



Dew point measurement in compressed air plants

Today, modern production processes cannot be imagined without compressed air as a versatile and reliable energy source.

Depending on the respective single case different demands are made on compressed air. Meeting a certain moisture degree or dew point/pressure dew point is the basis for a permanent failure-free plants operation.

CS Instruments GmbH has developed a pressure dew point multifunction measuring instrument DS 400 with lots of new advantages specially for moisture measurement resp. dew point/pressure dew point measurement in compressed air and gases.





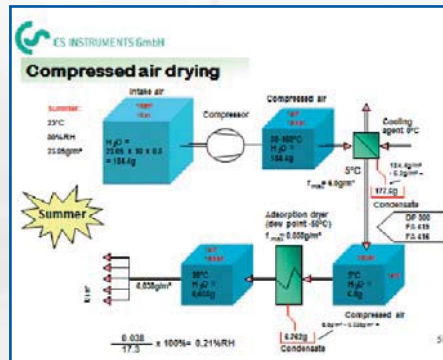
WOLFGANG BLESSING

Usually compressed air is made from ambient air by using piston or screw compressors and which then has to be dried more or less strongly.

The aim is to produce dry, oil-free and dust particle poor compressed air with the smallest possible efforts. Residual oil and dust particles can be removed by means of complex filter systems. However, moisture has to be reduced by means of dryers (refrigeration dryers, membrane dryers, adsorption dryers and so on) which ideally work independent from any load.

How does water get into compressed air?

Air is able to bind more water vapour if the temperature is higher and the volume is bigger. In contrary case it has only a poor capacity to bind water vapour if the air is compressed. 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 at the end of a compressor will always be at 100 % and that there will be additional water drops in the exit air. The amount of liquid which drops out under pressure can be large. For example a 30 kW compressor releases approximately 20 litres into the compressed air line at a humidity of 60 % and an ambient temperature of 20 °C. 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 be exceeded in no 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 and so on) agglutinate during transportation through the pneumatic conveying system
- Bubbles occur during varnishing and coating processes
- Drilled holes may get blocked due to dust which is carried along
- In winter control valves freeze in unheated halls

Application	Compressed air quality classes according to DIN ISO 8573-1			
	Particle		Residual flow	
	Class	µm	Class	Dew Point
Respiration 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 techn.	1	0.1	4	+3 °C
Transportation of food and beverages	2	1	3	-20 °C
Sand blasting plants	—	—	4-3	+3/-20 °C
General factory air	3	5	4	+3 °C
Break-up 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 too high moisture. 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 liquid water (also saturation, 100 % relative humidity). The lower the pressure dew point temperature the smaller is the amount of water vapour contained in the compressed air.

Refrigeration dryers for dew point values around + 2 °Ctd

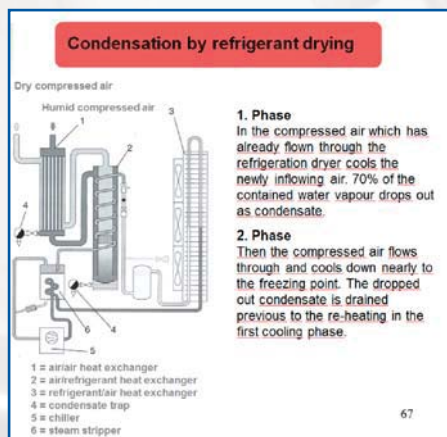


There are different types of compressed air dryers; refrigeration dryers or adsorption dryers are the most commonly used ones. Refrigeration dryers cool down the compressed air to approximately 2 to 5 °C. In this case the pressure dew point is also 2 to 5 °C. The excess water vapour condenses and drops out.

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

In most cases the refrigeration dryers are only monitored by an indication of the cooling temperature. Up to now stationary moisture monitoring systems are only installed in big plants resp. in case of particularly important applications.

However, it is not sufficient if only the cooling temperature is indicated. The following failures may lead to an exaggerated pressure dew point even if the cooling temperature seems to be alright:



- **Condensate in the refrigeration dryer is not drained off (condensate drain defective resp. soiled)**
- **Compressed air bypass in the refrigeration dryer (heat exchanger pipes worn out, corroded and so on)**
- **Compressed air bypass in the bypass line (wet compressed air passes the bypass instead of passing the dryer)**
- **Condensate overload of the refrigeration dryer due to poor condensate pre-separation**

If the refrigeration dryer fails this 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 automatically.

Condensate in blind lines can only be removed 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 consumptions without any avoidable problems of the refrigeration dryer. In this case it is quite difficult for the person who is responsible for compressed air to find out in the long-term the reason for the increased dew point values or in the extreme case for the condensate

Adsorption dryers for typical dew points around -30...-40°Ctd

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

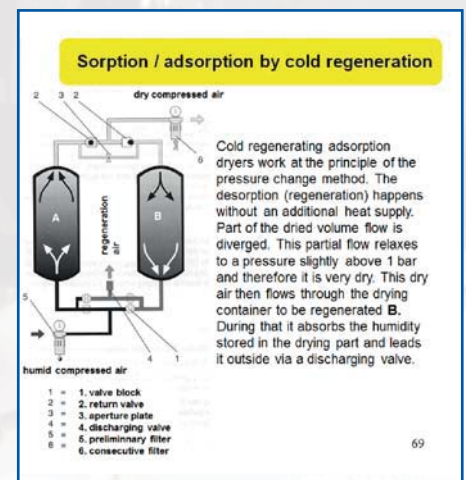
Effective adsorption dryers are able to dry compressed air down to a dew point of -40°C and lower.

Regenerative adsorption dryers 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 due to too big compressed air consumption**
- **Poor pre-separation of condensate**
- **Oily air**
- **Too long regeneration times of the single tanks**

New: DS400 dew point measurement with alarm grants process safety

For a safe process procedure it is necessary to monitor the demanded pressure dew points at any time and to get an alarm in case of exceedings of the threshold values.

Weltweit einzigartig mit 3,5 Zoll Graphik Display mit Touchscreen und Printfunktion

DS 400 dew point set

Worldwide unique with 3.5 inch graphic display with touch screen and print function



With the new "ready for plug-in"

DS 400 dew point sets for refrigeration dryers as well as for membrane/adsorption dryers down to $-80\text{ }^{\circ}\text{C}$ td can be monitored easily and safely. The dew point sets will be supplied completely wired, therefore a time consuming studying of the instruction manual is not necessary.

Exceeding of threshold values can be reported optically and acoustically. 2 relays for pre- and main alarm are freely adjustable.

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

The dew point set DS 400 consists of the multifunction measuring instrument DS 400 and the dew point sensor FA 410 including measuring chamber for pressure dew point measurement of compressed air and gases up to 16/50/350 bar. For pressures of more than 16 bar please use the high-pressure measuring chamber.

The heart of the dew point sensor is the worldwide proven humidity sensor of CS Instruments GmbH. 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 inch touch screen graphic display with zoom function and print key is **worldwide unique in this price class.**

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 behaviour.

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/ curves on site. Coloured measured 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 via 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
- Coloured measured 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 exceedings of threshold values
- Freely adjustable alarm delay for both alarm contacts with reset function
- Up to 4 sensor inputs for: Further flow sensors, dew point, pressure, temperature, consumption, active power meters, optional third-party sensors can be connected: Pt100/1000, 0/4..20 mA, 0-1/10 V, Modbus, pulse
- Integrated data logger 2 GB
- USB, Ethernet interface, RS 485
- Webserver

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