



## Dew point measurement in compressed air systems

Today, compressed air is an essential and reliable source of energy for modern production processes.

Depending on the particular application, the compressed air requirements may vary.

The compliance with a specific moisture content or dew point/pressure dew point is the basic prerequisite for a continuously trouble-free system.





Usually, compressed air is generated from ambient air which must be aspirated, compressed by using pistons or screw compressors and which must then be dried more or less strongly.

The aim is to produce dry and oil-free compressed air which is low in dust particles with the smallest possible effort. Residual oil and dust particles can be removed by means of complex filter systems. However, moisture must be reduced by means of dryers (refrigeration dryers, membrane dryers, adsorption dryers and so on) which ideally work in a controlled manner independent of any load.

### How does water get into compressed air?

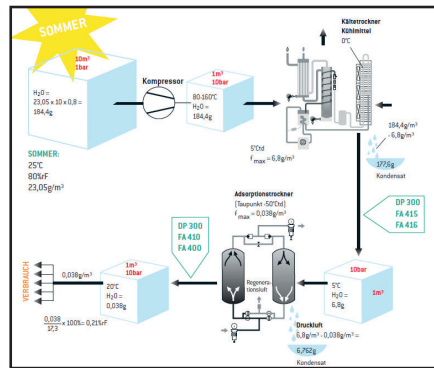
Air is able to bind more water vapor the higher the temperature and the larger the volume. Conversely, if the air is compressed, the capacity to bind water vapor is reduced.

A compressor compresses atmospheric ambient air into a fraction of its original volume. At a certain point of the compression process the water content of the air exceeds the decreasing ability of the air to bind water. The air is saturated and part of the water drops out as condensate.

By means of an additional decrease of the temperature even more water will condensate.

This means that the relative humidity on the output of a compressor will always be at 100 % and that there will be additional water drops in the outgoing air.

The amount of liquid which drops out under pressure can be large. For example, a 30 kW compressor thus releases approximately 0.7 CF into the compressed air line at a humidity level of 60 % and an ambient temperature of 68 °F in eight hours. In case of big compressors this value will be much higher.



### Effects of the moisture content

Depending on the application different demands are made on the compressed air. For each process the observance of a certain moisture content is the condition for a durably failure-free functioning of the whole system.

Most of the compressed air lines are made from steel or non zinc-coated steel. Since the corrosion speed strongly increases from a relative humidity of 50 % this value should not be exceeded in any case.

In the course of time, high moisture will lead to a corrosion in case of non zinc-coated lines. The rust gradually chips off and moves to the sampling points. This leads e. g. to blocked nozzles, defective control elements and production stops.

Expensive repairs and short maintenance intervals are inevitable. In addition to problems with corrosion and the described results the moisture content has direct influence on the quality of the final products.

### Which problems may arise in case of too high moisture?

In the following please find some of the most occurring samples:

- Hygroscopic products (spices, sugar etc.) get stuck together during transport by the pneumatic conveyor system
- Bubbles are formed during painting and coating processes
- Boreholes can clog up from dust being carried

Application	Compressed air quality classes according to DIN ISO 8573 - 1			
	Particles		Residual water	
	CL	µm	CL	DTP
Breathing air	1	0,1	1-3	-70/-20 °C
Spray guns	1	0,1	2	-40 °C
Medical technology	1	0,1	3-4	-20/+3 °C
Measurement and control technology	1	0,1	4	+3 °C
Conveying of food and beverages	2	1	3	-20 °C
Sandblasting equipment	---	---	4-3	+3/-20 °C
General factory air	3	5	4	+3 °C
Demolition hammer	4	15	5-4	+7/+3 °C

### Tasks of dryers

Different types of dryers are used in practice in order to control the problems of moisture levels that are too high.

In compressed air technology, the pressure dew point is the parameter for indicating the dryness of compressed air. The pressure dew point is the temperature at which the moisture which is contained in the compressed air condenses to form liquid water (also saturation, 100% relative humidity).

The lower the pressure dew point temperature, the smaller the amount of water vapor contained in the compressed air.



# Dew point

## Refrigeration dryer for dew point parameters around +35.6 Ftd.

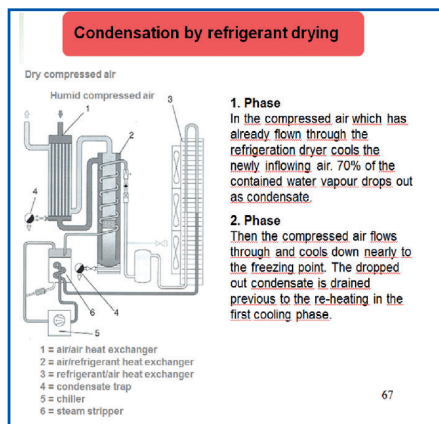
There are different types of compressed air dryers; refrigeration dryers or adsorption dryers are the most commonly used ones.

Refrigeration dryers cool down the compressed air to approx. 35.6 to 41 °F. In this case, the pressure dew point is also 35.6 to 41 °F. The excess water vapor condenses and precipitates.

After that the air is again heated up to room temperature.

The refrigeration compressed air dryers are monitored in most cases only by a display of the cooling temperature. A stationary humidity monitor is hitherto only installed in large systems or in particularly important applications.

However, the display of the cooling temperature alone is not sufficient. Even if the cooling temperature seems to be OK, the following errors can cause an excessive pressure dew point:



- **Condensate in the refrigeration dryer is not drained off (condensate drain defective resp. soiled)**
- **Compressed air bypass in the refrigeration dryer (close and corrode heat exchanger pipes and so on); compressed air bypass in bypass lines**
- **A failure of the refrigeration dryer inevitably leads to considerable problems with condensate in the compressed air line**

It is especially problematic (besides the already listed problems), if the condensate can concentrate in blind lines and does not drain off automatically. Condensate in blind lines can only be removed again by means of considerable efforts or dried and drained off by means of an extremely large amount of compressed air.

This often leads to increased dew point values at very low consumption rates, without the refrigeration dryer showing any obvious problems. In this case, it is quite difficult for the person who is responsible for compressed air to find out the reason for the increased dew point values or in extreme cases for the condensate in the long-term.

## Adsorption dryers for typical dew points -22...+40 Ftd.

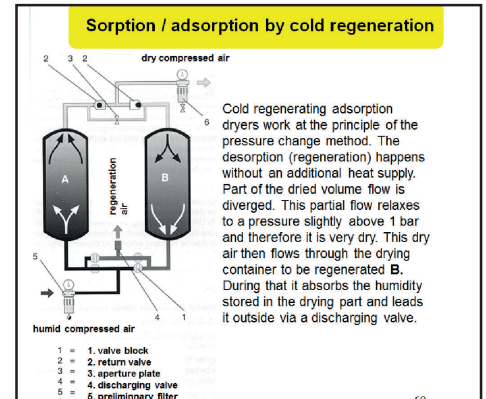
The functioning of the adsorption dryer is based on the principle of the attraction between the two masses. Water vapor is bound (absorbed) at the surface of a desiccant.

Effective adsorption dryers are able to dry compressed air down to a pressure dew point of -40 °F and lower.

Regenerative adsorption dryer exist of two tanks which are filled with desiccant. In different procedures there is one tank regenerated cold resp. warm while the other one dries the operation air.

Depending on the procedure and the operating conditions the desiccant has to be exchanged in cycles of three to five years.

**Certain operating conditions lead to a shortening of the life span of the desiccant:**



- **Overload on compressed air side due to excessive compressed air consumption**
- **Poor pre-separation of condensate**
- **Oily air**
- **Regeneration times of the individual tanks too long**

## New: DS 400 dew point measurement with alarm ensures process reliability

Unique worldwide with 3.5" graphic display with touch screen and print function.

An alarm delay can be set for each relay. This grants that only really long-term threshold value exceedances are indicated. Additionally every alarm can be reset.



The dew point set DS 400 consists of the chart recorder DS 400 and the dew point sensor FA 510 including measuring chamber for the pressure dew point measurement of compressed air and gases up to 232/725/5075 psi.

For pressures of more than 232 psi, please use the high-pressure measuring chamber.

The heart of the dew point sensor is the worldwide proven humidity sensor. In order to get quick and accurate measurements it is necessary that the humidity sensor is continuously flown by the gas (compressed air) to be measured. For this purpose a defined volume flow is blown out at a certain pressure via a capillary line.

The measuring chamber can be connected to the sampling point without any large installation efforts by means of the standard plug nipple for compressed air lines.

The big difference to customary paperless chart recorders is reflected in the simplicity of DS 400 on initiation and evaluation of the measured data.

The intuitive operation with the 3.5" touch screen graphic display with zoom function and print key is the only one of its kind in the world in this price category. By means of the graphic display with zoom function the drying procedure resp. the dew point curve can be seen at a glance and stored in the data logger. So the user can take a look at the stored measuring curves also without any computer at any time on site. This grants a quick and easy analysis of the drying behavior.

By means of the print key the actual screen can be stored as an image file to the internal SD card or to a USB stick and printed out at the computer without any additional software.

Ideal for documentation of the measured values/measurement curves on site.

Colored measurement curves can be sent by e-mail as image files or integrated into a service report.

The internal data logger enables the storage of the measured data for several years. The measured data can be evaluated on a USB stick or via Ethernet by means of the comfortable software CS Soft Basic.

#### Special features:

- **3.5" graphic display, intuitive operation via touch screen**
- **Zoom function for accurate analysis of measured values**
- **Colored measurement curves with names**
- **Mathematical calculation function for calculation of the dew point distance (condensate switch)**
- **Print key: optional indications can be stored as image files directly on a USB stick and sent by e-mail without any software**
- **2 alarm contacts for threshold value exceedance**
- **Freely adjustable alarm delay for both alarm contacts with reset function**
- **Up to 4 sensor inputs for: additional dew point, pressure, temperature, flow meters, electrical effective power meters, optional third-party sensors can be connected: Pt 100/ 1000, 0/4...20 mA, 0-1/10 V, Modbus, pulse**
- **Integrated data logger 8 GB**
- **USB, Ethernet interface, RS 485 / Modbus**
- **Web server**