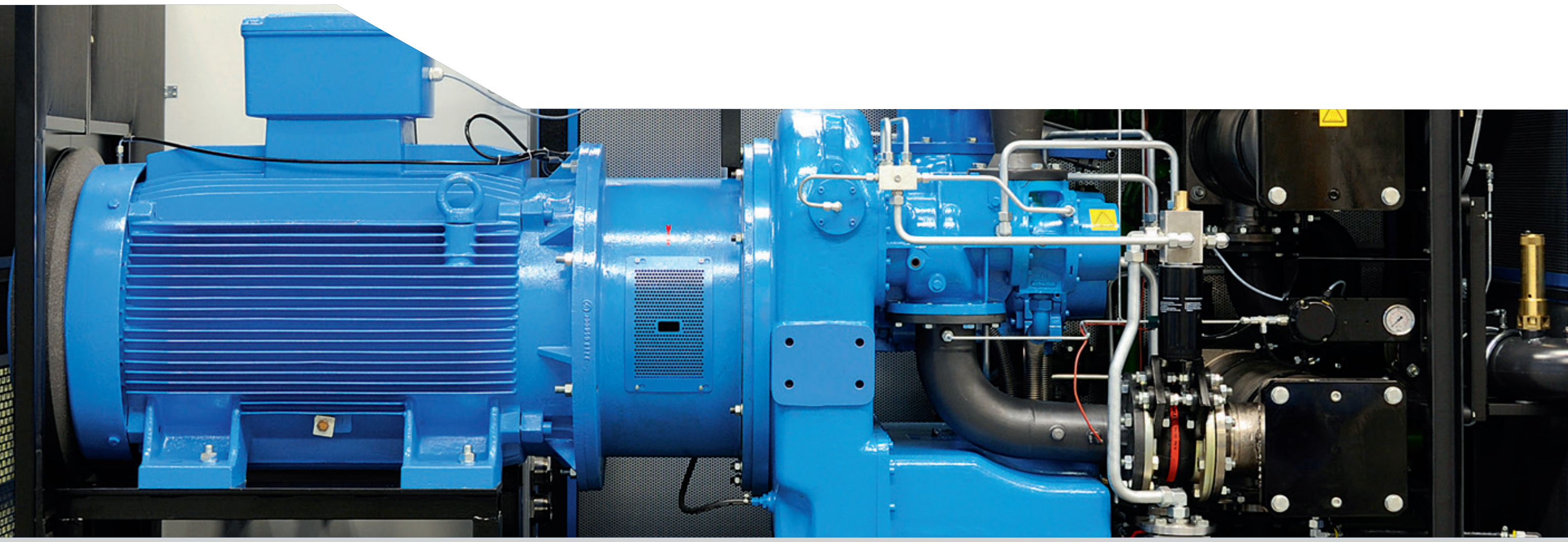
BOGE AIR. THE AIR TO WORK.

BOGE COMPRESSED AIR SYSTEMS

Satisfying the appetite for clean air



Compressed air is a critical utility in food and drink factories and processing plants. This white paper examines best practice guidance from the British Compressed Air Society (BCAS) and elsewhere for compressed air use in food and beverage manufacturing applications.

Food and drink is big business – indeed, it is the single largest manufacturing industry in the UK, with a turnover of £95.4 billion, according to consultancy BDO. The government estimates the value of food and drink exports in 2015 at £18bn, and total consumer expenditure on food, drink and catering in 2014 was £198bn.

Unsurprisingly, given the potentially devastating impact on human health of food and drink contamination, the sector is tightly controlled and heavily legislated. Nowhere is this more evident than in the area of compressed air. This ubiquitous presence in the food and beverage sector is used in a host of process applications including product handling, cooling and freezing, labelling, cutting and peeling food, bottle filling and packaging.

If contaminated air comes into contact with a food product, it can affect its taste, appearance, colour and shelf life, as well as compromising hygiene standards. Indeed, it can render products entirely unfit for consumption, leading to expensive recalls, damage to the company's reputation and sales, as well as resulting in costly compensation claims from consumer protection bodies.

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It can also have far more serious consequences that impact on consumers' welfare and wellbeing. For example, microorganisms and dirt can be pulled into the compressed air system along with oil and liquids that can seep through worn seals. The resulting contamination can lead to significant consumer health problems. Meanwhile, lower productivity, higher operating costs and potential legal action can result if shop-floor workers become ill as a result of contamination caused by poorly managed compressed air.

Finally, compressed air contamination increases maintenance and operating costs as moisture and dirt will lead to corrosion and wear on internal moving surfaces in cylinders and valves. Most food processing firms follow a quality control plan called Hazard Analysis and Critical Control Points (HACCP). HACCP is a systematic approach to food safety designed to prevent biological, chemical, and physical hazards in production processes that can cause the finished product to be unsafe.

So, for example, it helps food businesses examine how they handle food as well as introducing procedures to make sure the food produced is safe to eat. An effective way to mitigate risks is to use an HACCP 'prerequisite programme' (the processes and hardware that work alongside the HACCP system to provide the basic environmental and operating conditions essential for safe food production), which supports 'critical control points' (points, steps or procedures at which controls can be applied and a food safety hazard can be prevented, eliminated or reduced to acceptable levels).

The majority of food companies also specify their own standard, which is commonly aligned with the international standard ISO 8573. However, ISO 8573 is a general standard covering a range of contaminants and air purity classifications; it makes no specific recommendations about food industry compressed air purity.

Compressed air treatment

There are several potential sources of contamination in compressed air, including:

- Atmospheric air: If not treated, this air – when used for compression – can introduce contaminants like water vapour, airborne dirt, unburnt hydrocarbons, pollen and microorganisms into the compressed air distribution system.
- Air compressor: Compressors can add wear particles and oil lubricated compressors will introduce small amounts of oil used in the compression stage of the machine. The oil will be in the form of liquid, aerosol, vapour, and hydrocarbon oxidation particulates. After the compression stage, the after-cooler will cool the air, condensing water vapour and introducing it into the compressed air as liquid water and water aerosols.
- Air receiver and distribution piping: The air receiver and system piping that distribute the compressed air around the facility can store contaminants emanating from the compressor. Additionally, they cool the warm saturated compressed air which causes further condensation, adding more liquid water into the system, promoting corrosion and potential microbiological growth. Corrosion products, such as rust and pipe-scale, along with any microbial agents are then carried within the flow of compressed air.

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Voluntary code of practice

As a result, in 2007, the British Compressed Air Society and the British Retail Consortium produced a voluntary code of practice called Food Grade Compressed Air, the latest revision of which is BCAS Food Grade Compressed Air Best Practice Guideline 102, first published in July 2013. This document includes information on what type of compressed air equipment can be used, how it should be installed, maintained and audited and, perhaps most importantly, recommends the levels of air purity required to reduce the risk of contamination from dirt, water, microorganisms and oil.

The overarching aim of the guide is to help food and beverage processors use compressed air as safely and efficiently as possible, protecting them, their employees and consumers. Contaminants can exist in one of three forms – solid, liquid or gas – with each form influencing the others. So, for example, solid particulates agglomerate in the presence of oil or water to form larger particles; and oil and water can form an emulsion or condense (maybe producing oil or water vapour) inside the pipework of compressed air systems.

Solid contaminants come from sources including dust particles in the surrounding atmosphere drawn in by the compressor air intake, or by abrasion or corrosion within the compressed air system itself. They can range from large, granular to small submicron-sized particles.

Liquid contaminants formed within the compressed air system are mainly water and compressor lubricant/coolant although other liquid contaminants can be drawn into the compressor air intake from the surrounding atmosphere.

The liquid concentration depends on temperature and pressure. Liquids can be present as a result of the condensation of vapours and their concentration can range from high concentrations of liquid wall flow to droplets and small submicron-sized aerosols.

Liquid contaminants, particularly water, can cause corrosion in the compressed air distribution system, corroding components and generating other contaminants such as rust. Liquid contaminants generated from compressor lubricants/coolants should not have a negative impact on seals and non-ferrous piping, including aluminium and plastic.

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Gaseous contaminants generally comprise water vapour and compressor lubricant/coolant vapour, the concentration of which depends on the temperature and the pressure of the gas. Like liquid contamination, other gaseous contaminants can be present as they are drawn into the compressor air intake from the surrounding atmosphere. Gaseous contaminants can dissolve in any liquids present, or can themselves condense into liquid form through temperature reduction or increasing pressure.

The compressed air strategy outlined in the BCAS Best Practice Guideline 102 essentially calls for three things:

- Identify areas where compressed air is involved with food/beverages.
- Recognise contaminants that might adversely affect food/beverages.
- Establish whether the involvement with compressed air is direct or indirect.

Creating contamination-free air

BOGE offers a selection of oil-free air compressors that are ideal for the food and drink processing and packaging sector, because the complete absence of oil in the machine guarantees uncontaminated compressed air.

SO series:
The SO series of screw compressors features an intelligent design, innovative functional principle and high quality workmanship to ensure the reliable, safe and highly efficient production of oil-free compressed air. All component parts are easily accessible, which facilitates prompt and hassle free maintenance, and the use of high quality materials and reduced number of wear parts make the BOGE oil-free screw compressors as efficient and reliable as any demanding customer would expect.

HST:
BOGE's new High Speed Turbo (HST) compressors are designed so that the entire drive mechanism operates without any lubricants at all – giving users total confidence that compressed air is 100% oil-free. In addition to this, its low-maintenance and compact design, minimal energy use and reduced noise emissions make it one of the most innovative and effective compressors available to food and drink manufacturers.

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Best practice

To mitigate the impact of contaminants, Best Practice Guideline 102 recommends removing contaminants from compressed air as close to the point of use as is practicable. There are several ways to achieve this.

Liquids, aerosols and vapours

For liquids, aerosols and vapours, they include:

- Water separators – which provide bulk condensed water and liquid oil removal and are used to protect coalescing filters against bulk liquid contamination.
- Coalescing filters – used to remove water or oil in a compressed air system that is in the form of an aerosol. The aerosols, which are in the form of small droplets, are brought together by coalescing filter media to form larger droplets that are then deposited at the bottom of the coalescing filter bowl.
- Drying – Compressing air artificially raises the level of water either as vapour or aerosol until it becomes fully saturated, and condensation forms in the distribution system and ancillary equipment. Low humidity levels in compressed air can't be achieved with coalescing style filters alone. However, reductions in humidity can be achieved in different ways, for example, pressure over generation; refrigeration; membrane, and adsorption (or desiccant) dryers. Reducing water in compressed air also deals with microbiological contaminants like bacteria. Typically, absorption dryers provide the highest levels of compressed air dryness. They are not, however, a replacement for air sterilisation filters, which remove microorganisms and other toxins such as viruses and bacteria phage.

Condensate

For condensate, Best Practice Guideline 102 recommends regular draining and disposing of dissolved and emulsified contaminants from the compressed air. Solids, including dry particulates, are typically dealt with by dust removal filters. They generally have equivalent particulate removal performance to that of the coalescing filter and would use the same mechanical filtration techniques.

Indeed, filtration is the method of choice to sterilise compressed air which is used in food and beverage production processes. Absolute-rated, steam-sterilisable, PTFE or borosilicate filter cartridges are commonly used. The hydrophobic nature of PTFE and borosilicate prevents wetting thereby maximising microbial retentiveness during gas filtration.

Solids

Absolute removal of solid particulates and microorganisms is performed by a sieve retention or membrane filter. They are often referred to as sterile air filters as they also provide sterilised compressed air. Filter housings are manufactured from stainless steel where in-situ steam sterilisation of the filter housing, element and downstream pipework is required.

The piping between the sterile filter and the application must also be regularly cleaned and sterilised.

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Compressed air in action

The Black Sheep Brewery produces keg and bottled beer in its traditional brewery in Masham, North Yorkshire. Compressed air is used in various phases of the brewing process. When the brewery started to plan the expansion of its keg filling system, it was already using two BOGE SD15 screw compressors to operate the machinery and valves.

Since he was happy with this arrangement, master brewer Alan Dunn decided that a new keg filling system should also be equipped with BOGE compressors. BOGE recommended the SD 40 screw compressor with a built-in refrigerant dryer to minimise space requirements and save on the installation and assembly costs of fitting a separate dryer.

Meanwhile, Thatchers is a cider maker with more than 100 years' experience operating in Sandford, Winscombe, near Bristol. Growth in demand for its products has prompted the business to invest in the Jubilee building project, which will allow Thatchers to increase annual production from 52 million litres of cider to more than 100 million litres.

BOGE Platinum Partner Direct Air & Pipework supplied a BOGE SLF51 air compressor and downstream equipment to handle the varying demands of the new Jubilee building, which will contain the kegging facility, an additional bottling line and a new canning line.

The BOGE SLF51 air compressor has a specially designed airend providing high output volumes at low energy consumption allowing for reliable and energy efficient compressed air supply. A tighter/reduced system pressure virtually eliminates off load running, which in turn reduces start-up current peaks, that contributes to potential energy savings of up to 40%.

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

www.boge.com/uk