#### SECTION 13 1512 - WATER FEATURE COMPRESSED AIR SYSTEMS

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This section includes the following:
  - 1. Pneumatic Pipe and Fittings
    - 2. Rotary Screw Compressor
  - 3. Air Receiver and Accessories
  - 4. After Cooler
  - 5. Refrigerated Air Dryer
  - 6. Pressure Reducing Valves
  - 7. Compressed Air Filters
- B. Related Sections:
  - 1. SECTION 13 1401 WATER FEATURE PIPE AND FITTINGS
  - 2. SECTION 13 1403 WATER FEATURE PIPE HANGERS, SUPPORTS, AND ANCHORS
  - 3. SECTION 13 1501 WATER FEATURE MECHANICAL IDENTIFICATION
  - 4. SECTION 13 1502 WATER FEATURE PUMPS AND MOTORS
  - 5. SECTION 13 1503 WATER FEATURE FILTERS
  - 6. SECTION 13 1505 WATER FEATURE OZONE GENERATION AND INJECTION
  - 7. SECTION 13 1511 WATER FEATURE VALVES, GAUGES, AND METERS
  - 8. SECTION 13 1602 WATER FEATURE CONTROLS
  - 9. SECTION 13 1604 WATER FEATURE FIELD INSTRUMENTS, SWITCHEDS, AND ALARMS
  - 10. SECTION 13 1607 WATER FEATURE PROGRAMMABLE LOGIC CONTROLLERS

## C. References:

- 1. ASME SECTION 8D BOILER AND PRESSURE VESSELS
- 2. ASME B16.18 CAST COPPER ALLOY SOLDER JOINT PRESSURE FITTINGS
- 3. ASME B16.22 WROUGHT COPPER AND COPPER ALLOY SOLDER-JOINT PRESSURE FITTINGS
- 4. ASME B16.26 CAST COPPER ALLOY FITTINGS FOR FLARED COPPER TUBES
- 5. ASME B31.1 POWER PIPING
- 6. ASME B31.9 BUILDING SERVICE PIPING
- 7. ASME B32 METAL AND METAL ALLOY WROUGHT MILL PRODUCTS
- 8. ASTM B88 STANDARD SPECIFICATION FOR SEAMLESS COPPER WATER TUBE
- 9. ASTM D1248 STANDARD SPECIFICATION FOR POLYETHYLENE PLASTICS EXTRUSION MATERIALS FOR WIRE AND CALBLE
- 10. ASTM D2657 STANDARD PRACTICE FOR HEAT FUSION JOINING OF POLYEFIN PIPE AND FITTINGS
- 11. ASTM D2837 STANDARD TEST METHOD FOR OBTAINING HYDROSTATIC DESIGN BASIS FOR THERMOPLASTIC PIPE MATERIALS OR PRESSURE DESIGN BASES FOR THERMOPLASTIC PIPE PRODUCTS
- 12. ASTM D3035 STANDARD SPECIFICATION FOR POLYETHYLENE (PE) PLASTIC PIPE (DR-PR) BASED ON CONTROLLED OUTSIDE DIAMETER
- 13. MSS SP-80 BRONZE GATE, GLOBE, ANGLE AND CHECK VALVES
- 14. MSS SP-110 BALL VALVES THREADED, SOCKET-WELDING, SOLDER JOINT, GROOVED AND FLARED ENDS
- 15. NFPA 70 NATIONAL ELECTRICAL CODE (NEC)

#### 1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

- B. Product Data: Submit Manufacturer's literature including materials, dimensions, weights, capacity, electrical characteristics, and placement of openings, holes, and connection requirements.
- C. Shop Drawings: Provide drawing indicating piping schematic with electrical characteristics and connection requirements.
- D. As-Built Drawings: Provide drawings recording actual locations and elevations of piping, valving, penetrations, location of equipment, and electrical requirements for all equipment related to this section.
- E. Provide Certificate of Compliance from authority having jurisdiction indicating approval of air receiver.
- F. Provide Manufacturer's installation instructions, hoisting and setting requirements, and start-up procedures.
- G. Provide Operation and Maintenance data for Air Compressor, Air Receiver, and accessories, After Cooler, Refrigerated Air Dryer, and Pressure Reducing stations.
- H. Warranty: Submit manufacturer's warranty and ensure forms have been completed in the owner's name and registered with the manufacturer.

#### 1.3 QUALITY ASSURANCE

- A. Install Air Compressor, Air Receiver, and accessories, After Cooler, Refrigerated Air Dryer, and Pressure Reducing stations in compliance with applicable ASME, ASTM, and MSS guidelines and requirements.
- 1.4 DELIVERY, STORAGE, AND HANDLING
  - A. Coordinate delivery with installation time to assure minimum holding time.
  - B. Accept Air Compressor, Air Receiver, and accessories, After Cooler, Refrigerated Air Dryer, and Pressure Reducing stations on site in original factory packaging. Immediately upon receipt of shipment, inspect and check for damage.
  - C. Protect Air Compressor, Air Receiver, and accessories, After Cooler, Refrigerated Air Dryer, and Pressure Reducing stations from physical damage including effects of weather, water, and construction debris. Provide temporary inlet and outlet caps; maintain caps in place until installation.

# PART 2 - PRODUCTS

- 2.1 PIPE AND PIPE FITTINGS
  - A. Solvay Eltex Tubing 124 blue high-density polyethylene: ASTM D3035
    - 1. Fittings: ASTM D3035, Injection Molded
    - 2. Joints: ASTM D3035
  - B. Copper Tubing: ASTM B88 (ASTM B88M), Type K drawn
    - 1.
       Fittings:
       ASME B16.18, Cast Copper Alloy

       ASME B16.22, Wrought Copper and Bronze

       2.
       Joints:
       ASTM B32, solder, Grade 95TA
  - C. Copper Tubing: ASTM B88 (ASTM B88M), Type K annealed
    - 1. Fittings: ASME B16.26, Cast Bronze
      - 2. Joints: Flared
- 2.2 VALVES
  - A. Ball Valves:
    - 1. Approved Manufacturers
      - a. Asahi/America

- b. NIBCO
- c. MUESCO
- 2. Body: MSS SP-110, Class 150, 400 psi (2.76 MPa) CWP, Bronze, two piece
- 3. Ball: Chrome plated Brass
- 4. Seats: Teflon
- 5. Stem: Blow-out Proof
- 6. Handle: Lever type with balancing stops
- 7. Connections: Threaded Ends with Union
- B. Swing Check Valves:
  - 1. Approved Manufacturers
    - a. Asahi/America
    - b. NIBCO
    - c. MUESCO
  - 2. Body: MSS SP-80, Class 125, Bronze with Bronze Cap
  - 3. Disc: Bronze
  - 4. Seats: Rubber
  - 5. Connections: Threaded Ends with Union
- C. Air Outlets:
  - 1. Approved Manufacturers
    - a. Asahi/America
    - b. NIBCO
    - c. MUESCO
  - 2. Quick Connector: 3/8-inch (10mm) Brass, snap-on connector with self-closing valve, Style A.

## 2.3 UNIONS AND COUPLINGS

- A. Unions
  - 1. Copper Tube and Pipe: 150 psi (1.0 MPa) Bronze unions with soldered joints.
  - 2. HDPE Pipe: 230 psi (1.59 MPa) HDPE unions with Socket-fusion joints.
- B. Dielectric Connections
  - 1. Union with galvanized or plated steel threaded end.
  - 2. Union with copper solder end.
  - 3. Water impervious isolation barrier.
- C. Flexible Connector
  - 1. Neoprene with Brass threaded connectors.

#### 2.4 ROTARY SCREW COMPRESSOR

- A. Approved Manufacturers
  - 1. Kaeser Compressor, Incorporated.
  - 2. Ingersoll-Rand.
- B. Air Compressor Type and Construction:
  - 1. Single stage, oil-flooded, air- or water-cooled rotary screw compressor completely pre-piped and with pre-wired control panel.
  - 2. Manufacture compressor under strict ISO 9001 quality control standards.
  - 3. Capacity and pressure shall be as specified in the Contract Documents.

- 4. Compressor shall be capable of continuous full flow operation 24 hours a day at rated capacity and pressure.
- 5. Motor Voltage: 230/460 V, 3-phase, 60 Hz (220/380 V, 3-phase, 50 Hz).
- 6. Control System Voltage: 115V, 1-phase, 60 Hz (220V, 1-phase, 50 Hz).
- 7. Standard Compressor package shall be suitable for use in the 40 to 105 °F (4.4 to 40.5 °C) ambient temperature range.
- C. Air End
  - 1. Rotors Air End rotors shall have a SIGMA profile. Rotors shall be precision machined from cast iron. Air End drive shaft to be tapered for easy removal of Air End pulley.
  - 2. Casing Air End casing shall be cast iron.
  - 3. Bearings Air End rotors shall be supported on both ends by cylindrical roller bearings to carry radial loads. Angular contact bearings shall be installed on the discharge end of each rotor to carry thrust loads with minimal friction.
- D. Driver Motor
  - 1. Motor shall have TEFC enclosure.
  - 2. Motor winding shall be 100-percent copper and designed for full voltage starting.
  - 3. Motor service factor shall be 1.5 minimum.
  - 4. Motor speed: 3,600 rpm.
  - 5. Motor Insulation shall be Class F.
  - 6. Motor efficiency shall be 90-percent or higher.
- E. Starters
  - 1. Starter shall be magnetic, Wye-Delta, Reduced voltage starter to ensure low starting current and reduce thrust bearing loads.
  - 2. Starter shall be integrally mounted and wired in the compressor package and located in the control enclosure.
- F. Drive
  - 1. Drive shall be V-belt type.
  - 2. Drive shall include automatic V-belt tensioning device with visual adjustment indicator to maintain proper tension.
  - 3. V-belt shall be 100-percent oil-resistant.
- G. Control Cabinet
  - 1. Control Cabinet shall be NEMA 12 rated.
  - 2. Electrical components shall be UL Approved and labeled.
  - 3. Electrical schematic diagram shall be included in the service manual for ease of reference.
  - 4. Cabinet back plate shall be galvanized.
- H. Compressor Instrument Panel
  - 1. Control system shall be suitable for use in -4 to 140 °F (-20 to 60 °C) ambient temperature range.
  - 2. Control system shall meet or exceed NEMA 12 standards for environmental protection.
  - 3. Control system shall have the following characteristics:
    - a. Shall be an industrial PC with 2 MB of memory.
    - b. Include a soft PLC with centralized database.
    - c. Include an internal stabilized 24-VDC power supply and a real time clock with a scheduling timer.
    - d. Include a battery backup with a lifetime of ten (10) years or more.
    - e. Certified protection from electromagnetic interference.

- f. Provide digital and analog inputs and outputs for monitoring of standard and optional sensors.
- I. Enclosure
  - 1. Compressor shall have steel frame assembly and be completely enclosed, including the bottom
  - 2. Enclosure shall have removable access panels with safety interlock switches for protection of personnel during maintenance.
  - 3. Enclosure shall be sound insulated such that the compressor shall have a maximum full load noise level of 69 dBa at 3-feet (1m). All sound dampening material shall be oil repelling and cleanable.
  - 4. Air End and Motor shall be mounted on a steel frame isolated from the compressor frame with rubber vibration isolators.
  - 5. Compressor frame shall be isolated from the floor by rubber vibration pads.
  - 6. All access panels/doors shall have slotted key locks or handles. Door key shall be provided.
  - 7. Ambient cooling air shall enter the enclosure after passing through a 40-micron filter mat.
  - 8. Compressor shall be fitted with and air inlet filter rated at 4-microns
  - 9. All access panels/doors shall be gasketed.
- J. Internal Piping
  - 1. All major air and oil pipes shall be made of steel and feature flexible connections, with O-ring seals.
- K. Lubrication and Cooling System
  - 1. Compressor shall have differential pressure, oil circulation system.
  - 2. Compressor shall be factory filled with full synthetic lubricant.
  - 3. Oil filter shall be able to remove particles down to 10-microns.
  - 4. Compressor oil cooler shall have a thermostatic control valve to maintain optimum operating temperature.
  - 5. Compressor shall have a tank/sump with integral oil separator element that is rated at 217 psig (1.5 MPa) working pressure or more.
  - 6. Separation system shall include three (3) stages:
    - a. Mechanical Separation.
    - b. Two-Stage Coalescing Filter.
  - 7. Separation Tank shall also include the following:
    - a. Sump Pressure Gauge.
    - b. Fill Plug.
    - c. Oil Level Sight Glass.
    - d. Quick Disconnects for measuring air pressure differential across the filter element.
    - e. ASME coded safety relief valve installed.
  - 8. Separator shall be equipped with quick disconnect and oil drain hose for pressurized oil changes.
  - 9. Oil coolers and after coolers shall be easily accessible for ease of maintenance.
  - 10. Air-cooled after cooler and oil cooler shall be integrally mounted to the compressor enclosure.
  - 11. Oil cooler shall include drain plugs.
- L. Compressor Control
  - 1. Compressor shall have automatic dual control, various control, and quadro control as standard
  - 2. Switchable modulation control is and acceptable option.
  - 3. Compressor shall automatically load after starting if system demands it.
  - 4. Compressor shall have adjustable time delay to shut down the compressor after running unloaded for a pre-determined period.
  - 5. Compressor shall cut-in at 100 psig (690 kPa) and cut-out at 110 psig (758 kPa).

- M. Warranty
  - 1. Compressor Package shall be warranted to be free of defects in materials and workmanship for a minimum period of 12 months.
  - 2. Compressor Air End assembly, drive motor, and magnetic motor contractor shall be warranted to be free of defects in material and workmanship for a minimum of two (2) years without restrictions.
- N. Start-up Service
  - 1. Start-up Service shall be provided by a factory trained technician at no charge to ensure equipment is running properly and adjusted to factory specifications.
  - 2. Maintenance instructions shall be discussed with operators to ensure they understand routine maintenance procedures.
  - 3. The maintenance training shall be conducted at the time of equipment start-up.

## 2.5 AFTER COOLER

- A. Approved Manufacturers
  - 1. Kaeser Compressor, Incorporated
  - 2. Ingersoll-Rand
- B. Working Pressure: 135 psi (930 kPa)
- C. Discharge: Cool air to within 12 °F of ambient air temperature at specified flow capacity.

## 2.6 AIR DRYER

- A. Approved Manufacturers
  - 1. Kaeser Compressor, Incorporated
  - 2. Ingersoll-Rand
- B. Type: Self-contained Mechanical Refrigeration, including the following components:
  - 1. Heat Exchanger
  - 2. Refrigeration Compressor
  - 3. Automatic Controls
  - 4. Moisture Removal Trap
  - 5. Internal Wiring and Piping
  - 6. Full Refrigerant Charge
- C. Air Connections: Inlet and Outlet connections at the same level, factory insulated.
- D. Heat Exchangers:
  - 1. Provide air to air and refrigerant to air coils.
  - 2. Automatic control system to bypass refrigeration system on low- or no-load condition.
- E. Moisture Separator:
  - 1. Centrifugal type located at discharge and heat exchanger.
- F. Refrigeration Unit:
  - 1. Hermetically sealed.
  - 2. Operated continuously to maintain 35 to 39 pressure degrees F dew point.
  - 3. Housing: Steel cabinet provided with access panel for maintenance and inspection.
- G. Accessories included:
  - 1. Air Inlet Temperature Gauge
  - 2. Air Inlet Pressure Gauge

- 3. ON/OFF Switch
- 4. High Temperature Light
- 5. Power ON Light
- 6. Refrigerant Gauge
- 7. Air Outlet Temperature Gauge
- 8. Air Outlet Pressure Gauge
- 2.7 AIR RECEIVER
  - A. Approved Manufacturers
    - 1. Steel Fabricators
    - 2. Brunner
  - B. Receiver:
    - 1. Vertical Type
    - 2. Built to ASME regulations for working pressure of 150 psi (1.0 MPa)
    - 3. Flange or screw inlet and outlet connections
    - 4. Tank Finish: Epoxy Finish
    - 5. Capacity: As specified on the Contract Documents
  - C. Fittings included:
    - 1. Safety Valve
    - 2. Pressure Gauge
    - 3. Drain Cock
    - 4. Automatic Float Actuated Condensate Trap

#### 2.8 PRESSURE REDUCING VALVE

- A. Approved Manufacturers
  - 1. Wilkinson
  - 2. ARO
  - 3. Binks
- B. Pressure Reducing Station consists of the following components:
  - 1. Automatic Reducing Valve and Bypass.
  - 2. Low Pressure side relief valve and gauge.
- C. Valve Capacity
  - 1. Reduce pressure from 125 to 30 psi (861 to 206 kPa), adjustable upwards from reduced pressure.

#### 2.9 COMPRESSED AIR FILTER

- A. Approved Manufacturers
  - 1. Kaeser Compressor, Incorporated
  - 2. Ingersoll-Rand
- B. Capable of Removing:
  - 1. Liquid Water
  - 2. Solid Particulates
  - 3. Liquid Oil
  - 4. Oil Mist
- C. Removal Efficiency:
  - 1. 89.9999-percent at 400-scfm @ 125 psig (189 lps @ 862 kPa)

- 2. Capable of removing particles as small as 0.01-microns.
- D. Filter Elements consist of the following:
  - 1. Polypropylene Support Core.
  - 2. Multiple Layers of Polyester and Boroalicato Coalescing Medium.
  - 3. Include Drain Layer.
  - 4. Pressure Drop at 100 psi (690 kPa) at rated flow shall not exceed 1.0 psi (6.9 kPa).
  - 5. Maintenance indicator for indication of element replacement.
- E. Maximum Operating Temperature: 150 °F (66 °C)
- F. Housing shall consist of the following:
  - 1. Cast Aluminum Alloy Head
  - 2. Threaded Inlet and Outlet Connections
  - 3. Threaded to accept a bottom bowl
  - 4. Manual Drain
  - 5. Audible signal should the bowl be loosened while filter is pressurized
  - 6. Direction of Flow: Inside to Outside
  - 7. Maximum Pressure: 250 psi (1.38 MPa)
  - 8. Element Core to withstand pressure surges up to 30 psi (207 kPa) differential

## PART 3 - EXECUTION

- 3.1 INSTALLATION
  - A. Install Compressor Unit on concrete housekeeping pad.
  - B. Make Air Cock and Drain connection on horizontal casing.
  - C. Install line sized globe valve and check valve on Compressor discharge.
  - D. Install replaceable cartridge type filter silencer of adequate capacity for compressor.
  - E. Connect condensate drains to the nearest floor drain.
  - F. Install a valved bypass around the Air Dryer. Factory shall provide insulated inlet and outlet connections.
  - G. Install a valved drip connection at the low point of the piping system.
  - H. Install take-offs to outlets from top of main, with shut-off valve after take-off. Slope take-off piping to outlets.
  - I. Install tees instead of elbows at changes of direction of piping. Fit open end of each tee with plug.
  - J. Identify piping system and components, label as per SECTION 13 1501 MECHANICAL IDENTIFICATION.

#### 3.2 FIELD TESTING

- A. Copper Tube and Pipe:
  - 1. Compressed Air Piping Leak Test:
    - a. Prior to initial operation, clean and test compressed air piping in accordance with ANSI B31.1.
  - 2. Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.
  - 3. Cap and seal end of piping when not connected to mechanical equipment.
- B. High Density Polyethylene Pipe (HPDE):
  - 1. Prior to pressure testing, the system shall be examined for the following items:

- a. Pipe shall be completed per Contract Document layouts with all pipe and valve support in place.
- b. Pipe, valves, and equipment shall be supported as specified, without any concentrated loads on the system.
- c. Pipe shall be in good condition, void of any cracks, gouges, or deformation.
- d. Pipe flanges shall be properly aligned. All flange bolts should be checked for correct torque by the installer.
- e. All joints should be reviewed for appropriate welding technique.
- f. Socket-Joints to have two beads on the end of the fitting and on the outside of the pipe in contract. Refer to Manufacturer's instructions for weld bead inspection.
- g. Butt-Joints should have two beads 360-degrees around the joint. Refer to Manufacturer's instructions for specified weld bead inspection.
- 2. If any deficiencies appear, the quality control manager shall provide directions for repair
- 3. Pressure Test:
  - a. Test fluid should be compressed air with quality level set by Quality Control Engineer. In all cases test must be done hydrostatically.
  - b. Begin pressurizing the system in increments of 10 psi (69 kPa). Bring the system up to 100 psi (690 kPa) and hold. Allow the system to hold pressure for a minimum of two (2) hours and up to a recommended 12 hours. Check pressure gauge after one (1) hour. Due to natural creep effects on plastic piping the pressure will have decreased. If drop is less than 10-percent, increase the pressure back to 100 psi (690 kPa). At this time, the system may be fully pressurized to desired test pressure.
  - c. If after one (1) hour to pressure has decreased more than 10-percent, consider the test a failure. Note the 10-percent value may need to be greater for larger systems, or systems experiencing significant thermal changes.
  - d. Test to be witnessed by Quality Control Engineer and certified by the Contractor.
  - e. Obvious leaks can be found by individually checking each joint using a soapy water solution or an Ultrasonic Leak Detection gun. Leak detection guns should be available from the pipe manufacturer.

#### 3.3 PIPE SUPPORTS

- A. Pipe support shall be done in accordance with SECTION 13 1403 WATER FEATURE PIPE HANGERS, SUPPORTS, AND ANCHORS.
- B. Pipe shall be hung in accordance with the Manufacturer's recommendations to avoid damage to the pipe.
- C. Proper support spacing is required to avoid sagging of the material. Support spacing is temperature dependent and shall be based on the Manufacturer's recommendations.
- D. Hangers shall be supplied or specified by the pipe manufacturer.
- E. U-bolt hangers are not allowed for HDPE pipe due to pinpoint loading effects.

END OF SECTION