

High Pressure Cycling Refrigerated Air Dryers

525 – 1630 scfm

Point of Manufacture – West Chester, PA, USA

Date: 8-Jan-14
Cancels: All Previous

CYCLING PRODUCT SPECIFICATION

SCOPE

This specification describes a complete mechanical refrigerated drying system for the removal of moisture, oil aerosols and other contaminants from a compressed air or gas stream. This is accomplished by cooling the gas with a water cooled refrigeration unit to a temperature at which the contaminants condense and are separated from the gas stream. The dryer shall be complete in all respects, including integral component equipment, inter-connecting piping, wiring and controls. The dryer shall only require connection to utilities furnished by others.

OPERATING CONDITIONS & PERFORMANCE DATA

The dryer shall be rated for the following conditions:

Inlet Air Flow: XXX SCFM
Inlet Air Pressure: 580 psig
Inlet Air Temperature: 100 °F
Ambient Temperature: 100 °F
Outlet Pressure Dew Point: 38 °F

COMPONENTS AND CONSTRUCTION

Each dryer shall be complete with the following items:

1. Precooler/Reheater exchanger assembly.
2. Cycling refrigerated chiller
3. Refrigeration systems equipped with independent fully-hermetic compressor and water-cooled condenser.
4. Centrifugal air/moisture separator.
5. No air loss condensate drain to automatically discharge condensate.

6. Microprocessor based control system to regulate and monitor system operation.

7. Full cabinet enclosure to protect internal components.

PRECOOLER/REHEATER

Stainless steel heat exchangers are employed to simultaneously precool the incoming compressed air prior to being dehumidified and to reheat the chilled dry air (exiting from the air chiller section) prior to being supplied back into the high pressure compressed air system. The air is re-heated to prevent condensation formation in the compressed air piping system and to recover energy.

Air-to-air heat exchangers shall be designed to provide smooth, non-fouling exchange surfaces with minimal associated pressure drop.

The maximum allowable working pressure shall be 680 psig.

Internal and External Air Side Connections

All airside connections are made with 1-1/2" - 3" MPT. These connections occur where manifolds connect the precooler and reheater section of the heat exchanger to the field installed connection points for the compressed air circuit. The field supplied connections are furnished using carbon steel.

CYCLING REFRIGERATED CHILLER

Compressed air that was cooled from the precooler/reheater is delivered to a

chiller section comprised of stainless steel heat exchangers that are employed to cool and dehumidify the compressed air stream utilizing an environmentally safe thermal heat transfer fluid that is chilled by the refrigeration system. The chiller section is an extended surface heat exchanger manufactured of stainless steel. Continuous circulation of the chilled heat transfer fluid permits consistent and reliable heat exchange with the compressed air stream thereby allowing for relatively constant temperature and pressure dew point. The thermostatically controlled thermal mass allows the refrigeration compressor to cycle on and off depending on the heat load to the dryer. The temperature controlled operation conserves energy, reduces wear and tear on the refrigerant compressor, and minimizes the potential for freeze-up.

REFRIGERATION SYSTEM

The refrigeration system shall be designed to dry the rated amount of compressed air and will consist of one fully-hermetic reciprocating compressor, thermal mass circulation system, water-cooled condenser,, liquid to refrigerant evaporator section (to chill the heat transfer fluid), thermal expansion valve, refrigeration control valves, and refrigeration safety controls that are monitored by the microprocessor. Modulating device such as a hot-gas-bypass is not required. Refrigerant 404A shall be used to minimize environmental hazard.

**Refrigeration System (Components)
R404A Refrigerant**

Environmentally friendly R404A, a non-ozone depleting refrigerant, is used in the Cycling Dryer. R404A is not on any list for global obsolescence.

Compressor

A hermetically sealed reciprocating compressor is utilized throughout the Ingersoll Rand Cycling design range. All compressors have primary internal motor overload protection for single phase units or internal motor overload protection for three phase units. The compressor is installed on isolation mounts to reduce noise and vibration.

Piping

To ensure proper oil return to the compressor, all velocities through refrigeration piping meet or exceed the required specification.

Stress relievers have been added throughout the design to increase the refrigeration circuit's structural integrity by minimizing vibration transmissions and allowing for thermal expansion.

All suction-side refrigeration piping shall be insulated to prevent condensation formation.

Thermal Mass Cooling System

The thermal mass cooling system consists of a thermal mass reservoir, an environmentally safe heat transfer fluid, and stainless steel evaporators. Evaporators shall exchange heat between the refrigerant and the heat transfer fluid. The chilled fluid shall then be circulated to the chiller (compressed air to fluid) section. The thermal mass shall thus allow the

refrigerant compressor to cycle on and off automatically depending on the heat load to the dryer. The storage container and exchanger system shall be designed to deliver a 38°F PDP.

Thermal Mass Circulating System

The chilled heat transfer fluid is transferred to the air heat exchanger via the thermal mass fluid pump. Pump shall be maintenance-free, cartridge circulator pump. Pump shall run continuously to maintain flow through the air chiller at all times after the unit has been activated for operation.

CENTRIFUGAL AIR/MOISTURE SEPARATOR

A vertical air/moisture separator shall be located downstream of the chiller section. The compressed air and condensate stream exiting this chiller section shall be directed to the separator to allow for the separation and subsequent removal of the prior to entering the precooler/reheater exchanger section. Separation shall be performed at the coldest point in the system by means of centrifugal acceleration, expansion into an area of low velocity with sump area and change of air flow direction. These separation mechanisms shall provide for separation efficiency in excess of 99%.

PNEUMATIC NO-LOSS DRAIN

Condensate drain automatically discharges with minimal loss of valuable compressed air. Customer will need to supply 100 psig control air for proper operation. The no-loss drain valve shall be furnished as a field installed kit complete with installation

instructions. The control air fittings, regulators, and piping shall be field supplied by customer. A minimal quantity of air will be vented to promote free draining of the condensate.

MICROPROCESSOR CONTROLS AND INSTRUMENTATION

The chiller section and refrigeration system shall be controlled and monitored by a fully integrated microprocessor. The standard microprocessor shall incorporate the following features:

1. Percent Energy Savings Digital Readout
2. Chiller Temperature Digital Readout
3. Automatic Dryer Restart

Microprocessor shall also incorporate field programmable dew point settings to allow the dryer to be more closely matched to seasonal demands. A higher dew point setting shall allow refrigerant compressors to experience a lighter load thereby conserving more energy and further reducing compressor wear and tear.

PORO

Power Outage Restart Operation (PORO) is standard. PORO will automatically restart the dryer after a power supply interruption.

Enclosure and Baseplate

The cabinet forms a NEMA 1 / IP 21 rated enclosure. Optional NEMA 4 enclosure is available.

The cabinet is designed to safely contain components yet offer an aesthetically pleasing appearance and ergonomically planned maintenance access. The sheet metal enclosure is 16 or 18 gauge steel and is painted with electro-statically applied powder coat paint.

The Baseplate is painted black where applicable, while the remaining metal cabinet is beige.

Paint specification:

Flexibility: ASTM D522

Adhesion: ASTM D3369 Method B

Hardness: 2H pencil hardness test to ASTM D3363

Impact Resistance: ASTM D2794

Salt spray and humidity resistance: ASTM B117, ASTM D2247

Surface Prep: SSPC-SP8

Dry Film Thickness (DFT): 2.0 - 3.0 MILS (typical)

Control System

The electrical enclosure shall be NEMA 1.

TESTING

Final package and functional testing is performed on all dryers:

- 100% electrical functionality test
- 100% tracer gas leak test to the refrigeration side
- 100% refrigeration leak test at designed system pressure and vacuum rate of rise leak test.

- 100% Airside pressure leak test at 750 Psig / 52 bars

All heat exchangers are trace gas leak tested at 750 psig / 52 bars.

All heat exchanger assemblies are leak tested at 750 psig / 52 bars and pressure tested under water for air leaks.

Conformance Compliance (60Hz)

The following codes shall apply:

- Pressure Vessels: ASME Sec. 8, Div. 1
- Electrical: NEMA 1
- US/Canada/Mexico Free Trade: General Rule 2, Article 301-NAFTA

WARRANTY

Standard Ingersoll Rand warranty is provided. The warranty period is 12 months after start up or 18 months after shipment, whichever occurs first.