

**PART 1 GENERAL**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Materials and installation for piping, fittings, equipment used in compressed air systems.

**1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME Boiler and Pressure Vessel Code Section VIII Pressure Vessels.
    - .1 BPVC-VIII B - 2004, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 1.
    - .2 BPVC-VIII-2 B - 2004, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 2 - Alternative Rules.
    - .3 BPVC-VIII-3 B - 2004, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 3 - Alternative Rules High Press Vessels.
  - .2 ASME B16.5-03, Pipe Flanges and Flanged Fittings.
  - .3 ASME B16.11-01, Forged Fittings, Socket-Welding and Threaded.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A53/A53M-04, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - .2 ASTM A181/A181M-01, Standard Specification for Carbon Steel Forgings for General Purpose Piping.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA B51-03, Boiler, Pressure Vessel, and Pressure Piping Code.

**1.3 SUBMITTALS**

- .1 Shop Drawings:
  - .1 Submit shop drawings to indicate equipment, dimensions, extent of equipment piping system, etc.
    - .1 Vertical and horizontal piping locations and elevations and connections details.
    - .2 Other details including: Valves, Air Compressors, Air Receivers, and Air Purification Systems.
    - .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for air quality.
    - .4 Instructions: submit manufacturer's installation instructions.
    - .5 Closeout Submittals: submit maintenance and engineering data for incorporation into manual.

**PART 2 PRODUCTS**

**2.1 AIR COMPRESSOR**

- .1 General: Single stage, air-cooled, rotary screw, oil free compressor package.
- .2 Compressor package shall include:
  - .1 Water injected direct-drive air end assembly.
  - .2 Reverse Osmosis membrane water purification unit.
  - .3 Water cooler coils to maintain low compressor output temperature.
  - .4 Radial-type cooling fans for water and cabinet cooling.
  - .5 30 HP, 3/60/575V, TEFC, IP55 Main Drive Motor. If the compressor drive voltage is other than 575V, the supplier shall provide a transformer (shipped loose) to provide the required output voltage.
  - .6 Compressor air intake filter with 3 micron 99.9% efficiency element.
  - .7 Variable speed frequency inverter-type motor controller to match output to system demand from 46 cfm to maximum CFM.
  - .8 Sound attenuating cabinet with pre-filter panels to maintain internal components and water cooling coils in clean condition
- .3 Accessories: shipped loose and including:
  - .1 Supplied separately for user mounting are the following components:
  - .2 Primary power transformer if required.
  - .3 Condensate separator complete with "no loss" drain valve for removal of condensate at outlet air connection. Ingersoll Rand PNLD model II or equivalent in accordance with B6 Substitutes.
- .4 Capacity: Minimum 120 CFM of free air plus dryer purge air. 1000 kPa maximum.
- .5 Vibration isolation: 95% minimum efficiency.
- .6 Noise Level: 73 dB (A) maximum.
- .7 Microprocessor based compressor control system. Second compressor to start automatically if first compressor cannot meet load requirement.
  - .1 Standard of Acceptance: APPL / COMPAIR Model D22H RS. Rotary Screw, or equivalent in accordance with B6 Substitutes.

**2.2 AIR RECEIVER**

- .1 760 mm diameter x 1830 mm long (approx.) 240 US Gal vertical tank: to CSA B51, ASME Section VIII and provincial regulations, for working gauge pressure of 1380 kPa. Corrosion resistant construction (galvanized or internally coated).
- .2 Inlet and outlet connections: NPS 2.
- .3 Accessories: adjustable pressure regulator, safety relief valve, 64 mm diameter liquid filled dual scale gauge with minimum pressure range of 0 to 1400 kPa and 0 to 200 psig, drain cock and automatic electronic no loss drain valve.
- .4 Provincial inspector's certificate and label.

- .5 Finish: Exterior shop primed, ready for field painting.
- .6 Standard or acceptance: APPL Model 302428 or equivalent in accordance with B6 Substitutes.

### **2.3 BREATHING AIR PURIFICATION/DRYER UNIT**

- .1 Self-contained, skid mounted, complete with automatic controls, and wiring, sized for 4200 L/m air flow. 38 mm interconnecting piping, designed to CSAZ180.1-00. Electrical components prewired in an EEMAC-12 electrical enclosure with numbered terminal strips, labelled electrical input terminals for 1/60/115 power supply. All electrical control panels to carry CSA special inspection certification for acceptance in all Canadian provinces.
- .2 Capacity:
  - .1 To dry 4200 L/min to an atmospheric dew point of minus 40 degrees C, 700 kPa and 38 degrees C saturated inlet air.
- .3 Electrical supply: 120 V, 1 phase, 60 cycle.
- .4 Components to be as follows:
  - .1 Twin tower dryer with:
    - .1 Two desiccant towers, manufactured in compliance with the ASME code, and certified under the T.S.S.A., for use as unfired pressure vessels in all Canadian provinces. Each tower has plugged fill and drain ports, suitably sized to allow the convenient removal and filling of desiccant without the disassembling of other inter-connecting piping. The dryer comes complete with the initial fill of activated alumina desiccant. Each tower is also equipped with an ASME safety relief valve, and a 2 ½ in. dial liquid-filled pressure gauge, having a dual scale of 1 to 200 PSIG and 1 to 1400 kPa.
    - .2 Removable desiccant retainers/diffusers to prevent the migration of desiccant from the tower, and provide uniform air dispersal within the towers. The retainers to be either bushing or nipple-mounted, and constructed of rigid stainless steel wedge wire, with internal stainless steel support ribs.
    - .3 Inlet switching valves, normally open, pneumatically operated angle piston-style valves with teflon disc seal for positive sealing. Valve bodies of bronze construction.
    - .4 Purge exhaust valves, normally closed, pneumatically operated angle piston-style valves with teflon disc seal for positive sealing. Valve bodies of bronze construction.
    - .5 Purge exhaust mufflers provided on each purge exhaust valve for quiet operation.
    - .6 Four, 3-way solenoid valves to provide pilot signals for operation of inlet switching and purge exhaust valves. Solenoid bodies and internals of stainless steel construction.
    - .7 Two-way pneumatic repressurization valve to allow each tower to fully repressurize before being switched on line. The valve to include a shuttle valve which uses the pilot signals supplied for the purge exhaust valves. The valve to be actuated closed whenever purging is

- taking place, and opens when purging stops, to assist in repressurization. This repressurization assistance allows the user to reduce the purge flow if the dryer is being used at partial capacity, or allows the user to shorten the operation time cycle, while still being assured that full repressurization takes place before tower switching occurs.
- .8 A control air filter with a 5 micron replacement element, to prevent fouling of solenoid valves. The filter is to be supplied with a shutoff valve which allows the user to change the filter element without taking the dryer off line.
  - .9 Outlet check valves to be lift check valves with teflon seals for positive sealing. The valve piston is to be removable through a screwed cover, without removing the valve from the piping. The teflon disc is to be replaceable.
  - .10 Fixed purge air flow is to be regulated through a precision stainless steel purge orifice plate in a brass union-style body. The plate can be easily inter-changed to allow lower purge flow should the dryer inlet capacity be decreased, or the operating pressure is changed. The purge orifice is sized for maximum capacity, but may be down-sized if the dryer is operated at less than maximum capacity.
- .2 Coalescing filter as follows:
- .1 Model APCO-250-XA oil coalescing filter installed inline before the dryer. Filtration efficiency in the .3 to .6 micron range to be 99.97%. Absolute filtration of all solid particles larger than .01 microns, and all aerosol particles larger than .75 microns shall be achieved. The filter capacity shall be 250 SCFM minimum @ 100 PSIG with a pressure drop of 1 to 1-1/2 PSID with a dry element. Pressure drop for a wet element at rated capacity shall be 2 to 2-1/2 PSID. Filter housing to be rated for 230 PSIG operation, and have 1-1/4" F. NPT connections. The filter is to include a "no loss" drain valve complete with an isolation ball valve/strainer assembly. Ingersoll Rand PNLD model II drain valve or equivalent in accordance with B6 Substitutes.
- .3 After filter as follows:
- .1 Model APFO-250-X1 particulate removal after filter installed in line after the dryer, with a 5 micron absolute rating to prevent desiccant dust carry-over. Filter capacity to be 250 SCFM minimum @ 100 PSIG, with a pressure drop of .5 PSID with a new element. Filter housing to be rated for 200 PSIG operation, and have 1-1/4" F. NPT connections.
- .4 Catalytic convertor as follows:
- .1 Catalytic Convertor to convert CO to CO<sub>2</sub>. The convertor to consist of an ASME coded housing, complete with CRN registration, complete with stainless steel catalyst retainers/diffusers, and a suitable fill of Carulite 300 catalyst to provide an air-to-catalyst contact time of approximately .5 seconds.
- .5 Activated carbon filter as follows:
- .1 Model APCO-250-AC activated carbon final filter for installation in airstream before the dryer. The filter capacity shall be 250 SCFM minimum @ 100 PSIG with a maximum pressure drop of 1.1 PSI at full flow. The filter element shall be an activated carbon impregnated element for removal of particles down to .01 micron and final air

polishing for removal of odours. Filter housing to be rated for 230 PSIG operation, and have 1-1/4" F. NPT connections.

- .6 Controls as follows:
- .1 Precision hygrometer board, sensor, digital display dew point meter with a minus 40 to -9° C dew point range, and a capacitance-based moisture sensing probe mounted in an aluminum sensing well. The system will delay tower switching at the end of each repressurization period, and a "Purgeless" mode will commence if the outlet dewpoint (which is continuously monitored) being yielded is minus 40° C or lower. If the dew point is minus 39 degrees F. or higher, dryer operation and tower switching shall continue on the standard 10 minute time cycle basis. The hygrometer set point shall be adjustable (easily field adjusted) to transfer at any point from minus 39 to +15 deg. F. The scale shall also be easily adjusted to read in degrees Celsius if desired. The normal factory setting shall provide for the hygrometer output contacts to transfer when the dewpoint falls from minus 40 to minus 39 degrees F. This shall instigate tower switching to the freshly regenerated tower if the controls have been in the "Purgeless" condition.
  - .2 Programmable logic controller to allow for completely automatic operation of the system, including all alarms.
  - .3 A digital text display unit installed in the control panel door shall indicate "Left Tower Drying", "Right Tower Drying", "Repressurization", and "Purgeless" operation. Text display unit to also include an accumulated hour display, showing the total operating hours, plus the hours of operation in the "Purgeless" mode. A simple calculation of the time accumulated in the "Purgeless" mode (without the expenditure of purge air), can determine your cost savings for the controls based on your cost per SCFM. A visual flashing message display for any optional alarms shall also be programmed for display on the text screen.
  - .4 Selector Switch for "Purge Econ./Fixed Time" modes to allow the hygrometer to be bypassed, and the dryer operated on a fixed time cycle, should the hygrometer have to be serviced.
  - .5 "Off/On" selector switch.
  - .6 "High Humidity" alarm to include a second set of output contacts on the hygrometer board provided with "Purge Economizer Controls". The alarm shall include a text message, and audible buzzer sounding, and dry contacts for wiring of a remote alarm.
  - .7 Low outlet pressure alarm including an air pressure switch to monitor the outlet pressure, and provide an alarm condition if outlet pressure falls below 70 PSIG. The alarm shall include a text message, and audible buzzer sounding, and dry contacts for wiring of a remote alarm. Dry contacts may be common to both the "High Humidity" and the "Low Outlet Pressure" alarm.
  - .8 Carbon Monoxide detector, installed on the dryer control panel to monitor the outlet air for carbon monoxide after the catalytic convertor. The instrument shall provide output warning alarm conditions for carbon monoxide levels at 5 PPM. An audible alarm buzzer shall be activated, a visual display of text on the dryer text display shall appear. The dry alarm contacts (common with "High Humidity" & "Low Outlet Pressure" alarms) shall transfer upon an alarm condition.

- .7 Standard of acceptance: Air dryer/purification unit to be APPL (Air Power Products Limited -contact Mr. Grant Eagle Ph 519-662-2034) model AP-150-BA or equivalent in accordance with B6 Substitutes.

**2.4 COMBINATION FILTER-REGULATOR**

- .1 Factory assembled, heavy-duty with mounting bracket and low pressure side relief valve.
- .2 Maximum inlet pressure: 1034 kPa.
- .3 Operating temperature: minus 18 degrees C to plus 52 degrees C.
- .4 Filter element: 40 micron. Bowls: polycarbonate.
- .5 Pressure range in regulator: 34 kPa to 800 kPa.
- .6 Gauge range: Dual range 0 kpa to 1100 kPa and 0 to 160 PSIG.

**2.5 PIPING**

- .1 Piping: Type K or L hard drawn copper to ASTM B88M.
- .2 Fittings:
  - .1 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.
  - .2 Cast copper solder type: to ANSI/ASME B16.18.
  - .3 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .3 Dissimilar metal junctions: use dielectric unions, dielectric fittings to ASTM F492.
- .4 Flanges:
  - .1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24
- .5 Joints:
  - .1 Brazed joints.
  - .2 Teflon tape for threaded joints.
  - .3 Rubber gaskets, 1.6 mm thick; to AWWA CIII.

**2.6 BALL VALVES**

- .1 Three piece design or top entry for ease of in-line maintenance.
  - .1 Bronze body, stainless steel ball, PTFE Packing & Seat, lever handle.
  - .2 To withstand 1035 kPa maximum pressure.

**2.7 COUPLERS/CONNECTORS**

- .1 Industrial quick couplers. Specific to breathing system and not compatible with couplings on plant air or other piping systems. Provide a sign at each breathing air outlet reading "Compressed Breathing Air"
- .2 Maximum inlet pressure: 1700 kPa.

**2.8 BREATHING AIR HOOD**

- .1 Assembly shall be Wilson 4000 Series with R799 BIB acetate window, R800 Breathing Hose & Components and Wilson R912 Belt Mounted Personal Air Cooler or 3M #11964-1 Vortex cooling valve or equivalent in accordance with B6 Substitutes. To CSA-Z 94.4-93 (R1999). Provide four hood / hose assemblies and provide eight belt mounted control valve assemblies. Reuse existing equipment for the remainder of components required at each outlet.

**2.9 AIR DISTRIBUTION HOSE:**

- .1 Hose shall be FDA approved food grade. Reuse existing hose where possible. Allow for one new 50 ft section of 0.5" diameter hose.
- .2 1034 minimum pressure rating.
- .3 End fittings to suit application.
- .4 125 mm bend radius or less.
- .5 Standard or acceptance: Gates, 3M high pressure hose or equivalent in accordance with B6 Substitutes.

**PART 3 EXECUTION**

**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

**3.2 COMPRESSOR STATION**

- .1 Install on vibration isolators on housekeeping pad or steel frame as indicated.

**3.3 COMPRESSED AIR PIPING CONNECTIONS AND INSTALLATION**

- .1 Install flexible connection at compressors.
- .2 Install shut-off valves at outlets, major branch lines and in locations as indicated.
- .3 Install quick-coupler chucks and pressure gauges on drop pipes.
- .4 Install unions to permit removal or replacement of equipment.
- .5 Install tees in lieu of elbows at changes in direction of piping. Install plug in open ends of tees.
- .6 Grade piping at 1 % slope minimum.
- .7 Make branch connections from top of main.
- .8 Install compressed air trap at bottom of risers and at low points in mains.
- .9 Provide drain moisture traps at compressor outlets.

**3.4 FIELD QUALITY CONTROL**

- .1 Site Tests/Inspection:
  - .1 Testing: pressure test in, for 4 h minimum, to 1100 kPa, with outlets closed and with compressor isolated from system. Pressure drop not to exceed 10 kPa.
- .2 Manufacturer's Field Services:
  - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with Contract. The manufacturer is to provide start-up / adjustment assistance, training to The City's operating staff in the operation and maintenance of the breathing air system and is to assist The City in preparation of a monitoring and test log book.
  - .2 Schedule site visits to review work at stages listed:
    - .1 Upon completion of Work, after cleaning is carried out.
- .3 Obtain reports within 3 days of review and submit immediately to Contract Administrator.

**3.5 CLEANING**

- .1 Cleaning: blow out piping to clean interior thoroughly of oil and foreign matter. Clean contaminated pipe and fittings, before assembly, by washing with a trisodium phosphate solution followed by a thorough rinse with clean water and blow out with air. Refer to CSA Z180.1 Clause A14.2.
- .2 Check entire installation is approved by authority having jurisdiction.
- .3 Perform cleaning operations in accordance with manufacturer's recommendations.
- .4 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**