

Nirvana Cycling REFRIGERATED AIR DRYERS 200 to 800 scfm

Point of Manufacture – West Chester, PA, USA

Industrial Technologies
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NIRVANA 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: 38 °F

COMPONENTS AND CONSTRUCTION

Each dryer shall be complete with the following items:

1. Precooler/Reheater exchanger.
2. Cycling refrigerated chiller
3. Refrigeration systems equipped with independent fully-hermetic compressor and either air-cooled or water-cooled condensers.
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 precool the incoming compressed air using the exiting chilled, dry air allowing efficient heat exchange in the air to refrigerant circuit. The outgoing air, chilled to 38F, cools this incoming air and, while doing so, warms the exiting air to prevent condensation formation in the compressed air stream.

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 300 psig (220 psig with optional no air loss drain).

Internal and External Air Side Connections

All airside connections are made with 1-1/2" - 3" NPT for 60Hz designs and 50Hz designs. These connections occur where manifolds connect the precooler and reheater section of the heat exchanger to form inlet/discharge connection points at the point of connection between the compressed air system and the dryer. The piping connecting to the heat exchangers is carbon steel.

CYCLING REFRIGERATED CHILLER

Compressed air from the precooler/reheater is delivered to the refrigerated chiller which consists of stainless steel heat exchangers, where heat from the compressed air is exchanged with the thermal mass fluid. Continuous circulation of the glycol mass permits consistent and reliable heat exchange allowing 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 minimize freeze-up potential.

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, air-cooled or water-cooled condenser and refrigerant evaporator. 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 Nirvana Cycling Dryer. R404A is not on any list for global obsolescence.

Compressor

A hermetically sealed reciprocating compressor is utilized throughout the Ingersoll Rand Nirvana Cycling design range. All compressors have primary external 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 is covered with insulation to prevent condensation formation.

Thermal Mass Cooling System

The thermal mass cooling system consists of a thermal mass reservoir, thermal mass fluid and stainless steel evaporators. Evaporators shall exchange heat between the refrigerant and thermal mass fluid. 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

Thermal mass 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.

CENTRIFUGAL AIR/MOISTURE SEPARATOR

A vertical air/moisture separator shall be located adjacent to the chiller section. Compressed air and water condensed in the chiller 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 SOLENOID DRAIN (STANDARD)

Condensate is removed from separator by a timed solenoid drain valve which is controlled by the Microprocessor Controller.

NO AIR LOSS DRAIN(OPTIONAL)

Condensate drain automatically discharges with no loss of valuable compressed air.

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 fans, fan guards and cabinet form 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 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 enclosure includes both a solid-state compressor overload and fan motor overload protection (thermal and short circuit). The NEMA 1 electrical panel is ETL Listed to UL1995 and CAN/CSA C22.2 STD 236.

Panel Filter

An industrial grade panel filter comes standard on 200-800 scfm Nirvana Cycling dryers to help protect the refrigeration condenser from ingress of dust.

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 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: NEMA 1 design is ETL Listed to UL1995 and CAN/CSA C22.2 STD 236.
- US/Canada/Mexico Free Trade: General Rule 2, Article 301-NAFTA

WARRANTY

Standard Ingersoll Rand warranty is provided for the Nirvana Cycling Dryers, 50 and 60Hz designs.