

# Nirvana Cycling REFRIGERATED AIR DRYERS 1000 to 2400 SCFM

Point of Manufacture – West Chester, PA, USA

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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 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

Each dryer shall be complete with the following items:

1. Precooler/Reheater exchanger.
2. Cycling refrigerated chiller sections.
3. Refrigeration system equipped with independent fully-hermetic compressor and air-cooled or water-cooled condensers.
4. Centrifugal air/moisture separator.

5. Condensate drain to automatically discharges 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 220 psig.

### AIR SIDE CONNECTIONS

All airside connections are made with 150# ANSI FLG, NPT for 60Hz and 50Hz design. The inlet and outlet pipe is made from carbon steel pipe.

### CYCLING REFRIGERATED CHILLER

Compressed air from the precooler/reheater shall be 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 shall be designed to dry a set amount of compressed air and will consist of one fully-hermetic 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 compressor shall be utilized throughout the Ingersoll Rand Nirvana Cycling design range. All compressors 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 monitors compressor discharge temperature. The compressor is 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 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 COOLING SYSTEM**

The thermal mass cooling system shall consist of a centralized thermal mass reservoir, thermal mass fluid and stainless steel evaporators. Refrigerant from each 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. Evaporators shall exchange heat between the refrigerant and thermal mass fluid. 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**

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

**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

**ENCLOSURE AND BASEPLATE**

The fans, fan guards and cabinet shall form a NEMA 1 / IP 21 rated enclosure.

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 shall include both a solid-state compressor overload and fan motor overload protection (thermal and short circuit). 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 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: UL 508A
- US/Canada/Mexico Free Trade: General Rule 2, Article 301-NAFTA