

## **SECTION 11370**

### **AIR COMPRESSORS AND ACCESSORIES**

#### **PART 1 – GENERAL**

##### **1.01 WORK INCLUDED**

- A. This specification includes air compressors with air dryers.
- B. Furnish, install, start-up, and test air compressors and dryer. Included with the air compressor shall be heatless desiccant dryer, filter, adjustable pressure regulator, automatic drain, and all other accessories necessary for a complete, operable system. The components of this system shall be furnished by the pneumatic actuator supplier. (Section \*\*\*\*\*)

##### **1.02 RELATED WORK AND SPECIFICATIONS**

- A. Section 11090 – Pneumatic Valve Actuators (Vane Type)
- B. Division 16: Electrical

##### **1.03 QUALITY ASSURANCE**

- A. All compressors and filters specified in this section shall be supplied by a single manufacturer.
- B. Compressor manufacturer shall maintain a complete stock of spare parts commonly needed for the pumps specified at a location within the State of Texas or shall be able to deliver the spare parts within 48 hours of notification.
- C. The equipment manufacturer shall furnish a qualified field representative for a minimum of four (4) hours to inspect all equipment described herein after installation, and advise the CONTRACTOR and OWNER during startup and testing, and to train OWNER's personnel in routine maintenance and troubleshooting procedures. Travel to and from the project site shall not be included in the 4-hour period. CONTRACTOR shall coordinate the scheduling of such training and startup assistance with OWNER's personnel. OWNER may videotape training session.

##### **1.04 SUBMITTALS**

- A. Submittals shall be prepared and submitted in accordance with Section 01301.

- B. The following submittals are required, at a minimum, in addition to the applicable requirements of Section 01301.
1. Shop drawings and product data, including the following minimum information, bound neatly in a single package.
    - a. Design information for air demand, tank size, compressor, filter and dryer size.
    - b. Complete performance data for each item furnished.
    - c. Dimensions, connection sizes and types, anchor bolt and mounting information and drawings, and clearances required for all items furnished.
    - d. Listing of materials of construction for all items furnished.
    - e. Overall schematic showing compressor, dryer, and all devices furnished.
    - f. Complete wiring diagrams and data on controls to be furnished.
    - g. Location of nearest stocking distributor of spare parts.
    - h. Any other information necessary for ENGINEER to determine whether or not the equipment complies with these specifications
  2. Complete operation and maintenance data for all compressors and controls in accordance with Section 01301.
- C. Partial or incomplete submittals will not be reviewed by ENGINEER.

### **1.05 EXPERIENCE REQUIREMENTS**

- A. All equipment shall be the product of a manufacturer having at least twenty (20) U.S. installations of the type being proposed, each with a minimum of 5 years of installations of satisfactory service. Consideration shall be given only to the products of those manufacturers who can demonstrate at least ten (10) years experience in the manufacture, operation, and servicing of equipment of a type, size, quality, performance and reliability equal to that specified.
- B. A list of similar installations shall be furnished upon request with the shop drawing submittal, including names and telephone numbers of contacts.

### **1.06 DELIVERY, STORAGE, AND HANDLING**

Delivery, storage, and handling shall be in accordance with manufacturer's instructions.

### **1.07 SPECIAL EQUIPMENT WARRANTY**

All equipment furnished under this section shall have a special warranty, in accordance with the Contract Documents, for a period of one (1) year after final acceptance of this equipment. The

costs of removal, shipment, repair and installation by contractor shall all be included in warranty and correction of defective work.

### **1.08 ACCEPTABLE MANUFACTURERS**

- A. Quincy
- B. Ingersol Rand

## **PART 2 – PRODUCTS**

### **2.01 DESIGN REQUIRMENTS**

- A. Air compressors and dryers shall be sized to meet the requirements below and in the related equipment specifications and drawings.
- B. System shall be sized to carry the required capacity while running 25 to 30 percent of the time. Air shall be stored at 125 to 175 psi and used at 80 to 100 psi unless otherwise shown.
- C. The storage tanks shall be a minimum 200-gallon tank, except as noted above.
- D. Filters shall be designed for calculated CFM demand and per the specifications. Provide automatic condensate drains on the coalescing filter and receiver. Provide float drain on 2-micron final filter.
- E. Compressor and accessories shall be designed to be installed and operated in an indoor, washdown environment that is moist, humid, ventilated but not air-conditioned. All electrical components and enclosures shall be NEMA 4 rated and suitable for washdown type installation.
- F. Units shall be provided complete with controls, starter, and alternator prewired to the compressor. The alternator shall automatically sequence the units from the lead to lag thus equalizing the service demand on each compressor.

### **2.02 AIR COMPRESSORS**

- A. The cylinder and crankshaft with permanently sealed ball bearings shall be frame (crankcase) supported at front and rear.
- B. Crankshaft shall be ductile iron construction liberally sized with two heavy-duty ball bearings. Engineered shaft is balanced with a counterweight to ensure minimum running vibration.

- C. Connecting rods are single piece cast iron with sealed needle bearings on the piston pin end and sealed ball bearings on crankshaft end that require no maintenance or adjustment.
- D. Cylinders shall be anodized aluminum. The cylinders shall be precision honed for compatibility with the piston rings and employ deep radial fins to help remove the heat of compression. The cylinder heads shall be easily removable for inspection.
- E. The low and high-pressure pistons shall be aluminum. The low-pressure piston shall have one (1) compression ring and two (2) rider bands. The high-pressure piston shall have three (3) compression rings and two (2) rider bands. Rings and rider bands shall be Teflon
- F. The cooling fan shall provide cooling for the deep finned cylinders and multi-tube intercooler. Shrouds are to be used to direct the air blast. The fan shall be direct drive off the compressor crankshaft.
- G. The compressors shall have an intercooler. The intercooler between stages is to be finned multi-tube construction to provide maximum cooling area. It shall be located directly in the flywheel air blast to remove the heat of compression between stages keeping running temperatures and power needs to a minimum, and ensuring high air delivery for horsepower expended.
- H. Intercooler shall be provided with a safety valve to prevent over-pressurization.
- I. Centrifugal unloader shall be automatic in operation as a function of speed. It shall be simple in construction and sealed in the frame against wear and dirt. The unloader shall bleed air from intercooler and cylinders upon stopping, and prevent the compressor from starting against full load.
- J. A heavy-duty canister with dry type 4-micron inlet filter/silencer shall be provided.
- K. Aluminum heads shall be mounted on top of stainless steel finger valves. The valves shall provide a minimum 8,000 hours of life and require no lubrication.
- L. Drive shall be V-belt type with provision for easy take-up of belt slack. An easily removed totally enclosed belt guard shall be provided.
- M. The compressor and motor shall be aligned on a heavy steel base.
- N. AC motors shall be minimum hp listed above, 1800 rpm, TEFC enclosure, Class B insulation, 1.15 service factor, and self-lubricated ball bearings. Motors shall be for 480 volt, 3-phase. Motor submittals shall be in accordance with Division 16.
- O. Receivers shall be ASME, National Board coded, 125 psi, and include pressure gauge, drain valve, service valve, and safety valve. An automatic condensate drain trap with heater shall be provided.
- P. Units shall be equipped for both automatic start and stop operation with NEMA 4 pressure switch and constant speed operation with reliable suction unloader on compressor inlet. Unloaded horsepower requirement shall be 15 percent of fully loaded horsepower requirement.
- Q. An air-cooled aftercooler shall be included for all air compressors with dryers which shall lower package discharge air to within 25°F of ambient temperature. A safety valve is to be provided to protect against over-pressurization.

### **2.03 DRYER PREFILTER**

Filter shall be coalescing/particulate prefilter supplied by Dryer manufacturer. Removes particulates down to 0.01 micron and has automatic drain.

## 2.04 HEATLESS DESICCANT DRYER

### A. General:

1. Unit shall be factory assembled, self-contained and complete in all respects, including component equipment, interconnecting piping, wiring, controls and instrumentation.
2. Unit shall be free standing, requiring only inlet/outlet air connections, and electrical connection. All controls and instruments shall be factory set/calibrated so as to provide for “turn key” operation.

### B. System Criteria:

Inlet Flow Capacity	As required for each system
Purge Flow Requirement	15% of inlet
Inlet Pressure	100 psig
Inlet Air Temperature	100°F
Required Pressure Dewpoint	-40°F

### C. Operation:

1. Dryer operation shall be continuous and automatic. Drying/regenerating cycle is 10 minutes. Drying occurs in an upward direction, while regenerating of the wet desiccant bed is in a downward direction. The portion of air used in regeneration is expanded to atmospheric pressure at the dry air outlet of the dryer and routed to and through the off-line (regenerating) tower.
2. Regeneration is accomplished by passing a portion of dry expanded air through regenerating tower in a reverse direction to drying flow and then purging it to atmosphere.
3. The off-line tower shall gradually be brought up to line pressure prior to tower switching. This reduces desiccant attrition thus reducing subsequent dusting and premature aging of the downstream filters.
4. Velocity through the desiccant bed shall not exceed 65 ft/min. This assures that contact time is a maximum for the most efficient drying. Pressure drop through the system will not exceed 10 psid under normal operations.
5. Provide a particulate after filter which removes desiccant dust of 1 micron and larger with a 99.99 percent efficiency.

### D. Performance:

1. Dryer shall provide for water removal to better than  $-40^{\circ}\text{F}$  pressure dewpoint at all times.
2. Dryer shall perform at saturated inlet air temperatures of up to  $110^{\circ}\text{F}$  and ambient temperatures from  $32^{\circ}\text{F}$  to  $120^{\circ}\text{F}$ .
3. Discharge muffler shall reduce instantaneous discharge air noise to less than 85 dBA.

#### E. Construction and Components

Dryer towers shall be carbon steel, ASME coded and stamped. Towers shall have two support legs, constructed and carbon steel structural angle and welded to vessel body for dryer support.

1. To maintain lowest possible pressure drop, each tower will have inlet connection of a full port non-lubricated, pilot air operated, diaphragm valve.
2. Towers shall have stainless steel desiccant supports and stainless steel air diffusion screens.
3. Towers shall be primed and then finish painted with a bright acrylic enamel.
4. Each dryer tower shall be provided with separate fill and drain pots
5. Each dryer shall be provided with tower pressure gauge and a safety relief valve (set at 165 psig).

#### F. Piping and Fittings:

1. All piping shall be as per the Piping Schedule on drawing G-012. All fittings and interconnecting piping shall have 250-pound unions suitable positioned for ease of assembly and disassembly.
2. Threaded components shall conform to the National Pipe Thread (NPT) standards.
3. Control air lines shall be  $\frac{1}{4}$ -inch flexible nylon tube. The use of nylon tubing shall be limited to control air lines and sample air lines (for instrumentation, monitors, etc.). Tubing shall be connected by the use of push on fittings for ease of assembly and disassembly.
4. All components that use pilot air for operation are protected by an in-line 3-micron filter. Air supply shall be both clean and dry.

#### G. Dryer Flow Path

1. Drying flow shall be upwards through the desiccant bed, regenerating flow downwards (counter-current flow).
  - a. Wet inlet air flow shall be diverted through the dryer towers by the use of dual pneumatically operated

- diaphragm system and to contain no lubrication of any kind.
- b. Outlet dry air flow shall be controlled through the use of a 2-check valve manifold at the top of dryer.
- 2. Dryer shall have an adjustable purge flow system for precise purge air/dewpoint/pressure setting.
  - a. System shall be of a pressure-orifice type with a pressure-indicating gauge.
  - b. System shall be located near the top of the dryer so as to facilitate adjustment and observation.
- 3. Tower Repressurization/Depressurization
  - a. The off-line tower shall gradually be brought up to line pressure to tower switching
  - b. Tower switchover must occur at full line pressure for the purpose of reducing desiccant attrition with subsequent dusting and premature aging of downstream filters.
  - c. A pressure gauge on each dryer tower shall act as a visual indicator that tower switching is occurring.
  - d. The dual purge air valves shall be fitted with an exhaust silencer so as to minimize noise during tower depressurization and purging.

#### H. Desiccant Bed:

Dryer shall be filled with 2-5 millimeter, Grade A Activated Alumina.

- 1. Desiccant shall be rated for wet air service and shall not fracture in the presence of liquid water.
- 2. Desiccant life shall be 5-7 years provided no hydrocarbons are allowed to pass into desiccant bed.

#### I. Controls and Instrumentation:

- 1. Main control enclosure shall be NEMA-4 construction factory mounted directly on the unit and shall include all the controls, indicating lights, switches, and other instrumentation required.
- 2. Drying system shall be shipped completely calibrated and tested so that only single entry electrical connection is necessary for the units electrical system.
- 3. Timer: Timer shall be solid-state type for maintenance free operation. Mechanical (CAM) timers which are susceptible to wear and subsequent failure shall not be used.
- 4. Gauges: Unit shall include pressure gauges locally mounted on each tower and a purge gauge.

#### J. Blue Moisture Indicator (BMI):

1. A sample flow of dried air shall be passed through the BMI so as to provide a visual indication of the moisture content of airstream.
2. The BMI shall be continually sampling the outlet of the dryer towers.
3. The BMI shall contain a moisture sensitive desiccant that will change from blue to gray if excessive moisture is present in the airstream.

K. Dryer Control Options Available:

1. Nema-4 Construction: All controls shall be housed in a NEMA-4/12 JIC enclosure for protection from oil, water, and particulate contamination. All lights/valves mounted externally shall also be rated NEMA-4 service.
2. Failure to Shift Alarm: Unit shall be provided with a Failure to Switch Alarm light to indicate the following operational failures:
  - a. Valve sequencing failure.
  - b. Low system pressure.
  - c. Failure to depressurize.
3. High Humidity Alarm: System outlet air stream shall be monitored for a high humidity condition. If outlet pressure dewpoint exceeds -11°F, then an alarm light shall be lit.
4. AirMizer: Zeks' AirMizer shall be included to minimize the use of purge/regeneration air based on moisture loading of the desiccant beds.

This shall be accomplished using an integrated solid-state moisture analyzer which shall continuously monitor the desiccant bed. The monitoring shall be accomplished by the use of in-bed air sampling probes.

When the moisture analyzer “sees” dry air, the purge/exhaust valves shall remain closed to conserve purge air usage. The compressed air stream shall continue to cycle providing an equal moisture load being placed on each desiccant bed.

Once the moisture level reaches a predetermined level, the analyzer shall allow for desiccant regeneration. The dryer shall continue in normal operating mode until regeneration is completed, at which time the system shall return to the “purge saving” mode.

Failure to switch to alarm is included with the AirMizer feature.

5. Combine all alarm signals to one trouble alarm contact for remote alarm signal

## 2.05 SPARE PARTS

Furnish one (1) set of belts for each compressor and one (1) spare air filter for each prefilter and after filter furnished. Furnish mufflers for desiccant dryer.