D5IM – D34IM
MODULAR DESICCANT DRYERS
3-20 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 patented dual column configuration filled with desiccant material 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 3 - 20 cfm (5.10 – 34.00 m^3/hr) air flow range. Maximum operating pressure is 175 psig (12 barg). Maximum inlet temperature for all models is 122°F (50°C). All models are designed to perform in conformance with ISO 8573 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 molecular sieve for adsorbing the moisture from the compressed air.

Switching Inlet Valves

For continuous operation the compressed air stream is automatically cycled between two desiccant columns, one adsorbing while the other is being regenerated. On all models this cycling is done by the use of a passive ball valve.

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 cartridges is recommended after a period of time.
Service warning and service required is indicated on display using a traffic light LED arrangement.

Green LED: Normal operation
Yellow LED: Service warning
Red LED: Service required

Electrical Control

The continuous switching between the desiccant columns is controlled by a solid state timer.

Enclosure

The dryer range is mounted on a flame retardant ABS support enclosure housing all control equipment. The enclosure consists of two base plates and two compartment covers. On the larger base plate, the timer PCB & transformer are mounted and on the smaller base plate a fused terminal block (500mA) is mounted. The cover encloses the base plates and incorporates a main cable gland.

Filtration

A high efficiency coalescing pre-filter is integral to the dryer housing. Dust after-filters are integral to the desiccant replacement cartridges.

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 such as 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℉ (95℃) –356℉ (180℃), depending on the type of compressor. The after cooler will cool the air to approximately 15℉ (9℃) 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℃ (35.6 to 50℉) pressure dew point range. Since the lowest limit to which refrigeration dryers can perform without damage of freezing is 35.6-37.4℉ (2 – 3℃), 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℉ (0℃). 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 where 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 exhaust solenoid 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, 25 seconds, the exhaust solenoid valve closes, the left chamber is repressurized through one of the purge air regulators, 35 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.

The fully regenerated left chamber will now dry the saturated compressed air while the right chamber is being regenerated.