High Pressure Cycling Refrigerated Air Dryers

2525 to 6635 scfm

Point of Manufacture – West Chester, PA, USA

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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. Independent cycling refrigerated chiller section.
3. Refrigeration systems equipped with independent fully-hermetic compressor and water-cooled condensers.
4. Centrifugal air/moisture separator.
5. No air loss drain automatically discharges condensate.
6. Microprocessor based control system to regulate and monitor system operation.
7. Full cabinet enclosure to protect internal components.
8. Modular construction from 5050–6635 scfm

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 150# ANSI FLG, NPT for 60Hz design. 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. 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.

Refrigeration System (Components) Compressor
A hermetically sealed reciprocating compressor is utilized throughout the Ingersoll Rand Cycling design range. All compressors have an oil sump heater with primary internal thermal overload protection. The compressor is installed on isolation mounts to reduce noise and vibration.

Piping
ASTM B75 or ASTM B743 refrigeration gauge piping is utilized throughout the design. 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 is comprised of a thermal mass reservoir for 2,525 thru 3,315 SCFM models and a centralized reservoir for multi-module systems (5,050 thru 6,635 SCFM models), an environmentally safe heat transfer fluid, and a stainless steel evaporator module. The evaporator module 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.

2,525 – 4,150 SCFM (Single Module) Units
The chilled heat transfer fluid shall be continuously circulated between the thermal storage reservoir, the evaporator module, and the chiller module.

5,050 – 6,635 SCFM Multi-module Packaged Systems
Units comprised of multiple modules shall utilize a central thermal storage reservoir. Each module shall be furnished with an evaporator module which is factory piped to the central reservoir. The heat transfer fluid shall be circulated in parallel with the evaporator modules, chiller modules, and the central reservoir. The operation of each module shall be sequenced to allow the refrigerant compressor to cycle on and off automatically depending on the heat load to the dryer. The system shall be designed to deliver a 38°F PDP.

Thermal Mass Circulating System
Thermal mass fluid is transferred to the chiller modules via a 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. Muti-module systems shall be furnished with a maintenance free cartridge circulator pump for each module.

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 to provide 100 psig control air. 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 associated refrigeration system for each module 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. Suction Temperature Digital Readout
4. Suction Pressure Digital Readout
5. Discharge Pressure Digital Readout
6. Dryer Running Time
7. Diagnostic memory
8. Automatic Dryer Restart
9. Remote Start/Stop
10. Remote Communication Ready
11. High Discharge Pressure Cutout Alarm
12. High Chiller Temperature Alarm
13. Low Chiller Temperature Alarm
14. Compressor Heater Delay

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

Enclosure and Baseplate
The electrical enclosure is constructed as being NEMA 1. 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 possible, 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 entire electrical panel and conforms to UL 508A.

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:

- Performance Testing: ISO Guidelines, CAGI ADF-100
- Pressure Vessels: ASME Sec. 8, Div. 1
- Electrical: UL 508A
- 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.