

## SECTION – PACKAGED HVAC PUMPING SYSTEM

### 1 GENERAL

#### 1.1 SUMMARY

- A. Packaged HVAC pumping system for closed loop applications

#### 1.2 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

#### 1.3 SUBMITTALS

- A. Pumps curves with condition point and pump operating capacities shall be supplied.
- B. Component cut-sheets for air separator, expansion tank, valves, suction diffusers, controls and other equipment.
- C. 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. 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 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 UL508A 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 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 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 manufacturer's test facility instrumentation shall be NIST traceable and have current calibration certificates.
- I. 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. Furnish and install a TIGERFLOW Series ES-3000 Model UL/C-UL Duplex/Triplex factory engineered packaged HVAC pumping system. The system shall be complete, requiring only electrical and piping connections.
- B. The packaged HVAC pumping system shall consist of:
  - 1. Hydronic pumps
  - 2. Air Separator
  - 3. Expansion Tank
  - 4. Triple duty valves on the discharge branch of each pump
  - 5. Suction diffusers on the suction side of each pump
  - 6. Isolation valves on the suction side of each pump
  - 7. Controls consisting of:
    - a. TIGERFLOW MARK VI controller
    - b. Dedicated variable frequency drives for each pump
    - c. Differential Pressure transmitter
    - d. Flow meter (optional)
  - 8. Water make-up assembly
  - 9. Common suction and discharge manifolds.
  - 10. A common base or frame for components listed above

### 2.3 COMPONENTS

- A. 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.
- B. 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.
- C. Expansion Tank
1. 125# ASME stamped compression bladder tank.
  2. Tank shall be complete with tank fitting, gauge glass, and shut-off valves.
- D. Triple Duty Valve
1. Provide triple duty valve with spring loaded check feature
  2. Valve shall allow for in-line serviceability
- E. 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
- F. Isolation Valve
1. Cast iron lug style isolation valve
- G. Controls
1. The control panel shall be a **TIGERFLOW** Tiger's Eye MARK VI. 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 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
    - a. High Temperature Alarm, degrees Fahrenheit.
    - b. ON and OFF delays, seconds
    - c. 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.
  8. The PLC controller shall communicate with the variable frequency drives using Modbus protocol via RS-485 cables.
- H. 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 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.
- I. 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%.
- J. 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

### 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, providing an internet connection to the TIGERFLOW MARK VI controller shall be the responsibility of the contractor and/or the building's 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.