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Oil-Free vs. Lubricated Compressors in Food Applications

Introduction

The food and beverage industry relies heavily on compressed air for manufacturing operations.

As with many industries, compressed air provides a source of energy to drive automated systems. Its simplicity makes it a far more attractive option than servo or hydraulic systems. From food filling, cutting, or peeling of produce, to product handling and packaging needs, compressed air is the option of choice for many food applications.

Though air compressors are ubiquitous throughout the food processing industry, the highly stringent nature of Food and Drug Administration (FDA) regulations has led to misunderstandings as to the type of air compressors that may be used for a given application. For compressed air quality, the FDA's "Code of Federal Regulations: (CFR), Title 21," outlines the requirements for manufacturing, packaging, storing, and labeling of food products. Subpart D of this standard applies to the equipment used in food and beverage applications—including air compressors. FDA compliance ensures that the use of compressed air won't compromise food products.

The FDA requires that compressed air be completely free of oil, water, debris, and other contaminants in many applications. For this reason, many system designers opt for an oil-free compressor rather than a lubricated compressor. However, lubricated compressors can provide full FDA compliance when a complete integrated system approach is taken—and often at a lower cost and with greater longevity. To understand how this is possible, we first need to look at the options.

WHAT'S THE DIFFERENCE?

Oil-Free Compressors

Oil-free compressors are often considered ideal, even required, for food applications because it is misunderstood that they can be used directly with various food products. This misunderstanding comes from the fact that, without the use of oil in the compression chamber, it is assumed that these compressors eliminate the possibility of product contamination.

Oil-free compressors are designed to operate without oil in the compression chamber, but oil can enter the system from other contaminant sources located within the factory, including ambient conditions. Oil is also used as a lubricant to keep bearings cool, and this requires an intricate and expensive sealing system intended to prevent the oil from entering the compressed air. However, depending on the complexity of the seal and the harshness of its operating environment, oil-free compressors can be far more susceptible to failure, and a seal failure will allow oil to enter the air stream. This has the potential to create substantial waste, making downtime a very costly affair. So, oil-free compressors, like lubricated compressors, must have downstream filtration to avoid the dissemination of pollutants in the compressed air and ensure the safety of food products.

"An oil-free compressor will still require filtration," said Andy Jones, General Manager of Mattei's United Kingdom location. "It's a common misnomer that with an oil-free compressor, there can be no oil in the compression chamber. This isn't true."

Furthermore, oil-free compressors require more maintenance and become unreliable over time. For example, rotary screw airends require complete replacement or rebuilding more frequently in oil-free compressors than lubricated compressors, which greatly increases the overall cost to operate an oil-free compressor.

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Lubricated Compressors

Lubricated compressors cannot be used in direct contact with food products. In addition to the risks of ambient conditions and bearing grease, lubricated compressors use oil as a lubricant in the compression chamber; this oil is then separated and filtered. However, with treatments such as drying, filtering, mist collection, and the use of food grade lubricants, compressed air from lubricated compressors can be used in the same food applications as oil-free compressors. These treating processes help absorb hydrocarbons and organic odors, and, when treated properly, will achieve Class Zero oil-free air according to ISO industry standards.

An important part of compliance is the use of food-grade lubricants and a dedicated filtration system. For a lubricant to be considered food-grade, it must meet the approval of both the FDA and the U.S. Department of Agriculture (USDA). These agencies recognize three lubricant types: H1 lubricants, which may have minor contact

with food products; H2 lubricants, which have no possibility of contact with food products; and H3 soluble oils, which are applied to hooks, conveyors, or other equipment parts that might come into contact with food products. The use of food-grade lubricants in lubricated compressors has no effect on compressor performance. Additionally, lubricated compressors are more cost-effective than their counterparts, as oil-free systems are generally priced up to 45-50% higher than lubricated compressors.

"In terms of capital outlay, lubricated compressors are considerably less expensive than oil-free compressors," said Jones. "In the UK, we often see a difference in price of 30-40%, and even as much as 50% sometimes." Lubricated compressors are also more energy efficient, due to less friction, and the fact that the oil retains heat during compression.

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"A lubricated compressor is about 15% more efficient than an oil-free compressor," Jones said. "This is because the oil actually takes the heat out of the compression process, which makes the process as a whole more efficient."

Oil acts as a coolant, removing nearly 80% of heat produced by the lubricated compressor; the oil keeps operating temperatures low, ensuring high-performance efficiency.

THE VERDICT

Lubricated compressors cost less, are easier to maintain, and provide a longer service life compared to oil-free compressors. Oil-free compressors offer extremely limited durability, therefore delivering less operational flexibility.

Whether using food grade lubricants or our proprietary Absolute Zero Oil-Free Air System, our specialized Mattei line of rotary vane air compressors provides consistency in any food or beverage application. Our compressors help companies lower their operating costs, adding to overall productivity. Moreover, Mattei's non-toxic, synthetic food-grade lubricants—which have earned USDA approval—are engineered to deliver a longer service life for lubricated air compressors.

THE MATTEI ADVANTAGE

Mattei's air compressors are used to meet the diverse needs of American food and beverage companies. These companies are accountable for the welfare of millions of people; as such, food and beverage professionals are under constant pressure to comply with modern industrial regulations.

When properly utilized, our air compressors ensure performance that is equally safe and efficient. As a satisfied customer, Lance Lomberg of Dakota Specialty Milling can fully attest to this claim.

As one of the U.S.'s largest suppliers of whole grains, Dakota Specialty Milling relies on compressed air to support its processing facility. In this facility, food products are sorted, packaged, and subsequently sold to various bakeries across the country. Lomberg's team uses color sorter machines as a grain cleaner, which require a minimum of 90 pounds of compressed air at all times, without variance.

A new Mattei compressor recently replaced several reciprocating compressors in their processing facility. Now, a single Mattei OPTIMA 75 variable speed vane with food-grade lubricant provides reliable, abundant air for both processing and packaging applications.

"Dakota Specialty Milling recently completed renovating two additional facilities where an OPTIMA 15 and an AC 37 compressors are operating, and we are very pleased with our Mattei systems," Lomberg said. "We expect to see more Mattei units at our facilities in the future."

Oil-free compressors simply cannot match the efficiency of Mattei's lubricated models. As a sales representative of Anderson-Crane, Casey Loen has sold numerous air compressors to food and beverage professionals. According to Loen, customers regularly choose lubricated compressors due to the lower initial investment needed, and the increased performance and service life.

"The most common problems with oil-free compressors are higher overall costs and limited capabilities," Loen said. "In the long run, lubricated compressors—particularly Mattei rotary vanes—are the better choice."Whether it be utilizing our food grade lubricants or our Absolute Zero Oil-Free Air System, Mattei's rotary vane lubricated compressors are ideal for any food application and will improve your company's overall productivity. Contact Mattei today to learn more about these efficient, reliable air compressors.

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