TS Non-Cycling
REFRIGERATED AIR DRYERS

50Hz and 60Hz Design
Point of Manufacture – Davidson, N.C., USA

Date: January 3, 2006
Revision 2

TS PRODUCT SPECIFICATION

The TS refrigerated dryer is a non-cycling compressed air dryer designed for superior and reliable performance in a compressed air solution.

Enclosure and Baseplate

The cabinet is designed to safely contain components yet offer an aesthetically pleasing appearance and ergonomically planned maintenance access. The sheet metal enclosure is 14 gauge (1.905mm/0.075 inch) steel and is painted with electro-statically applied powder coat paint.

The Baseplate is painted black, 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

Internal and External Air Side Connections

All airside connections are made with 150# ANSI FLG, NPT for 60Hz designs and BSP for 50Hz design. These connections occur when manifolds connect multiple 3-in-1 heat exchanger(s) to form inlet/discharge connection points at the point of connection between the compressed air system and the dryer.

3-in-1 Heat Exchanger

The TS heat exchanger(s) are an integrated, aluminum channel design. They are designed to:
1. Pre-cool the inlet air,
2. Reduce the air stream to the needed dewpoint, and
3. Reheat the air prior to discharge.

The heat exchanger conforms to ASME pressure vessel code and complies with the European Union Pressure Equipment Directive 97/27/EC.

Micro-Channel Condenser

Micro-channel, parallel flow aluminum condensers and axial fans provide sub cooling to the refrigerant. The condensers are made of 3003 or 4045 aluminum. The design of the micro-channel condenser eliminates the soldered U-joints found throughout Tube-in-Fin condenser designs, which are a major source for refrigeration leaks.

The micro-channel's superior surface area to volume ratio, which is typically 18 times greater than an equivalent tube in fin condenser, enables:

- Less refrigerant usage
- Low pressure drop across the condenser

Industrial Grade Axial fans provide cooling airflow across the condenser. The fans, fan guards and cabinet form a Nema 1 / IP 21 rated enclosure.

Refrigeration System (Components)

Compressor
A hermetically sealed reciprocating compressor is utilized throughout the Ingersoll Rand TS design. 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 the baseplate to reduce noise and vibration.

Valves
All TS models utilize *Expansion Valves* to control refrigerant flow through the heat exchangers. Expansion valves provide consistent evaporator temperature by precisely matching the flow of refrigerant through the heat exchanger to the heat load produced by

the compressed air. Expansion valves are used in the design due to their superior reliability and precision.

Other expansion devices, such as capillary tubes, are unable to adjust and synchronize refrigerant flow to match the compressed air heat load. Therefore, capillary tubes do not allow evaporator temperatures to remain reasonably constant with varying ambient temperatures and changing compressed air heat loads on the heat exchanger(s).

To control refrigeration system pressures and return temperatures, a hot-gas by-pass valve is utilized. The hot-gas by-pass valve will re-direct refrigerant from the condenser back to the compressor's suction line to protect heat exchanger(s) from freezing and/or to prevent liquid refrigerant from slugging the compressor.

Piping
ASTM B280 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.

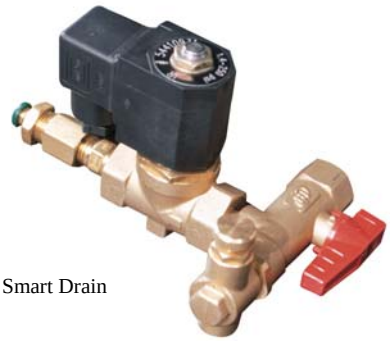
Stress relievers have been added throughout the design to increase the refrigeration circuit's structural integrity by minimizing vibration transmissions and allowing for thermal expansion.

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

Refrigeration System (Operation)

Control System
An Intellisys™ microprocessor controller fitted to all TS dryers. The Intellisys™ microprocessor combines visual outputs and triac outputs (triac AC outputs are fast and more reliable than traditional relay outputs). The controller displays:

- Ambient Temperature
- Evaporator Temperature and % Relative Humidity
- Warning LED for Low Evaporator Temperature
- Warning LED for High Evaporator Discharge Temperature
- Warning LED for Drain Valve issue
- Warning for High Ambient (above 115°F /46°C)
- Warning LED for Predictive Filter Element change out
- Alarm for High Compressor Discharge Pressure
- Alarm for High Compressor Discharge Temperature
- Alarm for Compressor Motor Overload



Smart Drain

Intellisys™ also controls the "Smart" drain. The "Smart" drain is electric solenoid drain that receives a signal from the Intellisys™ controller when to open. The ambient temperature determines the frequency of openings. As the ambient temperature increases, so will the amount of condensate extracted by the dryer. Therefore, in higher ambient environments, the drain will open more often than in low ambient environments which minimizes compressed air waste.

The electrical enclosure includes both a solid-state compressor overload and fan motor overload protection (thermal and short circuit). The entire electrical panel and conforms to UL 508 (UL file E66268 and passed electromagnetic compatibility testing).

R404A Refrigerant
Environmentally friendly R404A, a non-ozone depleting refrigerant, is used in the TS Dryer. R404A is not on any list for global obsolescence.

PORO

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

Panel Filter

An electro statically charged HAF (High Air Flow media) industrial grade panel filter comes standard on all TS dryers to help protect the the dryer from ingress of dust.

Testing

Final package and functional testing is performed on all dryers:

- 100% electrical functionality test
- 100% Helium leak test to the refrigeration side
- 100% refrigeration leak test at designed system pressure
- 100% Airside pressure leak test at 125Psig /8.6 barg

All Condensers are Helium leak tested at 600 Psig / 41 barg

All Heat Exchangers are Helium leak tested at 275 Psig / 19 barg and pressure tested under water for air leaks.

Conformance Compliance (50Hz)
The following codes shall apply:

- Electrical installation: IEC / EN 60204
- Electrical construction: IEC / EN 60947
- Performance testing: ISO Guidelines
- Mechanical design: Safety Standard EN1012 and EN292
- Flange connection (if applicable): Metric (DN/PN rating)
- Pressure Components: 97/23/EC (PED)
- Pressure Vessels: EN87/404
- SQL China: ASME Sec 8, Div. 1 (India)
- AS 1210 (Australia): Generic Immunity EN 50082
- Electro Magnetic Compatibility: EN 50081

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

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

Optional Connection

Efficiency Mode: When a host air compressor is connected to the TS (through a digital signal), the dryer will cycle based on evaporator temperature (between 35°F/3°C and 48°F/9°C) to reduce its runtime when the host air compressor is off. Upon receiving a signal that the host air compressor is back on, the dryer will engage back into full load operating conditions.

Warranty

Standard Ingersoll Rand warranty is provided for the TS Dryer, 50 and 60Hz designs.