DETAILED SPECIFICATION (50Hz / 60Hz)

D41IM – D299IM
MODULAR DESICCANT DRYERS
24-176 scfm

Point of Manufacture – Newcastle, UK

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Revision 1

MODULAR DESICCANT DETAILED SPECIFICATION

General Description
The Ingersoll Rand Modular dryer is a heatless modular dryer comprising of an extruded aluminum column filled with desiccant material which is assembled together using a bottom inlet and top outlet manifold which allows the design to meet varying capacity requirements.

One chamber is in operation (drying) while the opposite chamber is regenerating using the pressure swing adsorption (PSA) method.

A small volume of the dried compressed air is used to regenerate the saturated desiccant bed by expanding dried air from line pressure to atmospheric pressure, removing the water adsorbed by the desiccant material, and therefore, regenerating the dryer.

The desiccant chambers are repeatedly regenerated and brought on-line using a solid state timer.

Operating Limitations
The Ingersoll Rand Modular desiccant dryer operates in the 24 to 176 cfm (41 – 299 m^3/hr) air flow range. Maximum operating pressure is 232 psig (16 barg) for models D41IM to D110IM and 189 psig (13 barg) for models D150IM to D299IM. Maximum inlet temperature for all models is 122°F (50°C). All models are designed to perform in conformance with ISO 7183 standards.

General Purpose
The Ingersoll Rand Modular desiccant dryer is designed to remove water vapor from compressed air for critical applications. This dryer is designed for indoor use with ambient temperatures above 35°F (1.5°C).

Adsorption System
As a standard, all models use activated alumina for adsorbing the moisture from the compressed air. For optional -94°F (-70°C) dew points molecular sieve is used.

Switching Valves
For continuous operation the compressed air stream is automatically cycled between two desiccant columns, one adsorbing while the other is being regenerated. This cycling is done by the use of solenoid valves on models D41IM-D110IM and pneumatic cylinder valves on models D150IM-D299IM. A passive check valve is used on the outlet of all models.

Desiccant Towers
The heart of all adsorption dryers is the desiccant column. For continuous operation two columns are situated in parallel utilizing a patented twin chamber extrusion. All models use this high tensile extruded aluminum column design.

Desiccant
Replacement of the desiccant is recommended every 30 months.

Control and Instrumentation
The continuous switching between the desiccant columns is controlled by a solid state timer. LED's are used to indicate Power On, Fault, and Energy Management (optional). Pressure gauges are provided for both towers.

Enclosure
The dryer range is mounted on a metal support enclosure housing all control equipment.

Filters
The dryer range is shipped with an HE pre-filter and DP after-filter.

Fundamentals of Air Drying
How Water gets into the Air System
Water vapor becomes a major constituent in compressed air systems as it is distributed with the compressed air. Additional cooling of the compressed air as it is distributed in the plant air piping will condense the water vapor. This condensed water will corrode system components resulting in increased maintenance costs and reduced system efficiency. The Ingersoll Modular air dryer will adsorb the water of the air system before problems develop. All atmospheric air contains a certain quantity of water vapor, which is mixed with other gases eg nitrogen, oxygen, carbon monoxide. This water vapor is drawn into the

compressor with the incoming air during the compression cycle. Compressed air, at normal ambient temperatures, cannot hold as much water vapor as air at atmospheric pressure, however, the heat generated during the compression cycle increases its ability to hold water vapor. When the compressed air is cooled between the compressor and the point of use, this water vapor will condense out in the system piping, air receiver, tools etc. The quantity of water vapor condensed will be that amount which is in excess of the saturated temperature of the compressed air.

Aftercooling

Almost every air system uses an after cooler (air cooled or water cooled) to cool compressed air as it exits the air compressor. The air exiting the compressor is typically at 203°F (95°C) –356°F (180°C), depending on the type of compressor. The after cooler will cool the air to approximately 15°F (9°C) above the cooling medium, depending on the temperature of cooling water or cooling air. In almost all cases, the air exiting the after cooler is saturated, meaning it cannot hold any additional water vapor at its present temperature and pressure. Any decrease in compressed air temperature will result in water vapor condensing into the air system.

Types of Dryers

Depending on the application and the physical laws of nature, further moisture can be removed by the correct dryer selection. Two types of dryers are commonly used to remove moisture from compressed air, each with capabilities and limitations. These capabilities must match with end users requirements.

Refrigeration dryers cool the air by mechanical refrigeration to condense entrained water vapor; a moisture separator removes the condensate. Drying capabilities are in the 2 to 10°C (35 - 50°F) pressure dew point range. Since the lowest limit to which refrigeration dryers can perform without damage of freezing is 35 - 38°F (2 – 3°C), this type of dryer gives an excellent protection for installations where ambient temperatures remain above the freezing temperature of water.

Desiccant dryers are most suitable for any application that requires a pressure dew point below 32°F (0°C). When air-line freeze ups must be prevented or in critical processing, these dryers are commonly used. Desiccant dryers use porous, non consumable materials (desiccant) to adsorb water molecules from the air stream onto the surface of the desiccant. The adsorption principle is based on the affinity of the desiccant with the water. The desiccant can adsorb a certain quantity of moisture after which it needs to be regenerated (dried out) for re-use. To allow continuous operation, the air stream is automatically cycled between two desiccant towers; one tower is adsorbing moisture while the other tower is being regenerated. The means of regeneration differentiates the types of desiccant dryers.

Dryer Operation

Compressed Air Flow

100% saturated compressed air enters the dryer via the passive inlet ball valve and is directed up through one of the snow storm filled desiccant cartridges contained within the columns (depending on here in the cycle the controller timer is, this will be either the left column or right column).

During its flow, water vapor is adsorbed from the air. The adsorption is based on the affinity of the desiccant material towards the water vapor in the air. One of the outlet ball valves will be open and the other closed (again depending on the cycle position). This normally will be open for three minutes and then closed for three minutes (continuous operation). This continuous cycling is controlled by a solid state timer.

Regeneration Air Flow

Simultaneously to drying the compressed air in one chamber, a limited amount of dried air is passed from the dryer outlet and expanded to atmospheric pressure through purge regulator screw housed within the cartridge twist inserts. This regeneration air flows downwards through the saturated desiccant of the other chamber. The expanded dry air flows down through the chamber and regenerates the desiccant. The expanded regeneration air containing the adsorbed moisture is discharged through the exhaust solenoid valve. After 2 minutes, 30 seconds, the exhaust solenoid valve closes, the left chamber is repressurized through one of the purge air regulators, 30 seconds later (a total of 3 minutes) the second exhaust solenoid valve opens. The pressure in the right chamber is vented and the passive ball valve is switched due to differential pressure caused by the exhaust valve opening. The outlet ball valves switch as a result of the pressure difference between the two chambers.

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