Dew Point

CS INSTRUMENTS (PTY) LTD

The Importance of Dew Point Monitoring in Compressed Air Systems

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Why is there water in the compressed air line?

Depending on the inlet air conditions, air compressors can produce quite a lot of water. If this water is not removed, it travels through the piping and can rust steel pipes, and acts as a solvent for the compressor lubricants. The water picks up rust, oil, and dirt inside the piping—and washes it downstream to clog pneumatic components or even to contaminate product. This is a major concern for the automotive, food and pharma industries as well as many others.
Where does this water come from? It is in the ambient air! When compressing air the air acts like a sponge and the water vapour present in the ambient air will be squeezed out. On a normal summer day at 27°C ambient, a fully loaded 55kW compressor will produce about 85 litres of condensed water in an 8 hour shift.

Effects of the Moisture contents:

Depending on the applications, different compressed air qualities need to be achieved (including specific requirements on moisture levels, as well as oil vapour and particle contamination). For each process a certain dryness of the air (measured in dew point temperature °Cptd) guarantees a failure-free functioning of the whole system. These dew point temperatures are critical and should be monitored regularly or even continuously.
Most compressed air lines are made from steel or non zinc-coated steel. Corrosion in those pipe materials progresses rapidly if relative humidity levels of 50% are exceeded. Continuous high moisture levels will result in rust particles forming and gradually moving downstream to the pneumatic components at machine level. This can lead to blocked nozzles, defective control elements, production stops and even contaminated products.
Expensive repairs, frequent pneumatic component replacements, and short maintenance intervals are an unavoidable result of high moisture levels in compressed air systems.
In addition to problems with corrosion and the described results the moisture content has a direct influence on the quality of the produced goods.

The following lists the most occurring problems:

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Recommended compressed air qualities

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

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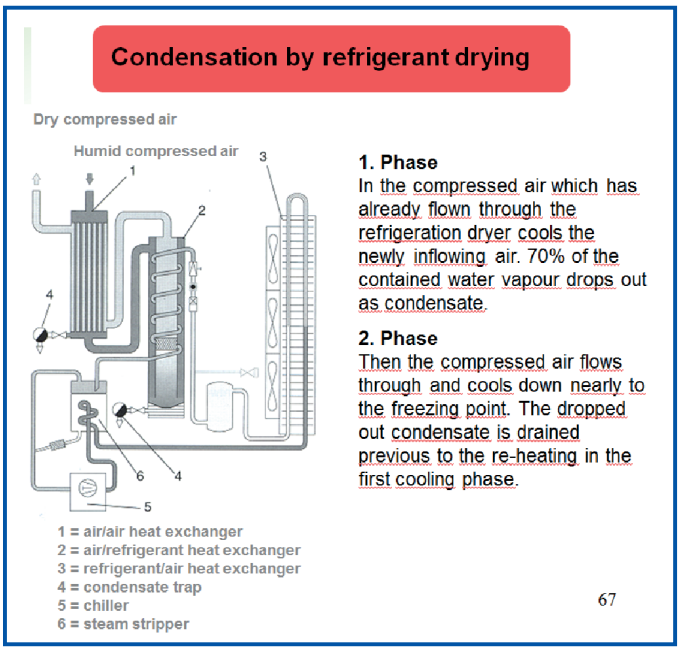
- Hygroscopic products (e.g. tablets, spices, sugars, certain plastics) agglutinating during transportation through the pneumatic conveying system and clogging up the system
- Bubbles occur during varnishing and coating processes
- Drilled holes may get blocked due to dust which is carried along
- Food products get contaminated with a mixture of water, oil, particles and micro-organisms

Dew Point

Tasks of dryers

Different types of dryers are used in order to achieve different levels of dryness. In compressed air technology the pressure dew point is the parameter for indicating the dryness of the 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 point at 100% relative humidity). The lower the pressure dew point temperature the smaller is the amount of water vapour contained in the compressed air.
The simplest dryers are refrigeration dryers which cool the discharge air down to about 3-5°Cptd and then remove the condensed water from the system.

There are different types of compressed air dryers; refrigeration dryers or adsorption dryers are the most commonly used. Refrigeration dryers cool down the compressed air to approximately 3 to 5°C. In this case the pressure dew point is also 3 to 5 °Cptd. 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 bigger plants to monitor particularly important applications.
However, it is not sufficient if only the cooling temperature is indicated. The following failures may lead to an elevated pressure dew point even if the cooling temperature seems to be alright:



- Condensate in the refrigeration dryer, is not drained off (condensate drain defective, stuck, or soiled)

- Compressed air bypass in the refrigeration dryer (heat exchanger pipes worn out, corroded or leaking),
- Compressed air is bypassing the dryer (wet compressed air passes through the bypass instead of passing through the dryer)

- Condensate overload of the refrigeration dryer,before a dessicant dryer due to poor condensate pre-separation at the after cooler of the compressor

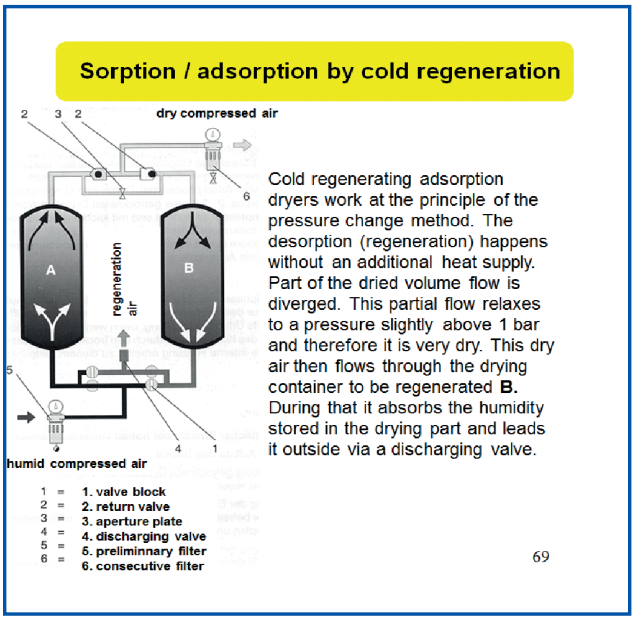
- Wrongly sized refridgeration dryer (not taking correction factors for worst case scenario conditions into consideration)

If the refrigeration dryer fails it inevitably will lead to considerable problems with condensate in the compressed air system. It is especially problematic if the condensate can accumulate in blind lines and does not drain automatically. Once accumulated in the compressed air system, condensate can only be removed with considerable efforts or dried and drained by using an extremely large amount of compressed air which is very costly and time consuming.
Not monitoring the actual dew point temperature after the dryer often leads to increased dew point values at very low consumptions without any evident or visible problems of the refrigeration dryer. In this case the moisture or condensate problem will only be picked up once it reaches the pneumatic components at machine level, hence after contaminating the whole system with moisture and condensate.

Dew Point

Desiccant dryers for typical dew points of -40ºCptd

The functioning of a desiccant dryer is based on the hygroscopic nature of the desiccant material. Water vapour is bound (adsorbed) at the surface of a desiccant. Effective desiccant dryers are able to dry compressed air down to a dew point of -40°Cptd and lower.
Regenerative desiccant dryers exist of two vessels which are filled with desiccant. During operation one vessels desiccant is being regenerated (dried out again) with either cold or warm dried compressed air while the other vessel dries the process 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:

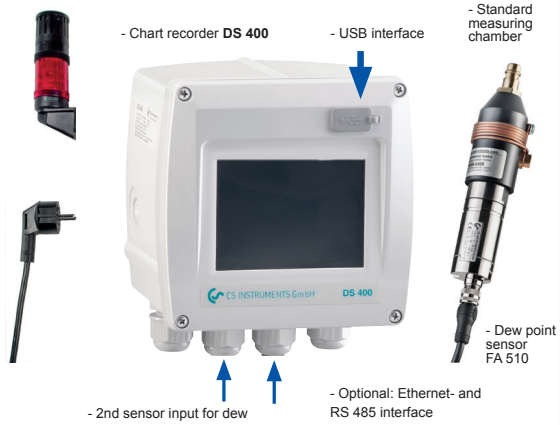


- Condensate in the refrigeration dryer,before a desiccant dryer is not drained off (condensate drain defective, stuck, or soiled)
- Compressed air bypass in the refrigeration dryer (heat exchanger pipes worn out, corroded or leaking),before a desiccant dryer
- Compressed air is bypassing the dryer (wet compressed air passes through the bypass instead of passing through the dryer)
- Condensate overload of the refrigeration dryer,before a desiccant dryer due to poor condensate pre-separation at the after cooler of the compressor

It is vital to monitor the performance of one of the most important components in a compressed air system, the dryer!
Please have a look at the CS Instruments product range to perform this important task!

Dew Point Set DS 400

consisting of:
- Option alarm unit (buzzer and continuous red light)
- Chart recorder **DS 400**
- USB interface
- Standard measuring chamber
- Dew point sensor FA 510
- 2nd sensor input for dew point or consumption sensor
- Optional: Ethernet- and RS 485 interface



Description	Order No.
Dew point set DS400 for desiccant driers (-80...20° Ctd.)	**0601 0510**
Dew point set DS400 for refrigeration driers (-20...+50°Ctd)	**0601 0512**
Options	
Option: Integrated data logger for 100 million measured values	Z500 4002
Option: Integrated Ethernet and RS 485 interface	Z500 4004
Option: Integrated webserver	Z500 4005
Option: 2 additional sensor inputs for analogue sensors (pressure sensor, temperature sensor and so on)	Z500 4001
Further accessories	
CS Soft Basic - data evaluation in graphic and table form - reading out of the measured data via USB or Ethernet	0554 7040
Alarm unit mounted at wall housing	Z500 0003
Alarm unit for external mounting with 5 m cable	Z500 0004
Calibration	
Precision calibration at -40 °Ctd or +3 °Ctd including ISO certificate	0699 3396

Dew Point

FA 500 Dew Point Sensor

Dew point sensor FA 500 from -80 to 20°Ctd

FA 500 is the ideal dew point measuring instrument with integrated display and alarm relay for refrigeration, membrane and desiccant driers.

Description	Order No.
FA 500 dew point sensor for refrigeration driers, -20...50 °Ctd	0699 0501
FA 500 dew point sensor for desiccant driers, -80...20 °Ctd	0699 0502
FA 500 dew point sensor, -60...30 °Ctd	0699 0503
Connection cables:	
Connection cable, 5 m	0553 0104
Connection cable, 10 m	0553 0105
Alarm cable, length: 5 m	0553 0106
Alarm cable, length: 10 m	0553 0107
Options for FA 500:	
Option max. pressure FA5xx 350 bar	Z699 0515
Option max. pressure FA5xx 500 bar	Z699 0516
Option special scaling FA5xx 4…20 mA=__ … __ g/m³, ppm etc.	Z699 0514
Option connection thread FA5xx, 5/8“ UNF	Z699 0511
Option connection thread FA5xx, 1/2“ NPT	Z699 0512
Option surface condition FA5xx, free of oil & grease	Z699 0517
Additional accessories:	
Standard measuring chamber up to 16 bar	0699 3390
High pressure measuring chamber up to 350 bar	0699 3590
CS Service Software for FA/VA sensors incl. PC connection set, USB connection and interface adapter to the sensor	0554 2007
Mains unit in wall housing 100-240 V, 10 VA, 50-60 Hz/24 VDC, 0.35 A	0554 0108
Power supply 100-240 VAC/24 VDC, 0.35 A for FA/VA series, 2 m cable	0554 0107
Calibration:	
Precision calibration at -40°Ctd or +3°Ctd including ISO certificate	0699 3396

DP 500 / DP 510

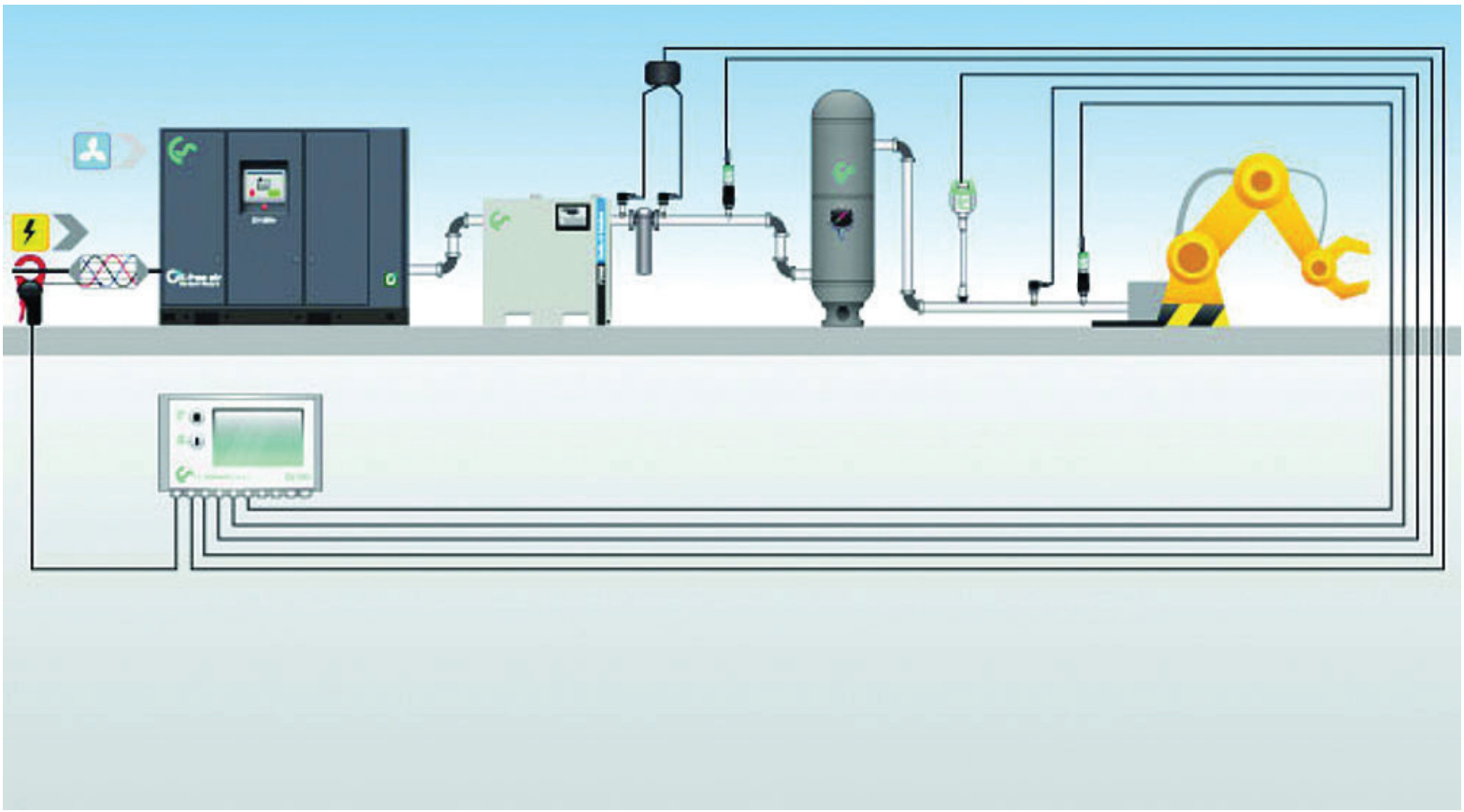
Application ranges:

- Compressed air: Examination of refrigeration, membrane, desiccant driers
- Technical gases: Residual moisture measurement in gases like N2, O2 and so on
- Plastics industry: Examination of granulate driers
- Medical compressed air/breathing air

2nd freely assignable sensor input for third-party sensors (only DP 510)

Description	Order No.
Set DP 500 in a case - consisting of:	0600 0500
Portable dew point meter DP 500 for compressed air and gases	0560 0500
Mobile measuring chamber up to 16 bar	0699 4490
Diffusion-tight PTFE hose with quick connector, length 1 m	0554 0003
Power supply for DP 500/510	0554 0009
Control and calibration set 11.3 % RH	0554 0002
Quick-lock coupling	0530 1101
Dry container for CS dew point sensors	0699 2500
Transportation case (small) for DP 500	0554 6500
Further options, not included in the set	
CS Soft Basic - data evaluation in graphic and table form- reading out of the measured data of DP 500/510 via USB	0554 7040
Precision calibration at -40°Ctd or 3°Ctd with ISO certificate	0699 3396
Additional calibration point freely selectable in the range between -80...+20°Ctd	0700 7710
High pressure measuring chamber up to 350 bar	0699 3590
Measuring chamber for atmospheric dew point	0699 3690
Measuring chamber for granulate diers with minimum overpressure	0699 3490
Measuring chamber for respiratory air bottles up to 350 bar	0699 3790
Portable dew point meter DP 500 for compressed air and gases (high pressure version up to 350 bar)	0560 0501

Dew Point



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