Filter factors

Pneumatic systems need to operate reliably, even in extreme conditions. John Hill examines the requirements, in terms of components, filters and maintenance

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However extreme the conditions, pneumatic systems today are expected to function reliably – and that is as true of mobile plant as it is of fixed installations.

To that end, equipment designers have developed components capable of operating with previously unattainable levels of performance. Materials include corrosion resistant aluminium alloys, stainless steels and techno-polymers. The units themselves have been simplified, with fewer moving parts. Sensitivity to dirt and contamination has been reduced by carefully mapping flow paths. And parts are now designed for easy maintenance.

But no matter how tolerant valves and cylinders may be of corrosion, metal, dirt, moisture and even microbial growths in the air supply downstream of the compressor, allowing these to persist will eventually affect both the reliability and longevity of pneumatic circuits. Removal technologies remain essential at key points throughout each installation.

Airline filters or water separators are often used as general purpose pre-filters, with, for example, water separators removing in excess of 92% of all bulk liquid contamination, including oils and corrosive chemicals. Then coalescing filters are probably the single most important purification equipment type, not only removing fine droplets of oil and water, but also stopping particulates down to 0.01micron.

Vexing vapour

But these don't stop water vapour and, even at moderate temperatures, unless moisture is removed from the air flow, it may condense as liquid in air lines, and even wash away cylinder and valve lubricants. Further, if the ambient temperature drops below freezing, ice can form in air lines and on the internal surfaces of components.

Hence the requirement for air dryers, such as refrigerant dryers and desiccant or adsorption dryers, which pass air over material that absorbs liquid from the compressed air system.

The latter are normally best for low temperature operation and are available in compact designs. Some make use of conventional steel pressure vessels, while others harness extruded aluminium pressure vessels. They can also be installed in single- or twin-tower configurations – and there are important differences, in terms of cost and maintenance, that determine which is appropriate for any application.

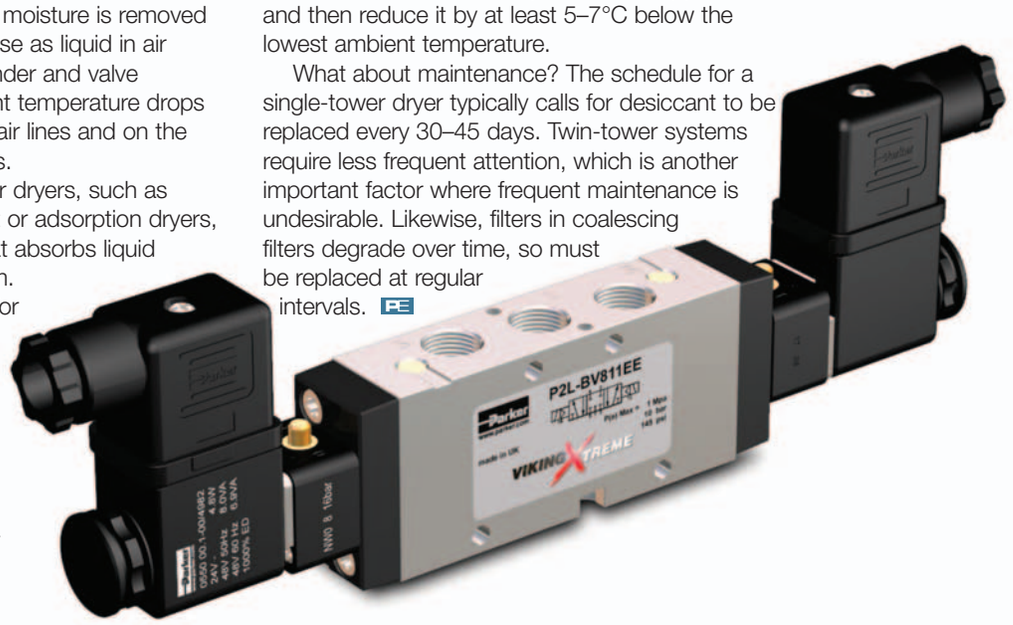
Both operate on the same principle of cyclical adsorption and desorption of water vapour. However, a twin-tower dryer provides a continuous stream of dry air, because, as the air is dried in one tower, desiccant is regenerated in the other – with a bleed of dry air being expanded across a purge orifice and the cycle switching every few minutes.

In a single-tower design, dry air to the application is stored in a receiver, downstream of the dryer. This tank must be sized to maintain the air system, with an additional volume for purge air. Then, when the desiccant bed is ready for regeneration, the compressor is unloaded and the bed depressurised. Purge air is then expanded across a purge orifice and counter-flowed through the desiccant in a short cycle, with purges roughly every 90 seconds.

Purge air requirements for twin-tower dryers are typically 15% of rated inlet flow, while those for single-tower dryers can be 15–25%. Single tower dryers are best where space is at a premium. They are also around half the price of twin tower models, although operating life is much shorter.

Either way, dew point suppression is the key measure of performance – more important than the air temperature rating. That is because, for every 7°C increase in temperature, air's ability to contain water vapour doubles. So, when choosing a dryer, you need to establish the dew point for the application and then reduce it by at least 5–7°C below the lowest ambient temperature.

What about maintenance? The schedule for a single-tower dryer typically calls for desiccant to be replaced every 30–45 days. Twin-tower systems require less frequent attention, which is another important factor where frequent maintenance is undesirable. Likewise, filters in coalescing filters degrade over time, so must be replaced at regular intervals. PE



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