Fact sheet

Water and humidity in compressed air

The ambient air taken in by compressed air systems generally contains a lot of water vapour. As the air is compressed, its temperature rises. Subsequent cooling leads to saturation of the compressed air so that the water vapour contained in the air condensates in the form of liquid water.

Water entering compressed air system in litres per day (24h) at an atmospheric air intake of 1000 m³/h (1 bar, a)														
Tempe-rature	**Max. humidity**		**Water content** at relative humidity of											
			50%		60%		70%		80%		90%		100%	
10°C	9.356	g/m³	112	litres	135	litres	157	litres	180	litres	202	litres	225	litres
20°C	17.148	g/m³	206	litres	247	litres	288	litres	329	litres	370	litres	412	litres
30°C	30.078	g/m³	361	litres	433	litres	505	litres	577	litres	650	litres	722	litres
40°C	50.672	g/m³	608	litres	730	litres	851	litres	973	litres	1095	litres	1216	litres
50°C	82.257	g/m³	987	litres	1185	litres	1382	litres	1579	litres	1777	litres	1974	litres

Damage caused by humidity

At a relative humidity of 65%, rust and corrosion are not the only problems, as micro-organisms begin to spread.

The pressure dew point (in °C) is a measure of the humidity of compressed air. If the compressed air temperature is above the pressure dew point, there is no condensation. If air temperature drops below that threshold, condensation occurs, so that the compressed air now contains liquid water, which might even freeze. When the ice thaws, it might cause a water hammer.

Dehumidifying compressed air

As a minimum requirement for a compressed air system, the pressure dew point should be 10°C below the lowest expected ambient temperature. Where the system is operated in a heated room at 15 to 20°C, this can normally be achieved by installing a refrigeration dryer, as such dryers can keep the pressure dew point as low as 3°C.

To meet the specific processing requirements for the production of drugs and foodstuff, operators however need lower pressure dew points. Where large volume flows are involved, the most efficient solution are adsorption dryers able to achieve pressure dew points of -20 to -70°C. Their efficiency reduces the relative humidity in the system to residual levels well below 65%, preventing the growth of micro-organisms.

In systems where only certain consumption points need to be supplied with high-quality compressed air, the most energy-efficient option is the installation of refrigeration dryers at the main compressed air station, combined with membrane dryers right at the draw-off points that require lower humidity levels.

Recommendation

The higher the temperature, the greater the capacity of air to retain water vapour. Cooling the compressed air station is therefore a key issue. In order to prevent warm exhaust air from mixing with cool intake air, we recommend physically separating the two air flows, for example by installing separate intake and exhaust air channels. In systems with high compressor performance, which tend to lead to high temperatures inside and around the compressor, water-cooled components might be a suitable option.

As a rule, compressed air should only be dried to the level required by the actual application.