Non-Cycling
REFRIGERATED AIR DRYERS
3250 to 8000 SCFM

Point of Manufacture – West Chester, PA, USA

Industrial Technologies
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NON-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 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: 100 psig
Inlet Air Temperature: 100 °F
Ambient Temperature: 100 °F
Outlet Pressure Dew Point: 39 °F

COMPONENTS AND CONSTRUCTION

Each dryer shall be complete with the following items:

1. Pre-cooler / Re-heat exchanger.
2. Independent non-cycling refrigerated chiller sections.
3. Complete refrigeration systems equipped with independent fully-hermetic compressor, air or water cooled condenser, refrigeration metering /control valves, and refrigeration control devices.
4. Centrifugal air/moisture separator.
5. Solenoid condensate drain valve controlled by an on board microprocessor provided with each module. A no air loss drain that automatically discharges condensate is available as an option.
6. Microprocessor based control system to monitor system operation for each module.
7. Full cabinet enclosure to protect internal components.
8. Modular construction (multiples of 2000 or 2400 SCFM modules)

PRECOOLER/REHEATER

Stainless steel heat exchangers are utilized to simultaneously pre-cool the incoming compressed air stream prior to the chiller section and to reheat the chilled dry air in order to prevent condensation in the outlet compressed air piping system. Pre-cooling of the compressed air stream is achieved thru a heat transfer process using the 39F chilled dry air leaving the evaporator (chiller) / separator section to reduce the temperature and pressure dew-point prior to entering the evaporator (chiller) section. This allows for efficient heat exchange in the air to refrigerant circuit. The chilled dry air temperature is elevated by a heat transfer process that recovers the heat from the inlet compressed air stream. Re-heating the dry compressed air stream prior to exiting the dryer prevents the formation of external condensation in the compressed air piping system.

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

The maximum design pressure shall be 220 psig.

Internal and External Air Side Connections

All airside connections are made with 150# ANSI flanges and fabricated using carbon steel pipe. The dryer inlet and outlet connections are manifolded respectively to the pre-cooler and re-heater section of the heat exchanger. The Multi-module design provides for a common inlet and outlet air header section which also serve as a common lifting point for the entire assembly and allows for flexible connection to the building compressed air piping system.

NON-CYCLING REFRIGERATED CHILLER

Compressed air that was cooled from the pre-cooler / re-heater is delivered to the evaporator section comprised of stainless steel heat exchangers. The dew point temperature of the compressed airstream is further reduced to the desired level through heat transfer with an evaporating refrigerant.

REFRIGERATION SYSTEM

The refrigeration system shall be designed to dry a set volume of compressed air and shall consist of one hermetic reciprocating compressor, condenser, evaporator section, and refrigeration specialties (including a refrigerant expansion device, filter dryer, & hot gas bypass valve). During part load operating conditions (i.e.

reduced air flow rates or lower inlet temperatures), a hot gas valve allows hot refrigerant gas to bypass the condenser and the expansion device while maintaining a dew point of less than 40F and to maintain a minimum evaporator pressure in order to prevent freeze-up of the air evaporator section. Refrigerant 404A shall be used to minimize environmental hazard.

Refrigeration System (Components)
Compressor
A hermetically sealed reciprocating compressor is utilized throughout the Ingersoll Rand Multi-module non-cycling design range. All compressors have an oil sump heater with internal thermal protection. A high pressure and low pressure transducer are provided to monitor compressor discharge and suction pressures for each module. 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.

The refrigeration piping is designed to minimize vibration to inter-connecting components while allowing for thermal expansion.

All suction-side refrigeration piping is covered with insulation to prevent condensation formation.

CENTRIFUGAL AIR/MOISTURE SEPARATOR
A vertical air/moisture separator shall be located adjacent to the evaporator section. Compressed air and water condensed in the evaporator section shall be delivered to the separator for the separation and subsequent removal of the water from the compressed air. 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%.

TIMED ELECTRIC DRAIN
The condensate collected at the bottom of the separator is discharged by a timed electric solenoid drain that is operated by the unit controller. The timing sequence of the drain can be set by the controller.

MICROPROCESSOR CONTROLS AND INSTRUMENTATION
The refrigeration system for each module shall be controlled and monitored by a fully integrated microprocessor that is provided for each module. The standard microprocessor controller shall incorporate the following features:

1. Chiller Temperature Digital Readout
2. Suction Temperature Digital Readout
3. Suction Pressure Digital Readout
4. Discharge Pressure Digital Readout
5. Dryer Running Time
6. Diagnostic memory
7. Automatic Dryer Restart
8. Remote Start/Stop
9. Remote Communication Ready
10. High Discharge Pressure Cutout Alarm
11. High Chiller Temperature Alarm
12. Low Chiller Temperature Alarm
13. Display Drain Valve Operation
14. Cycle Operation Of Condenser Fans To Match Refrigeration Load.

The first module in the system shall feature an enhanced controller that provides the following:

1. Compressed Air Inlet Pressure Digital Readout
2. Compressed Air Outlet Pressure Digital Readout
3. Compressed Air Inlet Temperature Digital Readout
4. Compressed Air Outlet Temperature Digital Readout

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

Enclosure and Base
The fans, fan guards and cabinet form a NEMA 1 / IP 21 rated enclosure. An optional NEMA 4 electrical 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 Base is galvanized metal while the remaining metal cabinet is IR 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 system for the Multi-module unit shall be provided with a main power enclosure to allow for single point power connection. Each module shall be furnished with a dedicated control panel that includes a microprocessor controller to allow for independent operation of each module. The Multi-module unit shall be factory wired and complete with all electrical controls required for proper operation. The electrical enclosure shall be NEMA 1 and the construction of the electrical enclosure shall be designed in accordance to UL508A. The compressor and fan motors shall be furnished with internal thermal protective devices. The electrical enclosure assembly shall be listed in accordance to UL508A. UL listed NEMA 4 control assembly is available as an option.

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 system design pressures and vacuum rate of rise leak test.
- 100% Airside pressure leak test at 125Psig /8.6 barg

All heat exchangers are trace gas leak tested at 550 psig / 37 barg.

All heat exchanger assemblies are leak tested at 275 psig / 19 barg and pressure tested under water for air leaks. All heat exchanger assemblies are tested under water at 400 psig / 27 barg for refrigerant leaks.

Conformance Compliance (60Hz)
The following codes shall apply:

- Performance Testing: ISO Guidelines, CAGI ADF-100
- Pressure Vessels: ASME Sec. 8, Div. 1 CRN/CSA (Canada)
- Electrical Enclosure Assembly: UL 508A
- US/Canada/Mexico Free Trade: General Rule 2, Article 301-NAFTA

WARRANTY
Standard Ingersoll Rand warranty is provided for the Multi-Module Non-Cycling Dryer designs.