

THE
EVER-EXPANDING ADVANTAGES OF
**OIL-FREE AIR
COMPRESSORS**

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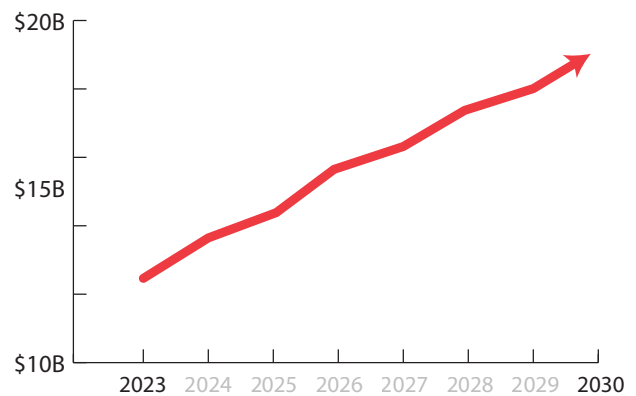
A RAPIDLY GROWING TECHNOLOGY

Choosing the right air compression system is about more than just meeting basic operational needs. For facility managers, directors, and project engineers, it's about enhancing product quality, ensuring regulatory compliance, protecting human health, and reducing maintenance and operational costs. To meet these needs, commercial bakeries, hospitals, electronics manufacturers, pharmaceutical companies, cannabis producers, and other industrial businesses requiring ultra-clean, contaminant-free air are turning to oil-free instead of oil-lubricated air compressors.

Currently, oil-lubricated compressors hold a larger market share than oil-free models. This is primarily due to the durability and cost-effectiveness of oil-lubricated compressors for general industrial applications. However, oil-free compressors are rapidly gaining market share because of increased health and safety consciousness, stricter environmental regulations, and advances in oil-free technology.

The numbers tell the story. According to Research and Markets, the global oil-free air compressor market is projected to reach approximately \$17.2 billion by 2030, with a compound annual growth rate (CAGR) of about 4.8% from 2023 to 2030.¹ There are many advantages of oil-free systems that are driving this growth.

Read more about the advantages of Oil-Free air compressors on the following pages.



Projected Compound Annual Growth Rate (CAGR)
2023-2030

¹ <https://www.turbomachinerymag.com/view/oil-free-air-compressor-market-report>

REDUCED OIL CONTAMINATION AND IMPROVED PRODUCT QUALITY

By far, the biggest selling point for oil-free compressors is the elimination of potential oil contamination. This is important in industries where even trace amounts of oil can compromise processes and products. For example, in commercial bakeries and food production facilities, oil contamination can spoil products or lead to expensive recalls. Even with food-grade mineral oil used in oil-lubricated compressors, trace amounts of oil can settle on food, adversely affecting taste and texture.

Similarly, laboratories, pharmaceutical companies, and cannabis production facilities prioritize air quality to ensure product integrity and meet industry-specific standards. By eliminating oil from their air streams, they maintain higher levels of product purity, which is critical for customer trust and compliance with industry standards.



HEALTH AND SAFETY PROTECTION

Hospitals and healthcare facilities rely on clean, oil-free air for surgical tools, ventilation, and patient care. Oil-free compressors help maintain sterilized environments, protecting patient health and promoting positive outcomes. So, in addition to health protection, oil-free compressors enable organizations to meet stringent regulations.

Likewise, oil-free compressors are ideal for preventing the inhalation of oil-tainted air in workplaces that require specialized breathing apparatus, such as laboratories or aircraft painting. Both hospitals and breathing equipment are heavily regulated. So, in addition to health protection, oil-free compressors enable organizations to meet stringent regulations.



REGULATORY COMPLIANCE

The International Organization for Standardization (ISO), the U.S. Food and Drug Administration (FDA), and the National Fire Protection Association (NFPA) have set critical standards for the use of air compressors in different business sectors. As regulations become more stringent due to increased attention on product safety, contamination prevention, and public health, oil-free compressors are the obvious solution. These are the most common regulations oil-free compressors help satisfy:



ISO 22000 — This worldwide food safety standard requires food production facilities to use air compressors that ensure zero contamination, as even minor impurities can spoil products or cause health risks. These regulations align with the FDA's mandates under the Food Safety Modernization Act (FSMA).

FDA Food Safety Modernization Act — The FSMA requires that any compressed air systems in direct or indirect contact with food or packaging undergo regular testing to ensure they meet high purity standards. Food production facilities are required to monitor for particles, moisture, and oil traces. This constant monitoring helps minimize contamination risks and product recalls.

FDA Quality System Regulation (21 CFR Part 820) — The FDA also enforces strict standards on compressed air quality for drug and medical device manufacturers. Air systems in these settings must produce air quality that prevents contamination by oil, particulates, water vapor, and microorganisms.

ISO 8573-1 — To meet the FDA Quality System Regulation, many medical device and pharmaceutical companies often adhere to the widely recognized ISO 8573-1. This international standard for compressed air specifies how much particulate matter, water, and oil may be present when used in sterile environments. Industries such as food and beverage and electronics also follow ISO 8573-1.

NFPA 99 — For air compressors used for medical applications in healthcare and laboratory settings, NFPA 99 specifies strict air quality and purity levels. Since this air supports life-saving equipment and procedures, compliance with NFPA 99 is crucial for patient safety, operational reliability, and prevention of liability issues.

LOWER MAINTENANCE AND OPERATIONAL COSTS

Regular inspection and maintenance of seals, bearings, and other components means less downtime, lower maintenance costs. However, they do require regular inspection and maintenance of seals, bearings, and other components. This streamlined maintenance means less downtime, lower maintenance costs, and improved operational efficiency. For this reason, oil-free compressors are particularly attractive to large-scale facilities that operate with complex schedules and have high productivity demands.

One drawback of oil-free systems is a higher initial investment is required compared to oil-lubricated systems. However, these costs are more than offset by the total cost of ownership. Over the life of the oil-free equipment, the lower maintenance and operational costs make oil-free compressors a smart investment.



ENERGY EFFICIENCY AND SAVINGS

Modern oil-free compressors are designed to maximize energy efficiency, often resulting in lower electricity costs. Many systems incorporate advanced variable-speed motors and optimized cooling mechanisms. These features enable the compressors to automatically scale their energy outputs up or down to match real-time demands. For large facilities such as those in the automotive and aviation industries, these increases in efficiency can produce substantial energy savings, improving the total cost of ownership and reducing environmental impact.



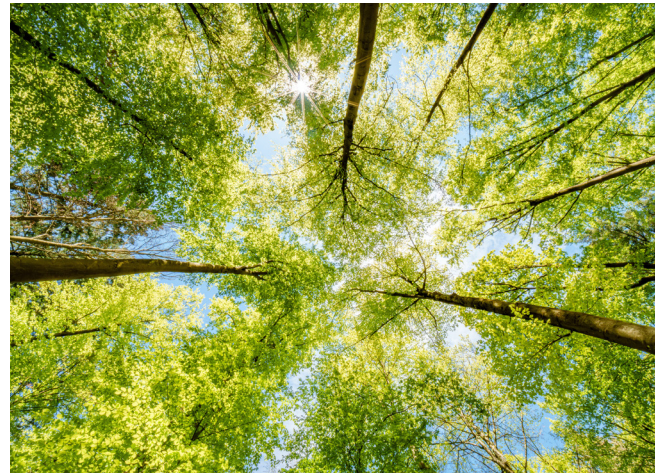
EXTENDED EQUIPMENT LONGEVITY AND RELIABILITY

Instead of using oil to minimize friction and component wear, oil-free compressors use newer, self-lubricating materials (like Teflon) and more durable parts. These lengthen their lifespans, making oil-free compressors especially advantageous in hospital and laboratory environments where equipment reliability is necessary for patient safety and critical research processes. However, this increase in longevity and reliability can be equally important in factory and manufacturing environments. If compressors fail, they can bring operations to a screeching halt, directly affecting production and the bottom line. Facilities that invest in oil-free systems often benefit from reduced replacement costs and fewer unplanned outages.



ENVIRONMENTALLY FRIENDLY

Sustainability has become a key component of corporate social responsibility. To reinforce their commitment to creating a healthier world and reducing unnecessary consumption of energy and natural resources, many organizations choose oil-free compressor systems. Not only does the adoption of oil-free technology help create a better world, but it also enhances brand image by signaling to stakeholders, customers, patients, regulators, and investors a commitment to sustainable practices.



THE FOUR TYPES OF OIL-FREE AIR COMPRESSORS

Regardless of the size of an operation, there is an oil-free compressor system to meet its needs. Each of the four main types of oil-free air compressors has its pluses and minuses. This section is designed to give you a quick overview of the merits of each. Before selecting a compressor type, we recommend consulting with an expert who can properly assess your situation and make a recommendation based on his or her years of experience in the field.



Scroll compressors — The smallest of the four types, scroll compressors are available from 3 to 80 horsepower. Scroll compressors get their name from two spiral-shaped components, one fixed and one moving. These scrolls create a series of gas pockets that compress the air. One of the advantages of scroll compressors is that they can be combined in series to create a flexible system. Need to use a large piece of equipment that requires all of them? A computer controller will run them all. Need to power a less-intensive piece of equipment? The computer will power off some of the compressors.

Scroll compressors are the lowest-cost option and are ideal for lower-volume operations where compressors don't need to run all the time. They also have the added advantage of a built-in fail-safe. If one of the compressors fails, another one can power on to take up the slack.

However, they do have some notable disadvantages. Because they are connected, this creates multiple potential failure points, increasing the difficulty of troubleshooting. They are also less efficient than other compressors and are limited in air volume output. Each compressor only has a single-air end, which can be used to run one device.



Rotary tooth compressors — Available in 20 to 75 horsepower, rotary tooth compressors are the next step up in air volume. These compressors use two meshed rotors moving in the same direction to compress the air. Compared to scroll compressors, they are more efficient and run quieter. However, they are less flexible. Like scroll compressors, they only have one air end.



Two-stage dry rotary screw compressors — Putting out 25 to 600 horsepower, two-stage dry rotary screw compressors are a major jump up in power, efficiency, energy savings, and durability. Air is compressed in two stages, with cooling occurring between them. (Since these compressors are oil-free, it takes two stages to compress the same volume of air as an oil-lubricated compressor.)

With proper maintenance, they will last a long time. Two-stage dry rotary screw compressors with 200,000 hours on them have been known to run for 20 years or more. These compressors also offer the benefit of multiple air ends. Disadvantages include a higher initial cost than scroll and single-screw compressors and a need for specialized maintenance because they are more complex machines.



Centrifugal air compressors — The most efficient of the four types of oil-free compressors, centrifugal air compressors are designed to provide plantwide power. These large compressors use high-speed rotating impellers to accelerate air and increase its pressure. They are comparable in cost to similar-sized two-stage rotary screw compressors. They also provide multiple air ends. Their only downside is that they are not suitable for lower-volume applications — tasks requiring 1,200 or less CFM of air pressure.

FUTUREPROOFING

In many cases, oil-lubricated systems are initially less expensive than oil-free ones. While this can be tempting, it may not be in an organization's best long-term interest. Regulations continue to tighten and are moving towards greener solutions. Case in point: The FDA doesn't yet specify oil-free compressors for food production. However, that is likely to change in the near future.

When considering a new compressor system, installing an oil-free one makes more sense than financing a costly conversion later. Or, if a business or organization is already running oil-lubricated systems, it may make sense to get ahead of the curve. Make the conversion now so your operation is not adversely affected by sudden regulation changes.



THE BREHOB ADVANTAGE

Knowledgeable System Assembly

Even for project engineers, choosing and installing an oil-free compressor system is not an easy task. Selecting the right air compressors for the job isn't the only consideration. One must know how to put the whole system together. There are a whole host of questions that must be answered before installation can begin:

- Which tasks will require the compressors?
- Will the compressors need to run together or independently?
- Will they be running continuously or intermittently?
- How much horsepower is needed?
- Which ISO, FDA, or NFPA regulations must we meet?
- Will there be enough power and air volume for growth or expansion?
- What redundancies can be built into the system so a mechanical failure doesn't shut down the whole operation?

Turnkey Installation

It can take years — even decades — to acquire the knowledge and skills to successfully install oil-free compressors. This is why it makes sense to contract with a firm specializing in turnkey installations. If you try to do it yourself, the cost of a mistake can be astronomical. Let someone else assume the risk.

A good firm will have regulatory certifications and a deep knowledge of each industry acquired from previous

installations. Plus, it's just easier. You'll have one point of contact instead of multiple contractors to manage.

For example, the firm I work for, Brehob Corporation, provides a full turnkey experience. We'll assess your situation, guide you through available options, and suggest alternatives you may not have considered. Plus, we'll take care of all the details, including wiring controls, managing the subcontractors, and sourcing parts and labor.



On-Going Preventative Maintenance

If an oil-free air compressor system goes down, the owner loses money — not just in repairs, but in lost productivity. The best way to avoid this is to routinely perform preventative maintenance. Inspecting belts and couplings, cleaning cooling fins and radiators, calibrating safety devices, replacing worn parts, installing new air filters and more goes a long way to keeping a system trouble-free.

Detailed Air Audits and Air Sampling Reporting

Checking the health of a system with air audits and/or air sampling are two ways to optimize efficiency and ensure everything is performing at its best.

- **Air audits** — An air audit provides a week-long snapshot of what the system is doing. What level of air pressure is it creating? Are all the machines or components running? How hard are they running? What's the flow rate? How are the air compressors interacting with each other?
- **Air sampling** — During air sampling, the testers take air samples from the output of the compressors (after filtration) to record moisture levels and look for traces of carbon monoxide and contaminants such as oil.

Both air audits and air sampling are surprisingly affordable. They enable organizations to make better-qualified business decisions about their air compressor systems. Should they repair? Should they convert? Should they scale up? Should they scale down? Companies like Brehob that install air compressor systems offer both of these services.

While the organization can assign some of its workers to perform the maintenance, it's often more economical to hire an outside firm. Experts like Brehob will tailor a maintenance schedule to the specific types of equipment used, load cycle, budget, and production timetables.



CONCLUSION

With more stringent regulations and a greater focus on air purity, oil-free compressor systems will continue to grow in popularity. When one considers the benefits of enhanced product quality, improved efficiency, and reduced maintenance and operational costs, it's no wonder that industries — from food production to health care, pharmaceuticals, cannabis, electronics manufacturing, and other industrial businesses — are increasingly turning to oil-free compressors.

Deciding to go oil-free may be easy, but installing these systems is challenging. As we have explained, it is a job best left to experts like the Brehob Corporation, which has over 70 years of experience. If you need assistance estimating a new oil-free system, overhauling an oil-lubricated one, or performing an air audit, please contact us at (317) 820-2718 or at brehob.com.

ABOUT THE AUTHOR

John Hannah is an air compressor engineer with Brehob Corporation, one of the Midwest's largest installers of commercial air compressor systems. Based out of Troy, Michigan, Hannah has been estimating and managing compressor installations for over 20 years.

