconds
c. Manual or automatic reset
3. High system alarm settings
a. High system pressure, psig
b. ON and OFF delays, seconds
c. Manual or automatic reset
4. High suction economy mode
a. Economy mode suction pressure, psig
b. Economy mode enable / disable
c. ON and OFF delays, seconds

(iv) Separate Alarm Silence and Alarm Reset buttons

(v) Current system status screen displays:
1. Pump(s) currently running
2. Active alarms and warning messages

(vi) System event history screen displays a minimum of the last 100 system events, including pump start /stops, alarm conditions and alarm acknowledgements.

(vii) Pump run time screen displays the total operating time for each pump. Provide individual resets for each pump run time

(viii) Lead pump alternation options will include:
1. Automatic alternation on lead pump shutdown
2. Manual alternation when operator touches alternate button
3. Timed alternation:
a. Daily (user specified time of day)
b. Weekly (user specified day of week and time of day)
c. Monthly (first week of month on user specified day of week and time of day)

(ix) Multi-Level Security
1. 5-8 Password protected security levels (field changeable passwords)

g. HMI, Tier II (optional): In addition to the functionality of the Tier I controller, the Tier II controller shall allow web-enabled access and control of the local station HMI via a browser on a desktop/laptop or web enabled mobile devices. The web interface shall allow the same functionality as the local HMI.

h. A common alarm relay provides dry contacts for customer monitoring.

i. An alarm horn with a minimum sound level of 85 db, annunciating all alarm conditions

2. The control panel shall be listed under UL/C-UL 508 and meet NEC (NFPA 70) requirements.
3. TIGERFLOW "TAP" Technology : The Tiger's Eye "TAP" control algorithm shall allow for varying discharge pressure with varying flow rates in order to compensate for varying friction losses in the system as described in ASHRAE 90.1. The control algorithm shall meet the requirements of ASHRAE 90.1.
4. The system control algorithm shall use a speed adjust curve calculation proportional response. Step response algorithms shall not be considered equal.
5. The Tiger's Eye shall provide Building Automation System communication through Modbus or BACnet (with optional Tier II HMI) protocol. Communication shall be provided via an RS-485 port.
6. The following event reporting shall be provided via BAS communication:
   a. Individual VFD status
   b. Remote System Disable
   c. Phase Loss Alarm
   d. Flow Switch or Level Switch option enabled
   e. Individual Pump Run
   f. Individual Pump Fault
   g. Individual Pump Hand/Auto status
   h. Low System Alarm
   i. Low Suction alarm
   j. High System Alarm
   k. General Alarm
   l. Alarm Horn Silenced
   m. System Sensor Failure
   n. Suction Sensor Failure
   o. Economy Mode engaged
   p. Fatal alarm
7. The following events initiation shall be available via BAS communication:
   a. BAS System Disable
   b. Enable BAS Set Point
   c. BAS Set Point (psi)
8. IF VFD's are mounted inside the control panel, drive keypads shall me door mounted and accessible without opening the control panel or disengaging power.
9. The control panel shall have a minimum short circuit current rating of 1200 kVa.
10. The PLC controller shall communicate with the variable frequency drives using Modbus protocol via RS-485 cables.

I. VARIABLE FREQUENCY DRIVES (VFD)

1. Each drive will have individual disconnects and short circuit protection. Drive manufacturer must provide a two year minimum warranty.
2. Drives will be configured to provide the following operating features:
   a. Drive keypad will have manual, off and automatic mode selection and will accessible to operators without opening an enclosure.
   b. When in automatic, drive will run upon closure of the respective run permissive contact

c. When in automatic and with a run permissive signal, drive speed will responded to a 0-10 V DC speed reference signal from pump controller.

d. Drive will provide a limited number of automatic resets for fault conditions and will maintain a history of faults.

J. Suction and system pressure transducers

1. Transducer wetted parts shall be a 300 series stainless steel.
2. Transducer shall output a 4-20 mA signal with a minimum accuracy of +1%.

K. Flowmeter, paddlewheel (optional)

1. Flowmeter shall be a paddle type with:
   a. Non-metallic paddle wheel
   b. An accuracy of: ± 1.0% of full scale over recommended design flow range and ± 4.0% of reading within calibration range
   c. Installation in 10X upstream and 5X downstream pipe diameters straight pipe run.
   d. A design flow velocity of .5-30 ft/sec

3 EXECUTION

3.1 INSTALLATION

A. Installation of the system shall be per the manufacture's recommendations and shall meet applicable federal, state and local codes.

B. Coordination of building trades and subcontractors and compliance with federal, state, and local codes shall be performed by the contractor with unit responsibility.

C. Unless otherwise negotiated, remote mounted instrumentation, control wiring and mapping of BAS communication points shall be the responsibility of the controls engineer/contractor.

D. Unless otherwise negotiated, interfacing of the Tier II HMI to the building's network to allow for web-enabled access shall be coordinated of the contractor having unit responsibility and the buildings IT professionals.

3.2 START-UP

A. Four (4) hours of start-up service and field training will be provided by the manufacturer's representative unless otherwise negotiated.

B. Prior to start-up, the station will be installed per manufacturer's instruction with power and water connected, communication lines connected, data point mapped and electrical inspection performed and approved. Sufficient water flow supply and demand shall be available to emulate full station designed performance.

C. The manufacturer's representative shall be given a minimum two (2) weeks of notice for start-up.

D. During start-up, the station shall be tested for start and stop conditions, pump condition point and full station flow. *Note if no flowmeter is purchased, it is the responsibility of the site to provide an accurate method for measuring or inferring flow.

E. Unless otherwise negotiated, each TIGERFLOW system shall be warranted for a period of (18) months from date of shipment or (12) months from date of startup, whichever occurs first. Warranty specifics are defined in TIGERFLOW Warranty terms.