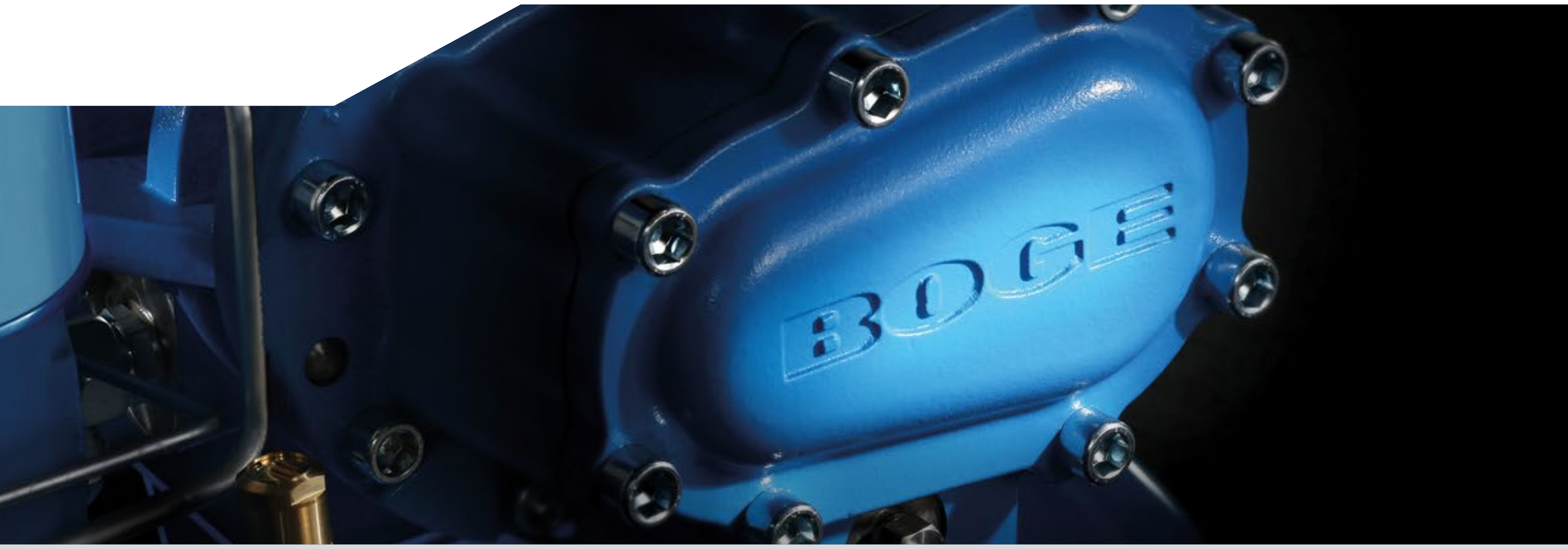
BOGE COMPRESSED AIR SYSTEMS

How to keep your compressed air supply clean and pure



Although they may actually be too small to see, there are many unwanted substances and particles in our atmosphere that can penetrate into pneumatic systems powered by compressed air, which can adversely impact the integrity, purity and functionality of these devices. These include dust, pollen, moisture and compressor oil, which can all have an adverse effect on compressed air quality.

With so many potential contaminants in the atmosphere, as well as those that may be physically injected into the system either by the compressor or by human error, contamination of some description is hard to avoid. So how do contaminants manage to seep through, what can be done to prevent the problem or remove them before any long-term damage is caused and what are the consequences when they are ignored or dealt with inadequately?

The biggest contamination threat to any compressed air system is an airborne one. Our atmosphere is rich with suspended particles of dust, grit and pollen which in itself is an accepted environmental factor.

In a factory however, where product and manufacturing by-products and dust are denser and can be in more plentiful supply, there is an average of 140 million particles per cubic metre of air[1].

Although up to half of these may be less than 2mm in size, and dry particulate matter at low concentrations may not cause an impurity issue, it does become a problem when it merges with moist compressor oil or other lubricants and starts to congeal. The result of this mixture is that this coagulated blend will accumulate and adhere to stationary and moving surfaces inside a pneumatic device. And then? Valves stick and seals and parts wear, leading to costly machine failure and downtime.

It's not just dry or airborne substances that can interfere with the smooth running and purity of compressed air devices. Water vapour, which naturally occurs in air, will condense when the warm air emitted from a compressor comes into contact with the comparatively cold surfaces of downstream equipment. Drains fitted to a compressor can remove condensate, but this will not effectively break down moisture suspended in the air flow. The collateral damage from this is far-reaching.

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A moisture build up over time breaks down lubricating oil, creating corrosion on exposed metal surfaces – which will break off, leading to problems elsewhere in the system and increase the friction between moving parts.

The third common contaminant in the air supply is compressor oil. Although it may not naturally be associated with airborne contamination, compressor oil becomes a potential threat to purity when emitted as an oil vapour. This can condense as a film within valves and cylinders, collecting dirt and grit on its journey, which can damage the surface of moving parts. Furthermore, oil that travels from an air compressor into a system becomes oxidised and degraded once it has been subjected to the heat of compression. The substance produced is usually acidic and can appear as a varnish-like substance that possesses properties completely opposed to lubrication.

One part that often experiences the greatest impact by compressor oil are valve seals, as it causes the Acrylonitrile butadiene rubber used within the O-ring and bonded spool devices to expand, meaning that the valve can eventually become stuck in one position.

Further difficulties can be caused by chemical substances, which may be sucked in from the air supply into the compressor. Without treatment or sufficient filtration, these will attack rubber, seals and gaskets, leading to the steady decline in operating efficiency.

The fallout from contamination in food processing

Compressed air is used across many processes and stages of food processing; thus making it a

particularly interesting sector when considering the consequences of contamination.

If contaminated air does come into contact with a food product, it can affect and alter taste, appearance, colour and shelf life, as well as compromising hygiene standards. The combination of dirt, particles and micro-organisms being pulled in, alongside the oils and liquids that can seep through worn seals and O-rings, make food processing extremely susceptible to impurities. As well as the threat of rust breaking off and getting into the food processing cycle, water condensate must be taken into account as it can create exactly the right conditions for mould, bacteria growth and spores. Exposing customers to any of these could have major repercussions to the company's reputation, in addition to the health implications.

In order to avoid such situations, the majority of food processing firms are keeping to the rules of Hazard Analysis and Critical Control Points (HAACP)[2] as well as undertaking risk analysis, but this doesn't always extend to the inner workings of a compressed air

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system. Therefore, most companies specify their own compressed air standard, which is most commonly aligned with ISO8573.1-2010, section 6[3], which covers and advises on what is: direct contact with food, indirect contact with food, or non-contact, high risk, and finally, non-contact, no risk.

So what needs to be put in place in order to break down or remove all of the contaminants?

Building a defence system

The best protection from contaminants is one that prevents them from getting through, such as filtration. While a fitted filter attached to the compressor intake may be adequate to catch and remove larger elements, a more robust solution is required in order to remove contaminants under 2-5 microns, as well as water vapour and excess compressor oil that has found its way in.

A higher level of defence is the installation of separate preventative and control measures located downstream of the actual compressor, which include filtration, drying, pressure regulation and where necessary, lubrication.

Filtering out the fragments and fluids

The standard mechanism for filtration works by directing air at high speed over a slatted deflector plate, which creates a vortex that spins both solid particles and moisture droplets away from the air stream, while any liquid or solid matter in solution is collected in the filter base and drained away.

When dealing with smaller particles such as oil mist that tend to be below 0.5 microns, there is a need for a secondary filter. Made from a fine stainless steel mesh, the multiple layers of filter tissue combined

with absorbent gauze catch the particles, which form a film on the filter, rather than penetrate the machine. Filtration is effective for ensuring air supply remains pure, and depending on the material used and number of layers, it can trap and remove particles as small as 0.01 micron, which encompasses 99.99 per cent of contaminants.

Drying and absorbing moisture

Although the majority of air compressors are supplied with an after-cooler, removing most of the condensation caused by compression and reducing air temperature to within 10-15 degrees C of ambient temperature, an additional adsorption dryer is often required to combat excess water vapour. The circumstances for this are commonly if parts of the pneumatic system are exposed to areas where temperatures fluctuate, such as where pipes run along outside walls.

The adsorption dryer works by forcing the moist air through a drying agent such as dehydrated chalk or magnesium, lithium or calcium chloride, creating a solution which can then be drained away.

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Whereas this method requires a drying agent, there is also the regenerative type of adsorption dryer that adsorbs moisture into a material such as silica gel or activated alumina. These adsorbent materials do not undergo any type of chemical reaction as the moisture is instead bound to the drying agent by adhesive force, also referred to as unbalanced molecular attraction.

Whatever drying method is decided upon, whether its refrigeration or adsorption for example, it needs to be used in tandem with fine micro-filters which will ensure that any fine impurities are blocked from entering a pneumatic system in fine mist form.

While adding further filtration to combat the onslaught of contaminants is a chief consideration, there are a number of other areas to keep in mind. Not only do filters need to be regularly checked and replaced where necessary, but operators need to keep an eye on pressure and lubrication levels. If either of these are overlooked, then the possibility of filters or dryers not performing their job becomes heightened.

It's also vital to consider that when it comes to filters on any pneumatic device, size really does matter. Using the wrong specification means that particles cannot be collected and the chances of mechanical breakdown or contaminants seeping through, start to increase.

Finally, before opting for or installing any filtration or drying process, it's recommended that every consideration is made regarding the specific application and demands of the overall pneumatic system. This, together with whether the contaminants are airborne, moisture or oil-based, will ensure that the solution matches the specific contamination requirement.

To find out more about BOGE Compressors and specialist gas generators, please contact us or visit our website:

www.boge.com/uk

References

1 - The Pneu Book, page 24 (SMC Pneumatics Ltd)

2 - Food Standards Agency http://www.food.gov.uk/business-industry/caterers/haccp

3 - http://www.iso.org/iso/catalogue_detail.htm?csnumber=46418

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