Verification of Performance of Industrial Dryers using Ceramic Tile Hygrometers

Application Background

Dry compressed air supplies are frequently required for industrial applications worldwide, there are a number of different methods of delivering this. The most frequently occurring style of dryer is the twin-column desiccant dryer, which operates using two cylinders filled with a moisture adsorbent. The wet supply air is fed [at pressure] into each cylinder in turn, one of which dries the air while 'regenerating' the other. These dryers are split into two main types:

Heatless Regeneration

These dryers use either Activated Alumina or Molecular Sieves as their drying mediums; they are capable of dew points as low as -50°Cdp & -90°Cdp respectively. They function due to the partial pressure gradient of the adsorbent, which results in the deposition of the moisture from the wet air onto the surface of the adsorbent. While this is occurring, a small proportion of the dried air is fed back into the regenerating column to aid desorption, and a sudden drop in pressure of the active column carries the saturated air to the exhaust. The role of the columns is switched using a cycle timer, the 'dwell' time of each cycle is usually set dependent upon the adsorbent capacity of the columns.

Heated Regeneration

The general component layout of this type of dryer is broadly similar to that of the Heatless regeneration type. The fundamental difference is that regeneration is effected by an electric heating element in direct contact with the adsorbent bed in addition to a flow of already dried air. This causes significantly quicker desorption than the dry air flow alone.

Because of this, the drying process can be altered in order to improve performance. It is possible to use the internal volume of the adsorbent in addition to the surface area. This greatly increases the moisture capacity of each column, and, when knowing the adsorbent capacity and time of each column, the dwell times can be increased to make maximum use of the capacity available. Also, with the application of heat it is possible to fully regenerate the absorbent in this time.

Measurement Technique

In the case of heat-regenerative dryers, large electrical or steam heaters are used to regenerate columns of saturated desiccant material and in such cases energy efficiency is of prime importance. As the input air flow, temperature and pressure are often variable dependant on plant conditions, this causes the demand placed on the dryer to vary. In order to maintain air quality and to increase efficiency it is beneficial is control the cycle time dependant on the output performance required. By monitoring the moisture content of the outlet air using a hygrometer, this information can be used to provide feedback to the cycle controller, only allowing it to switch columns when the drying column has adsorbed to its full capacity, rather than at a fixed time interval. This technique is known as Dew-point Dependant Switching (DDS). This provides a corresponding increase in efficiency due to the less frequent interruption to the air supply. For on-line measurements either a transmitter or hygrometer (with display) may be implemented dependent on whether the user wishes to feed into a data acquisition system or simply provide a local display of the measured dew point. Increasingly transmitters are used for this application, being easy to install, relatively low cost and offering a standard milliamp output signal that is suitable for input into a control system that can control the function of the air dryer.

Most Michell Impedance sensors are suitable to use for this control function, including the Easidew transmitter, which is a fully self-contained probe, powered by a 12 to 28VDC input and providing a linear mA output in °C dew point. This transmitter can be used alone, providing an output into a controller or external monitoring system. It can also be used in conjunction with Easidew On-Line Hygrometer, which couples the transmitter with an easy-to-install display unit that provides transmitter excitation, digital display, milliamp output and a dual alarm The Cermet II Hygrometer is a sensor/monitor combination with intelligent digital display that offers multiple engineering units, mA, voltage and RS232 output options with up to four alarm contacts.

An MDM300 Portable Hygrometer can be used to carry out spot checks on dryers

It is common for a portable hygrometer to be used for spot checking air quality where there are multiple usage points or long air line runs from compressor to the working location. The Easidew Portable, provides a digital display and milliamp output with an integral re-chargeable battery pack contained within a hard-wearing Peli-Case, and a full sampling system with filtration, flow and pressure regulation. The MDM300 Portable Hygrometer also offers multiple engineering units and features an in-built data-logger for storing up to 8000 measurement points.

All of the above units are suitable for measurements at both atmospheric and at line pressure, and both the Cermet II and MDM300 can take an auxiliary pressure input for active pressure compensation if required.

These instruments are also suitable for confirming the output of other types of dryer, such as refrigeration dryers.

Reference Users

Parker-Hannifin, Atlas Copco, Zander, Xebec, Pneumatic Products, Pneumatech, Gardner-Denver, Hi-Line, Nanoporus Solutions

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