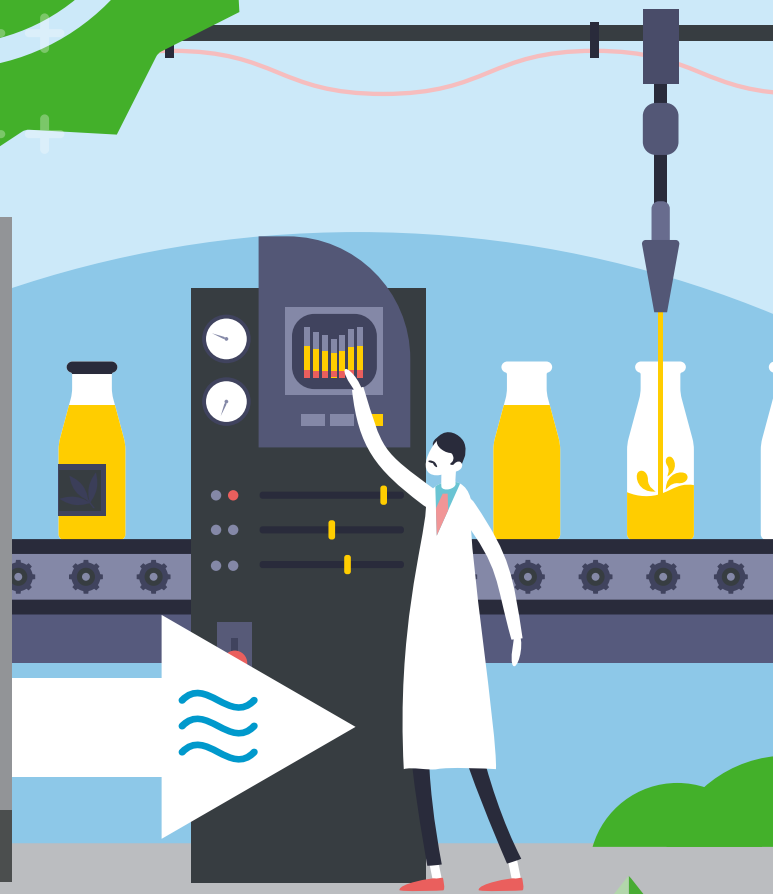
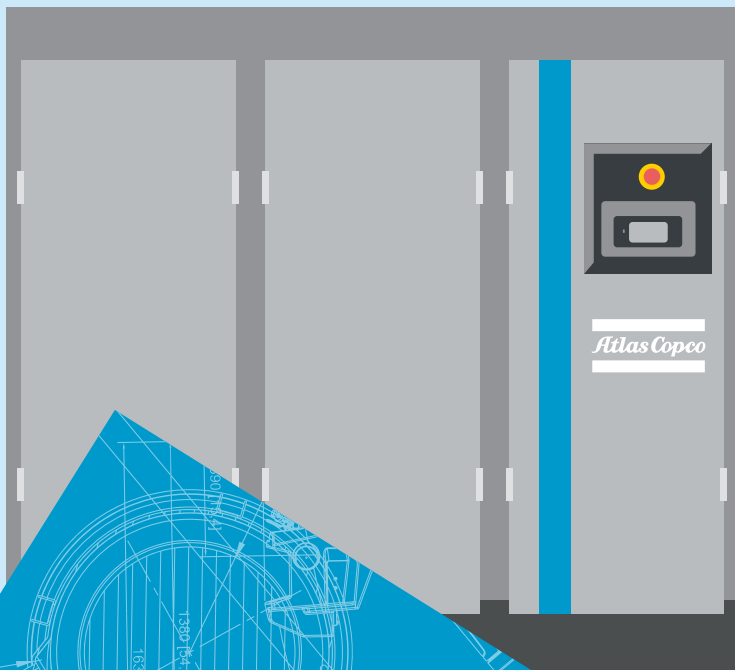


Atlas Copco



The Ultimate Guide to Oil-Free Compressed Air

GUIDE

How to produce oil-free air for controlled manufacturing environments

If you work in a sensitive manufacturing environment where no compromises can be made, you probably already know a little about oil-free compressed air. But how do you **guarantee 100% oil-free air** and what are the risks of not taking this route? The answers are in this essential guide.

Section 1: Introducing oil-free air compressors

In some production environments, maintaining the highest levels of air purity is a critical consideration. From semiconductor and electronics manufacturing to medical and food and beverage, any traces of oil in the air can lead to costly production downtime, product spoilage, and reputational damage.

Many manufacturers in such sectors choose to install oil-free air compressors to ensure that the risk of such incidents is almost eliminated. These state-of-the-art systems produce the highest quality class zero air. Oil-free compressors can also eliminate the need for additional ancillary filtration equipment, – by reducing replacement filter element costs and operational pressure drops, which means they can deliver significant savings in lifecycle costs.

But selecting the most suitable oil-free compressor can be a daunting task. There is, for instance, an important distinction to be made between 'Class 0' oil-free compressors which guarantee absolutely no oil contamination of air, and so-called 'technically oil-free' where oil as a contaminant is introduced to the compressed air system and needs to be filtered out and removed downstream of the compressor.

This e-Book explains the basics of oil-free compressed air, providing an explanation of the different sorts of categorisation, and explaining which type of technology is most suitable for the set of circumstances at hand. It considers maintenance advantages and energy savings associated with oil-free air compressors, while providing best practice examples of real-world application.



Section 2: The risks associated with oil-in-air contamination

In most manufacturing facilities and workshops, tiny traces of oil contamination in the air represent no cause for concern.

In such instances, oil-injected screw or vane compressors are the most suitable and cost-effective solution. Indeed, even if there are traces of oil, the air can be further cleaned up - if need be - through the application of coalescing and carbon-activated filters, plus carbon towers,

However, oil contamination simply cannot be risked in specific applications, and having an oil-free compressor is a must.

Take the crucial semiconductor manufacturing industry as an example. We are all aware by now of the knock-on effects that problems with semiconductor manufacturing can have on the wider world. In this sector, oil contamination would represent a 'game over' scenario, resulting in the spoilage of the high-value

batch of computer chips being processed. Furthermore, the highly-tuned machinery used to manufacture the chips would then need to be thoroughly cleaned or replaced, resulting in costly downtime and unnecessary expense.

Meanwhile in the food industry, health and safety concerns come first. Food contaminated with oil residue from compressed air would look and taste unacceptable and could even have an impact on consumer wellbeing. Alternatively, it might discolour the food packaging, which would affect product aesthetics and lead to long-term reputational harm.

In these and many other environments, no compromises can be made. Oil-free air must be supplied – and only oil-free compressors can deliver that outcome. Ultimately, oil-free compressors are the only sure-fire way to reduce risk and provide long-term peace of mind.



Section 3 – How do oil-free compressors work?

Oil-free compressors operate without oil in the compression chamber, which eliminates the contamination with oil in the downstream compressed air.

Rather than using oil for lubrication, sealing and cooling, these types of compressors will typically utilise other types of technology such as water jackets and specially coated compressor elements, with microscopic tolerances to deliver efficient oil-free compressed air.

In oil-free screw compressors, which make up the bulk of the market for this type of product, external gears synchronise the position of the counter-rotating screw elements. As the rotors do not come in contact nor create friction between each other, no oil is required for

lubrication within the compression chamber. Precision engineering of the housing and elements minimises pressure leakage and drops from the pressure side to the inlet. As the internal pressure ratio is limited by differences in air temperature between the inlet and discharge ports, oil-free screw compressors are frequently built with several stages and inter-stage cooling to maximise the pressure reach.

For the end-user, oil-free air technology does away with the need to buy additional filter equipment with frequent replacements. Leaks and energy usage are minimised, and the need for condensate treatment to remove oil - along with the collection/disposal of oil contaminated condensate - is eliminated.

Section 4: The difference between oil-free and 'technically oil-free'

Selecting the correct type of oil-free compressor for the task at hand can be difficult, primarily because of nuances in terminology that need to be considered to avoid any unintended consequences at the point of use.

Compressed air has its own set of International Organisation for Standardisation (ISO) standards. The ISO 8753-1 Standard governs the ultimate air purity determined by the number of particles per cubic metre as a function of particle size, with compressors ranked from ISO Class 0-5. There is a crucial distinction to be made here – because ISO Class 0 oil-free air represents a higher standard than ISO 1 'technically oil-free air', with different performance outcomes.

ISO Class 0: Oil-Free Air: This class is the cleanest and least risky choice. While compressors delivering ISO Class 0 oil-free air might have a higher upfront price point than traditional oil-injected models, they are deemed much more suited for sensitive environments such as pharmaceuticals, electronics, food, and beverage.

ISO Class 1: Technically Oil-Free Air: This class allows for a certain level of oil contamination to be introduced into the compressed air stream, which then needs to be

filtered and removed. This approach results in a higher chance of contamination, due to the potential failure of the ancillary equipment. For example, the oil-separator might rupture, or the carbon filter might become saturated. By knowingly using a system that adds oil into the compressed air, these failures are always possible, no matter the maintenance regime.

In some circumstances, ISO Class 1 - Technically Oil-Free Air might represent a perfectly acceptable solution. But it cannot guarantee oil-free air and is therefore not comparable to Class 0. Indeed, Atlas Copco was the first manufacturer to be awarded TÜV-certified Class 0 credentials for its Z range of oil-free dry-screw compressors, a product that set new standards in oil-free air. Atlas Copco was also the first compressor manufacturer to hold ISO 22000 certification for the manufacturing site at Antwerp in Belgium. This accreditation confirms the implementation of the same Hazard Analysis Critical Control Point and safety procedures used in the food industry in the design and production of all oil-free compressors.



Section 5: Saving on energy costs

In addition to saving on through-life costs, using modern oil-free compressor technologies can also deliver significant energy savings. The latest range of rotary screw and rotary tooth Z (VSD+) compressors, for example, offer market-leading energy efficiency performance compared to older designs.

At the heart of the Z (VSD+) oil-free rotary screw air compressor range is the iPM permanent magnet motors, carefully designed in-house at Atlas Copco – providing guaranteed levels of consistency and reliability, resulting in the highest compressor package efficiency. Meanwhile, the use of a variable speed drive, which closely follows the air demand by automatically adjusting the motor speed, can result in energy savings of up to 35% versus a similar size fixed speed compressor.

For large-scale, high-energy applications like glass processing, food processing, steel manufacturing, automotive and petro-chemicals, Atlas Copco's ZH centrifugal compressors offer unbeatable energy efficiency in process air or bulk air applications presenting a flat load or when providing a baseline flow in mixed installations with VSD screw compressors.

It is also possible to equip oil-free compressors with an energy recovery unit, where up to 94% of the compressor's power can be converted into usable

energy. This can be used to heat water for sanitary purposes, space heating or process applications and is an important consideration for companies looking to become carbon neutral.

Also, a 'heat of compression' dryer, such as the Atlas Copco MD model, offers an energy-efficient way to dry compressed air. This type of air drying equipment is a good match for oil-free screw or centrifugal compressors, with the heat generated in the compression process used to regenerate the desiccant. Atlas Copco rotary drum dryers completely avoid the loss of compressed air versus a purge desiccant dryer, needing a minimal amount of power to achieve very low dew points compared to a heated desiccant dryer.

Finally, oil-free compressors can also take advantage of both Atlas Copco's advanced central controllers and its remote monitoring tools to further boost energy efficiency. A master controller will optimise the operation of a compressed air system with multiple compressors. Furthermore, the compressors can also be easily connected to the cloud for mobile monitoring over a secure network – providing a real-time means of avoiding breakdowns and production losses.

The latest oil-free compressors deliver the highest-quality air, while making no compromises on performance, reliability, and energy efficiency.



Section 6: Saving on maintenance costs

Oil-Free compressed air systems require fewer pieces of ancillary equipment and less maintenance versus a technically Oil-free system meeting the same ISO air quality. The gulf between the two solutions is further widened when looking at specific applications such as the food industry.

Starting with the oil itself, it is important to clear up a common misconception, namely that oil-free compressors are all oil-less. Most oil-free compressors still require oil for lubrication of the drive train gears. Clever sealing technology prevents this oil entering the compressed air stream. However, the fact the oil is not used for sealing and lubrication within the compression chamber, where temperatures are increased, means this oil is not replaced as frequently as it would be in an oil-lubricated machine, and not in the same quantities either. To add to this, Food Grade oil is typically expected to be used in food and beverage applications to prevent the eventual contamination having any adverse health effects on consumers. Food grade oil degrades even quicker, meaning frequent oil replacements, as often as every 2,000 hours.

Moving downstream of the compressor in an oil-free system would typically include some aftercoolers, a dryer and some dust filters before being distributed for use. In the technically oil-free solution, the equipment mentioned above is also fitted downstream, along with oil separators, coalescing filters and carbon capture towers - all increasing the amount of maintenance required, increasing the pressure drop (thereby increasing the pressure the compressor needs to run at to achieve point of use pressure) and increasing the risk of failure, with many more failure points. There is also a requirement by law to treat the oil-contaminated condensate produced before it is discharged down a drain.

If a typical compressor installation operates for ten years, the increased maintenance could easily dwarf the higher initial capital investment required to operate an oil-free compressor.



Section 7: Oil-free compressors in action

Oil-free compressors are a proven technology that have been applied in just about every type of industry around the world. These include:

Automotive: high-quality, contaminant free paint finishes, high air volume requirement

Food and beverage: high-quality end-products with no risk of oil contamination or recalls, which could damage the brand reputation.

Chemical: increased product purity, strict processes requirements, less waste, increased safety.

Electronics: uninterrupted control systems and maintenance of clean-room conditions essential to high product quality.

Oil and gas: trouble-free control systems and processes, upgraded safety, security and a higher quality end product.

Textiles: more efficient production, reduced maintenance costs, improved textile quality, less wastage.

Pharmaceuticals: pure products, reducing contamination risks, more efficient processes, decreased waste.



Recent success stories

Specific customer success stories involving the oil-free compressors range cover craft brewers determined to preserve the quality of their products, through to electronics manufacturers operating to the strictest 'clean room' environments. Below are three of the more recent applications.

Old Mecklenburg Brewery

Old Mecklenburg Brewery in Charlotte, US, produces German-style beer to 500-year-old 'Reinheitsgebot' purity laws using only hops, barley, water and yeast. The company uses Atlas Copco oil-free compressors to ensure that oil traces in the air can never contaminate these quality ingredients.

Coca Cola's Chaudfontaine

Coca Cola's Chaudfontaine bottling plant in Liege, Belgium, makes use of local spring water. The facility uses compressed air for a broad range of purposes, including bottling, labelling and transport. It has selected Atlas Copco oil-free compressors because it wants the water to remain naturally pure at all times.

Air Liquide

Air Liquide's plant in Sicily produces industrial gases for customers in the food, pharmaceuticals, and other industries. Minute traces of oil in the air in the production process could inflame at very high temperatures. It uses Atlas Copco 100 per cent oil-free compressors to eliminate this potential safety threat.



Get in touch: Start your oil-free journey today

As a global pioneer in compressed air technology, with a history spanning almost 150 years, Atlas Copco has the knowledge and experience to help you select the most suitable compressor for the task at hand.

This decision-making process involves taking a balanced view of all available options – whether that is traditional oil-injected/sealed/lubricated compressors or the latest oil-free air solution.

If **100% oil-free air** is required, without fail, then Class-0 certified oil-free compressors are the only possible route to a risk-free solution. Hopefully, this e-Book has dispelled any myths and misconceptions

To find out more about how oil-free compressors can deliver significant benefits to your organisation, contact an Atlas Copco specialist today:

To contact us, either:

Call: 0800 181085

Email: compressorsGB.web@atlascopco.com

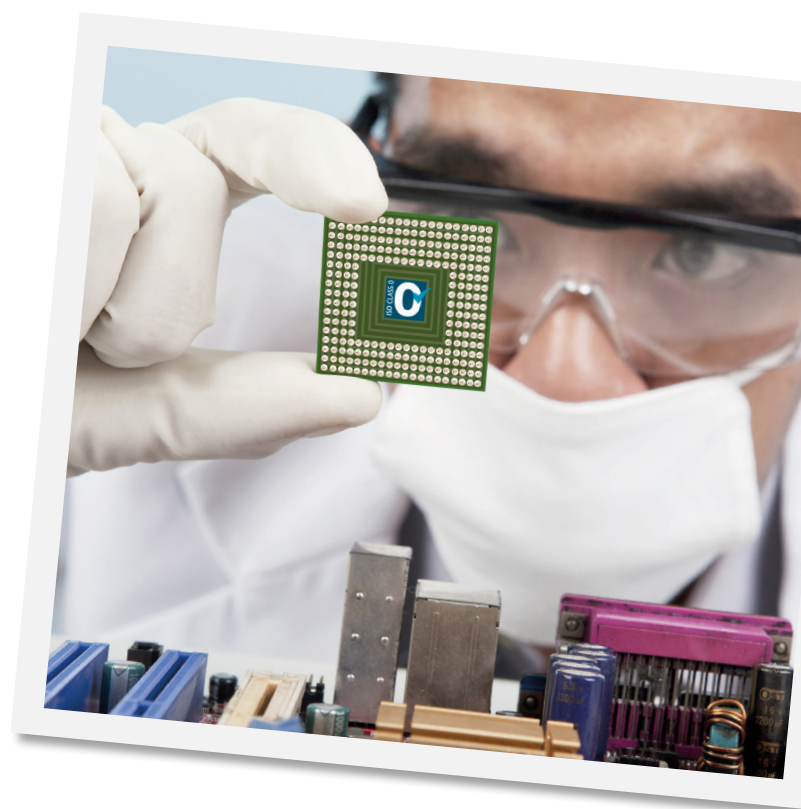
Or visit our dedicated oil-free compressor web pages:

<https://www.atlascopco.com/en-uk/compressors/products/air-compressor/oil-free-air-compressors>

about genuine oil-free compressors and has presented the benefits of using Class-0 oil-free air in sensitive production environments.

Atlas Copco has developed a multi-level offer to guarantee oil-free air, matched to your budget and air quality goals. Importantly, this is not a product strategy – it is a customer strategy. We can help you navigate that journey by establishing your air needs, assessing energy efficiency, ensuring scalability, and integrating the right level of service support and remote monitoring.

Whatever the requirement, Atlas-Copco can help.



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