Nirvana Cycling
REFRIGERATED AIR DRYERS
3250 to 19200 SCFM

Point of Manufacture – West Chester, PA, USA

Industrial Technologies
Davidson, NC 28036

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Cancels: All Previous

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 nominal flow rating of the dryer (SCFM) shall be rated for the following conditions:

Inlet Air Pressure:	100 psig
Inlet Air Temperature:	100 °F
Ambient Temperature:	100 °F
Outlet Pressure Dew Point:	38 °F

COMPONENTS AND CONSTRUCTION

Dryer shall consist of factory-assembled dryer modules conjoined to form a single compressed air dryer requiring a single electrical connection, single air connection, and water connection (water-cooled dryers only). Each dryer shall be complete with the following items:

1. Precooler/Reheater exchanger.
2. Independent cycling refrigerated chiller sections.
3. Refrigeration systems equipped with independent fully-hermetic compressor and air-cooled or water-cooled condensers.
4. Centrifugal air/moisture separator.
5. No air loss drain to automatically discharge condensate.
6. Microprocessor based control system to regulate and monitor system operation.
7. Full cabinet enclosure to protect internal components.

AIR CONNECTIONS

All air connections shall be made via flanged connections at the ends of the inlet and outlet air headers. Air headers shall be designed such that connections can be made at either side of the dryer. Connections at the left side of the inlet air header and right side of the outlet air header (or vice versa) shall also be permitted.

PRECOOLER/REHEATER

Stainless steel heat exchangers precool the incoming compressed air from the inlet air header 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 220 psig.

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 refrigerant mass allows the refrigeration compressor to cycle on and off depending on the heat load to the dryer. The temperature controlled operation conserves energy, reduce wear and tear on the refrigerant compressor, and minimize freeze-up potential.

REFRIGERATION SYSTEM

The refrigeration system within each module shall be designed to dry a set 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 shall not be used. Refrigerant R404A shall be used to minimize environmental hazard.

COMPRESSOR
A hermetically sealed reciprocating compressor is utilized throughout the Ingersoll Rand Nirvana Cycling design range. All compressors shall have an oil sump heater with primary external motor temperature protection and internal, secondary motor temperature protection. A primary, external sensor with secondary, internal protection shall monitor compressor discharge temperature. The compressor shall be installed on isolation mounts to reduce noise and vibration.

PIPING
ASTM B75 or ASTM B743 refrigeration gauge piping shall be utilized throughout the design. To ensure proper oil return to the compressor, all velocities through refrigeration piping shall meet or exceed the required specification.

Stress relievers shall be used throughout the design to increase the refrigeration circuit's structural integrity by minimizing vibration transmissions and allowing for thermal expansion.

THERMAL MASS COOLLING SYSTEM
The thermal mass cooling system for the dryer shall consist of a centralized thermal mass reservoir, thermal mass fluid and stainless steel evaporators. Refrigerant from each module's Refrigeration System shall be circulated within the evaporator of each module, liberating heat from the 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 shall be transferred to the air heat exchanger via each modules 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. Thermal mass fluid shall circulate to each module via common glycol headers that deliver glycol to each module.

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%.

NO AIR LOSS DRAIN
Pneumatically controlled condensate drain will automatically discharge with no loss of valuable compressed air.

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

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

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

ENCLOSURE AND BASEPLATE
The fans, fan guards and cabinet shall form a NEMA 1 / IP 21 rated enclosure. Optional NEMA 4 rating shall be available.

The cabinet shall be 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.

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 entire electrical panel shall conform 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 125 psig /8.6 barg

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

All heat exchanger assemblies shall be leak tested at 275 psig / 19 barg and pressure tested under water for air leaks. All heat exchanger assemblies shall be 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: UL 508A
- 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.