

**SECTION 23 21 30 – PACKAGED BOILER SYSTEM****PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary
- B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 SECTION INCLUDES

- A. Packaged Boiler System

1.3 REFERENCES

- A. ASHRAE American Society of Heating, Refrigerating, and Air-Conditioning Engineers
- B. UL Underwriters Laboratory
- C. ASTM American Standards for Testing Materials
- D. ASME American Society of Mechanical Engineers
- 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

1.4 SYSTEM DESCRIPTION

- A. Furnish and install a **TIGERFLOW** Systems LLC, Series WHS-11000-HVAC-PEC factory assembled packaged boiler system for heating water.

1.5 SUBMITTALS

- A. Complete submittal for boilers
- B. Pumps curves with condition point and pump operating capacities shall be supplied.
- C. Component cut-sheets for air separator, expansion tank, valves, suction diffusers, controls and other equipment.
- D. 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. System Flow Diagram and Piping Schematic showing the overall system piping arrangement including remote mounted sensors and transmitters.

6. Sequence of Operation

- E. 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.

1.6 OPERATION AND MAINTENANCE DATA

- A. System design information sheet.
- B. Description of system operation.
- C. Packaged system dimension and general arrangement drawing.
- D. Electrical power and control wiring diagram.
- E. Pump operation and maintenance instructions.
- F. Special electrical component operation instructions.

1.7 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 systems and controls for use in HVAC applications.
- B. The packaged system 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 stations.
- E. The packaged system 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 equipment selected.
- F. The packaged system shall be factory run tested to insure condition point is maintained at the expected power draw.
- G. The packaged system shall be factory run tested to insure the sequence of operation satisfies all requirements of the design specification.
- H. The packaged system 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 be fabricated by AWS D1.1 certified welders.
- K. Welder's certifications shall be available upon request.
- L. The packaged pumping system manufacturer must have experience with the programming wiring and testing of controllers of the same manufacture as the BAS. Proof of this experience,

including a list of similar installations, shall be provided to the engineer upon request. The manufacturer must have an in-house software team for all PLC and HMI programming.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver the packaged boiler system to the site under contract provisions.
- B. Safe storage and protection of the packaged boiler system shall be the responsibility of the contractor.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. TIGERFLOW Systems LLC

2.2 PACKAGED BOILER SYSTEM

- A. General: Furnish and install a TIGERFLOW Series WHS-11000 packaged boiler system for heating water.
- B. The packaged boiler system shall consist of:
 - 1. Boiler(s)
 - 2. Hydronic pumps
 - 3. Hydronic Components
 - a. Air Separator
 - b. Expansion Tank
 - c. Triple duty valves on the discharge branch of each pump
 - d. Suction diffusers on the suction side of each pump
 - e. Isolation valves on the suction side of each pump
 - f. Common suction and discharge headers
 - g. Make-Up Water Assembly
 - 4. Controls consisting of:
 - a. TIGERFLOW MARK VII controller
 - b. Dedicated variable frequency drives for each pump
 - c. Differential Pressure transmitter
 - d. Flow meter (optional)
 - 5. Intake Air Ventilation Duct
 - 6. Exhaust Duct
 - 7. Gas Piping
 - 8. Condensate Drain Piping
 - 9. A common base or frame for components listed above
 - 10. Prefabricated environmental enclosure

2.3 COMPONENT

A. Boilers

1. Boilers shall be as specified in section 235216 "Condensing Boilers"

B. Hydronic Pumps

1. Pumps shall be base-mounted, single-stage, end suction design with back pull-out, capable of being serviced without disturbing piping connections.
2. Pumps volute shall be Class 30 cast iron with integrally-cast pedestal support. The impeller shall be cast bronze, enclosed type, dynamically balanced, keyed to the shaft and secured by a locking cap screw.
3. The liquid cavity of the pump shall be sealed off at the shaft by an internally-flushed mechanical seal with ceramic seal seat of at least 98% alumina oxide content, and carbon seal ring, suitable for continuous operation at 225 F. A replaceable bronze shaft sleeve shall completely cover the wetted area under the seal.
4. Pumps shall be rated for a minimum of 175 PSI working pressure. Casings shall have gauge ports at nozzles and vent and drain ports at top and bottom of casing.
5. Pump bearing housing assembly shall have heavy-duty, re-greasable ball bearings, replaceable without disturbing piping connections and have support at coupling end.

C. Air Separator

1. Provide a, 125# ASME stamped tangential air separator complete with an internal stainless steel air collector tube and stainless steel strainer basket.
2. The air separator shall be ASME section VIII stamped.
3. The air separator shall be rated for 125 PSI at 375° F.

D. Expansion Tank

1. 125# ASME stamped compression bladder tank.
2. Tank shall be complete with tank fitting, gauge glass, and shut-off valves.

E. Triple Duty Valve

1. Provide triple duty valve with spring loaded check feature
2. Valve shall allow for in-line serviceability

F. Suction Diffuser

1. Class 125 cast iron with integrated strainer
2. Drain plug to allow removal of foreign particles without disassembly
3. Series 304 stainless steel strainer screen

G. Isolation Valve

1. Cast iron lug style isolation valve

H. Controls

1. The control panel shall be a **TIGERFLOW** Tiger's Eye MARK VII. 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, 60 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 zone pressure readings in psig
 - 5) Supply and return temperatures
 - 6) Current flow in GPM (if flowmeter specified)
 - 7) Adjustable manual (hand) speed setting
 - 8) Direct access to menu screen
 - (ii) Menu screen providing direct access to all system settings and status screens
 - 1) System 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) High Temperature Alarm, degrees Fahrenheit.
 - 2) ON and OFF delays, seconds
 - 3) Manual or automatic reset
- (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. The 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 508A and meet NEC (NFPA 70) requirements.
3. The system control algorithm shall use a speed adjust curve calculation proportional response.
4. The Tiger's Eye MARK VI shall provide Building Automation System communication through Modbus or BACnet protocol. Communication shall be provided via an RS-485 port, and an Ethernet port.
5. The following event reporting shall be provided via BAS communication:
 - a. System Pressure
 - b. Individual VFD status
 - c. Remote System Disable
 - d. Phase Loss Alarm
 - e. Individual Pump Run
 - f. Individual Pump Fault
 - g. Individual Pump Hand/Auto status
 - h. High Temperature Alarm
 - i. General Alarm
 - j. Alarm Horn Silenced
 - k. System Sensor Failure
 - l. Fatal alarm
6. The following events initiation shall be available via BAS communication:
 - a. BAS System Disable
 - b. Enable BAS Set Points
 - c. BAS Set Point (psi)
7. IF VFD's are mounted inside the control panel, drive keypads shall be door mounted and accessible without opening the control panel or disengaging power.
 - I. Variable frequency drives (VFD's)

1. Each drive will have individual disconnects and short circuit protection.
 2. Drive manufacturer must provide a two-year minimum warranty.
 3. Drives will be configured to provide the following operating features:
 - a. Drive keypad will have manual, off and automatic mode selection and will be 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 respond 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. 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: $\pm 1.0\%$ of full scale over recommended design flow range and $\pm 4.0\%$ 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
- L. Enclosure
1. Prefabricated Environmental Enclosure by Kysor Systems or approved equal
 2. Wind rating of 120 mph
 3. Zone 4 Seismic rating
 4. Walls shall have R30 insulation rating
 5. A prefabricated roof system shall be provided for the enclosure to provide a waterproof and ultraviolet-proof covering for insulated ceiling panels. Roof system shall be galvanized standing seam, 22 gauge, 16 inches wide, sheet metal over ceiling panels with a slope of $\frac{1}{4}$ " per foot.

2.4 FABRICATION

- A. The packaged pumping system manufacturer shall provide a completely assembled and tested water circulating system that is fabricated using all new components. Fabrication shall incorporate sound engineering design, proven manufacturing techniques and the latest proven technology available.

2.5 FINISHING

- A. The manufacturer shall operate and maintain a paint spraying facility that conforms to EPA, OSHA and local codes.
- B. The complete packaged pumping system shall be factory painted with lead-free, high gloss enamel prior to shipment.
- C. Nameplates for each major component including pumps, motors, variable frequency drives, and electrical control panels shall be masked prior to painting and all shall be clean and legible prior to shipment.

2.6 SOURCE QUALITY CONTROL

A. TESTING FACILITY

- 1. The packaged pumping system manufacturer shall maintain an NIST traceable factory test facility
- 2. The manufacture's test procedure must be defined as part of an ISO:9001 registered quality management program.

B. FACTORY TESTS

- 1. After factory assembly, the packaged pumping system shall be hydrostatically tested at 50 PSIG over maximum system working pressure or to 150 PSIG (whichever is higher) for a minimum of one hour.
- 2. Each pump shall be individually tested for performance while at full speed. Pump performance measurements shall include shut-off pressure and pump TDH and motor full load amps at 25%, 50%, 75% and 100% of pump design capacity.
- 3. During the variable speed wire-to-water efficiency test each pump and combination of pumps shall be operated according to multiple system curves in increments of 5% from 25% to 100% of design flow. The system is adjusted to operate the pump(s) at each design point where system/pump flow, system/pump head, pump speed, amperage, input kW and supply voltage are recorded. This test provides actual system wire-to-water efficiency based on the selected set points.
- 4. Each Control panel must be designed, built and tested per UL508A prior to integrating with the pumping system. The testing includes verification of wiring, component operation, programming and sequence testing.

5. The pumping system must be connected to a test tank with the actual components, valves and sensors specific for this project. Any calibrations or adjustments that are required for proper system operation will be performed. All sequencing controls, alarms and system operation must be tested and verified to be functional prior to removal from the test tank. These tests may be witnessed by the engineer, owner or a representative if required.
6. All testing must be performed with NIST Traceable instrumentation. The NIST Traceable instrumentation must be independently calibrated in accordance with NIST and Hydraulic Institute Standards.

C. INSPECTIONS

1. The manufacturer shall provide access to the owner or his representative to the fabrication facilities at any time during the construction of the packaged pumping system. All testing may be witnessed by a representative of the owner, contractor and/or consulting engineer.

D. VERIFICATION OF PERFORMANCE

1. A written report certified by an officer of manufacturing company and/or a licensed engineer shall be provided to the owner's representative on request.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. The contractor shall off-load, store, locate, level, anchor, pipe and wire the system and the remote components in accordance with manufacturer's instructions.
- B. Alignment: Base mounted pumps shall be aligned by the contractor after installation using a qualified millwright and the alignment shall be certified in writing.
- C. The contractor shall confirm that all components necessary for a complete and proper startup are installed, wired and operational prior to scheduling startup. A system startup request form shall be filled out and signed by the contractor and returned to the factory to certify readiness.

3.2 CLEANING

- A. All piping in the building system shall be thoroughly cleaned and free of debris, dirt, sand and other impurities. After flushing the system, start-up of the pumping system can commence.

3.3 ADJUSTING

- A. During initial start up, the mechanical contractor shall, under the supervision and assistance of the manufacturer or his representative, adjust all mechanical and electrical components to actual job conditions.

3.4 DEMONSTRATION

- A. After all adjustments have been completed, the owner and/or his representatives will receive a thorough demonstration of the system operation and will receive training in the operation and adjustment of all components.
- B. System manufacturer or his representative shall provide up to two (2) 8 hour days, during not more than one (1) trip to the jobsite for startup, adjustment and training of owner's personnel on the operation and maintenance of the packaged pumping system.

END OF SECTION 232130