When dry air is important

Dewpoint Measurement in Compressed Air Systems

Compressed air is widely used in production facilities for purposes such as the operation of process machinery and the actuation and control of pneumatic valves, cylinders and controllers. It can also be used as a transport medium or purge gas. Humidity has unfavorable effects on the compressed air distribution system and on the processes in which it is used. But the use of compressed air dryers and reliable dewpoint monitoring ensures that the wheels of industry keep turning.

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Compressed air is widely used in many industrial applications.

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In a compressed air system, the aim is to produce dry, oil-free and dust-free compressed air at low cost. Oil and dust can be removed with filter systems, but humidity must be adjusted with dryers. Exactly how dry the air should be depends on the specific process using the compressed air.

Humidity can be a problem in compressed air

A typical pressure of a compressed air system is 7 bar (101.5 psia). The dewpoint temperature is a pressure-dependent parameter, so that, as the compressor compresses the air, the dewpoint of the air increases. At a certain point, the air becomes saturated and some of the water condenses.

Moisture in compressed air can cause many problems both to the end product and to the components of the air distribution system itself. Humidity may affect the quality of the end product by, for example, causing adherence of hygroscopic products (e.g. sugars) and leading to bubble formation in coating processes.

As the majority of compressed air systems are made of steel or non-galvanized steel, they corrode when they are in contact with moist compressed air. Rust and scale forms in the piping and is blown into sensitive equipment. This in turn leads to faults in control systems and widespread operating problems. If the system is partly installed outside, ice-formation should also be taken into account.

Quality class	Particle size in microns	Dewpoint °C	°F	Oil content mg/m^3
1	0.1	-70	-94	0.01
2	1	-40	-40	0.1
3	5	-20	-4	1
4	15	+3	37	5
5	40	+7	45	25
6	-	+10	50	-

Table 1. ISO8573.1 specifications.

Refrigerant and desiccant dryers reduce humidity

The problem of excess humidity can be solved by using dryers, the two basic types of which are refrigerant dryers and desiccant dryers.

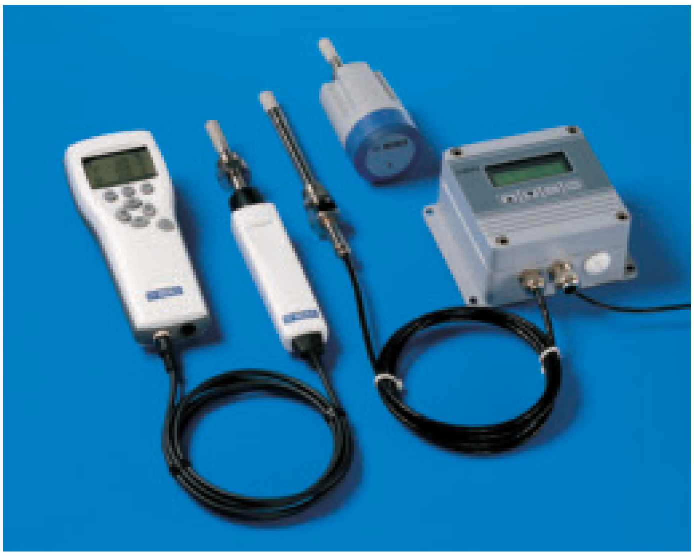
Refrigerant dryers use a refrigeration system and heat exchangers to drive down the temperature of compressed air to 2-5 °C (36-41°F), which is also the dewpoint of the air. The excess water vapor condenses and is separated from the air, and the air is then warmed up.

Desiccant dryers operate on the basis of adsorption. Chemical beads, called desiccant, adsorb water vapor from compressed air. The most common desiccants are silica gel, activated alumina and molecular sieve. A desiccant dryer is considerably more effective than a refrigerant dryer. Although it typically provides a -40 °C (-40 °F) dewpoint, even -100 °C (-150 °F) dewpoints are possible.

Desiccant dryers usually have two desiccant-filled towers and switching valves that direct the compressed air flow first through one tower and then through the other. A desiccant dryer's basic operation consists of one drying cycle and one regeneration cycle, which is continuously repeated. While one tower dries the air, the parallel drying tower is in the regeneration mode.

Considerable savings through dewpoint monitoring

Dewpoint monitoring ensures that the dryer is functioning according to its specifications. Concerning desiccant dryers, dewpoint measurement can also be used to control the desiccant regeneration interval. Regeneration is not started until the desiccant tower has been used to its full capacity as indicated by a rise in the outlet air dewpoint. Unlike conventional timer-based regeneration, this system takes into account the fact that when compressed air is dry, the regeneration interval may be much longer than for moist air. Thus, because it avoids unnecessary regeneration, dewpoint-dependent switching provides the user with up to 80 % savings in the energy costs of drying compressed air, typically making a realistic repayment period for the investment less than one year[1].



Vaisala's DMP248, DMT242 and DM70 transmitters for measuring the dewpoint of compressed air.

Standards specify the quality of compressed air

ISO8573.1 is an international standard that specifies the quality of compressed air. The standard has three categories:

- Maximum remaining dirt particle size in microns
- Maximum allowable dewpoint
- Maximum remaining oil content

Each category is given a quality class number between 1 and 6 according to the reference values shown in Table 1.

For example, a dryer that conforms to ISO8573.1 class 1.1.1 specifications reaches a dewpoint of -70 °C (-94 °F). In addition, the remaining dirt particles are small and the oil content is low (max 0.1 µm and 0.01 mg/m^3, respectively). Specific industries and applications may also have their own additional standards and guidelines, such as ANSI/ISA-7.0.01-1996 for instrument air.

Vaisala's dewpoint transmitters for monitoring compressed air

Vaisala's dewpoint transmitters DMP248, DMT242 and DM70 are all suitable for monitoring the dryness of compressed air. The DMP248 with a display is a high-end product for versatile use. The DMT242, a compact and rugged transmitter, is well suited to OEM (original equipment manufacturer) applications such as compressed air dryers. The DM70 complements the product range. It is a light portable that can be used for spot measurements at the compressed air line or for field checks of other dewpoint transmitters, for example. ■

References

1. Savings in the Energy Consumption of a Compressed Air Dryer (in Finnish). Sarlin 360°, 1997, No. 4, p 14. Sarlin Group, Helsinki, Finland.