AB-3 Series Externally Heated Blower Purge Regenerative Air Dryer (1,500 - 7,000 scfm)

1.0 Scope

1.1 Work by Seller

1.1.1 Design, fabricate, test and deliver a externally heated blower purge regenerative compressed air dryer with prefilter, drain valves and afterfilter in accordance with this specification.

1.1.2 Furnish under this specification: multi-stage coalescing filter, automatic drain valve, dual tower heated dryer, color-change moisture indicator, pressure gauges, pressure differential indicators, and final high temperature particulate filter, all prepiped, prewired and supplied with legs for floor mounting.

1.1.3 Sellers manufacturing facility shall be certified and registered to ISO9001 (ANSI/ASQCQ Q90 Series).

1.2 Work by Buyer

1.2.1 Equipment installation

1.2.2 Piping connections to compressed air dryer and filter system from distribution system.

1.2.3 One 460 volt three phase, 60 cycle power connection.

1.2.4 Drain connections to sump.

1.3 **Codes and Standards** (latest edition)

1.3.1 National Electrical Manufacturers Association (NEMA)

1.3.2 American Society for Testing Materials (ASTM)

1.3.3 American National Standards Institute (ANSI)

1.3.4 National Electrical Code (NEC)

1.3.5 ASME Boiler and Pressure Vessel Code, Section VIII

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1.3.6 Occupational Safety and Health Act (OSHA)

1.3.7 Compressed Gas Association (CGA)

1.3.8 ISO9001 (ANSI/ASQCQ Q90 Series)

1.4 Submittals

1.4.1 Seller shall provide:

1.4.1.1 A reproducible drawing stamped certified for construction and signed by an authorized agent of the manufacturer.

1.4.1.2 Manuals for installation, operation and maintenance including specific instructions for filter replacements.

1.4.1.3 Elevation and plan drawings

1.4.1.4 Electrical schematic

1.4.1.5 Mill Test Reports for ASME Code Vessels

1.4.1.6 Form U-1 manufacturer's data report

2.0 Products

2.1 Mechanical design and equipment design details

2.2 General Design

2.2.1 The externally heated blower purge regenerative compressed air dryer shall be a complete unitized filtration and drying system. The integrated package shall produce clean and dry air from ordinary compressed air by using a combination of impingement, coalescence, adsorption, and mechanical interception. The air dryer package accomplishes this by removing the liquid water, oil, particulate matter and moisture to produce clean, dry compressed air.

2.2.2 All equipment specified herein shall be prepiped and prewired, such that the buyer need only to supply utilities and make tie-ins to form a complete functioning system.

2.3 Basic Design

2.3.1 Coalescing oil and water removal filters

2.3.1.1 Multi-stage coalescing compressed air filter to remove liquid water, solid particulate, liquid oil and oil mists from the air. The filter shall have a theoretical filtration efficiency greater than 99.9999% by weight at 0.3 micron particle size and shall be

capable of removing particulate as small as 0.01 micron. No prefilter shall be required for effective operation of filter.

2.3.1.2 Filter shall use (in order to prevent early clogging of the element) centrifugal separation and impingement to remove up to 99+% by weight of contaminants before the compressed air reaches the element, in order to prevent early clogging of the element, while limiting excessive pressure drop and to provide a long life between element replacements. Contaminants thus removed shall drain into a sump with external drain connection.

2.3.1.3 Filter elements shall consist of perforated support core and multiple layers of graded glass fiber coalescing medium which remove progressively smaller particles. Element shall also include a drain layer that consists of a PVC coated polyurethane foam that is compatible with all synthetic compressor lubricants that are in common use. The drain layer shall drain coalesced oil mists and droplets to a second sump with external drain connection.

2.3.1.4 The filter shall have an initial (dry) pressure drop of 0.4 psi and wetted pressure drop with clean element shall be 1.0-1½ psid, at 100 psig and rated flow. The average pressure drop over life of elements shall be approximately 3.5 psi when replaced at the recommended interval of 7.0 psid. The filter shall include differential pressure indicator for indication of need for element replacement. The indicator shall be in the green zone when element is good and in the red zone to indicate need for element replacement.

2.3.1.5 The filter housing shall be constructed of ASME code welded, pressure vessel quality steel, complete with flanged inlet and outlet connections, and shall include a second, external drain connection. Direction of air flow shall be from inside to outside of element. Maximum pressure surge up to 30 psi differential. A relief valve connection shall be provided.

2.3.1.6 The filter shall be provided with two automatic electronic drain valves with LED indicators for "Power On" and "Drain Open" with manual push-to-test buttons. The valve body shall use Viton seals with a full 7/16" orifice and to further reduce possible plugging of drain, a cleanable Y-strainer should be provided in line. Drain valves are mounted prepiped and prewired into package.

2.3.2 Externally Heated Blower Purge air dryer to remove water vapor.

2.3.2.1 The air dryer shall be capable of reducing the moisture content of the air to maintain an outlet pressure dew point of -40°F. The dryer shall provide a continuous supply of dry air by automatically switching the flow of air between the twin desiccant towers.

2.3.2.2 The dryer shall be of dual chamber design with each chamber filled or capable of being filled with equal quantities of adsorbing desiccant.

2.3.2.3 The drying flow shall be downward to minimize fluidization of the desiccant in the event of upset conditions.

2.3.2.4 Regeneration flow shall be counter-current to the direction of the inlet gas flow.

2.3.2.5 To facilitate filling and draining of desiccant without the need to disassemble manifold piping, each desiccant chamber shall be fitted with fill and drain ports.

2.3.2.6 Each chamber shall be provided with a removable stainless steel perforated sheet inlet diffuser screen and desiccant bed support screen.

2.3.2.7 Each chamber shall be fitted with a relief valve. Chambers shall not to be supported by interconnecting piping in any way.

2.3.2.8 Desiccant vessels shall be designed in accordance with the ASME Pressure Vessel Code and shall be U stamped.

2.3.2.9 Only dry, oil-free outlet air shall be used for pilot air necessary for dryer operation. A high surface area particulate pilot air line filter shall be furnished for this service.

2.3.2.10 All vessels, steel piping and structural supports shall be shot blasted to commercial blast cleaning (SSPC-SP6) specifications to remove scale and rust prior to painting. No visible oxidation of the surface shall be permitted between the time of blasting and priming. Surfaces shall be coated with an epoxy primer and high solids epoxy-enamel top coat.

2.3.2.11 Depressurization flow shall be downward or controlled flow upward to prevent fluidization of the desiccant. The dryer shall be equipped with a repressurization circuit to allow the regeneration chamber to reach line pressure prior to switchover. Repressurization shall be with dry air, and shall be controlled to prevent fluidization of the desiccant bed.

2.3.2.12 An external heater and blower shall be used to regenerate the dryer. The heater and associated purge piping shall be thermally insulated. Heater shall utilize incoloy sheathed low watt density heater elements. Heater shall be complete with a temperature indicator to monitor heater outlet regeneration gas temperature, an adjustable thermoswitch to control the regeneration gas temperature and a thermocouple to monitor heater element sheath temperature and provide over-temperature alarm. A thermoswitch, monitoring the regeneration air temperature as it

exits the chamber shall control the length of the heating period. The blower motor and heater shall be electrically interlocked so the heater is de-energized in the event of a blower motor failure. The blower supplied shall be of the positive displacement type in order to maintain constant flow when blower pressure fluctuates.

2.3.2.13 No process air shall be used for regeneration but may be used for repressurization at switchover. Sweeping with dry process air to decrease the temperature of the desiccant bed prior to switchover is allowable. Sweep rate and time must be stated in all proposals. The average and peak sweep rate shall be provided by vendor.

2.3.2.14 The heater shall be electrically interlocked with the switching valve mechanism to prevent the heater from energizing in the event of switching failure.

2.3.2.15 Valves shall be non-lubricated and of suitable design for the high temperature service of heat regenerated dryers. Valve disc and stem shall be stainless steel. Valve operators are to be supplied with permanently lubricated packings. Switching valves shall be designed with low break-away requirements. The vendor shall state in his proposal the pilot air pressure required. Ball valves and plug valves are not acceptable.

2.3.3 Final Particulate Filter

2.3.3.1 The compressed air particulate filter for removal of solid particulate from air at an absolute 0.9 micron filtration. The initial (dry) pressure drop at inlet air pressure and rated flow shall not exceed 1 psid. The filter shall include a visual indicator for element replacement. The indicator shall be in the green zone when element is good and in the red zone to indicate need for element replacement.

2.3.3.2 Filtration mechanisms shall be mechanical separation and interception. Filter housing shall incorporate a large-volume sump for the collection of separated particulate. Filter elements shall be replaceable and non-directional and shall be constructed of non-fiber releasing pleated, microglas fiber and non-woven polyester medium with glass-filled end caps. Elements shall be replaceable without breaking air connections. The elements are to be pleated and have six (6) times the surface area of smooth elements to allow a longer service life.

2.3.3.3 The element is to be mounted on a stainless steel support core and be capable of withstanding pressure surges up to 100 psi differential. The housing shall be constructed of diecast aluminum and incorporate the means to provide an audible signal should bowl be inadvertently loosened while filter is pressurized. The housing shall incorporate a manual drain for periodic removal of contaminants collected in sump.

2.3.4 Control and Alarm Monitoring System

2.3.4.1 Control enclosures shall be watertight and rated NEMA 4 for non-hazardous location.

2.3.4.2 An energy saving demand cycle control shall be included as part of the dryer package. This system shall perform the following functions:

- Assure full utilization of the moisture holding capacity of the desiccant bed before regenerating the bed.
- Maintain outlet dew point at or below the specified level throughout the drying period.

2.3.4.3 Continuous moisture sensing shall be accomplished via the use of a hygrodynamic sensor to assure full utilization of the moisture holding capacity of the desiccant before switching and regeneration.

2.3.4.4 The dryer controller shall be comprised of intrinsically reliable and durable components not susceptible to shorting and corrosion.

2.3.4.5 **Fail-Safe Mode:** Any power interruption to the dryer shall not result in interruption of the air flow through the dryer.

2.3.4.6 The controller shall be responsible for initiation and monitoring of the dryer operation. The control shall contain built-in diagnostics to check each operation as it is initiated, secure it, and ensure its continuation.

2.3.4.7 If a failure is detected by the controller at any point, the controller shall verify the problem, and where possible, attempt to clear the problem prior to producing an alarm condition.

2.3.4.8 The controller shall have a system schematic on the face which displays the current position and phase of the drying cycle.

2.3.4.9 As a minimum, the controller will display the following functions when they occur. The display must be in text form and may be indicated with status lights where appropriate.

- Digital Monitor
  - Chamber Status
  - Chamber Temperatures
  - Regeneration Air Inlet Temperature
  - Regeneration Air Exhaust Temperature
  - Outlet Air Humidity (Optional)
  - Blower Motor & Heater Amperes (Optional)

- ♦ Digital Control
  - – Drying
  - – Switchover
  - – Depressurizing
  - – Heating (Optional Sweep)
  - – Outlet Air Humidity (Optional)
  - – Repressurizing
  - – Standby
- ♦ Digital Diagnostics
  - – Valve Switching Failure
  - – Blower Motor Overload
  - – Heater Over-Temperature
  - – High Humidity (Optional)
  - – RS-232 / 485 serial port for remote monitoring & fiber optic output for operation up to 3 miles

2.3.4.10 Visual color change moisture indicators panel mounted. The indicator will be blue when dry and pink when wet.

2.3.5 Piping

2.3.5.1 All pipe 2-1/2" & smaller shall be standard weight ASTM A53 GR B with threaded connections. All threaded fittings are 150# black malleable iron and conform to ASTM A197 and ANSI B16.3.

2.3.5.2 All pipe 3" and larger shall be standard weight ASTM A53 GR B with butt welds and flanged connectors. All butt weld fittings are standard weight ASTM A106 GR B seamless pipe and 150# raised face ASTM A105 forged steel flanges.

2.3.6 Design Pressure and Temperature

2.3.6.1 The maximum allowable working pressure shall be 150 psig.

2.3.6.2 The rated capacity is based on inlet air conditions of 100 psig and 100°F. Ambient temperature range shall be 35°-120°F.

2.3.6.3 All pressure vessels shall be hydrostatically pressure tested to 1½ times the maximum operating pressure. The dryer assembly shall be tested with shop air pressure and all threaded pipe connections shall be soap bubble tested.

2.3.7 The compressed air drying and filtration system shall be Kemp AB-3 Series Externally Heated Blower Purge Regenerative Desiccant Compressed Air Dryer Model Number _____.