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FEATURES

QUALITY, SAFETY & RELIABILITY FEATURES

PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION FEATURES

COLUMNS

FROM THE EDITOR | Maintenance

We'd like to recognize the compressed air system service technicians and installers for answering the call, sometimes in the middle of night, to keep our "COVID-19 critical industries" running smoothly during these difficult months. Thank you for being true professionals!

Quality, Safety and Reliability

Air compressor preventive maintenance is the focus of an article provided to us by Derrick Taylor, from PneuTech USA. It's a very useful article, one worth forwarding to colleagues in other plants. It describes how preventive maintenance saves money and then provides a useful checklist on how to do it.

Zack Barnes, the Service Coordinator at Sauer Compressors has also provided a wonderfully practical article titled, "Care for Your Air: A Guide to Air Compressor Maintenance."

Proper lubrication selection and maintenance is fundamental to all maintenance functions. Dave Brockett, from Isel Inc., has written, "A Technician's Guide to Lubricant Base Stocks." This article is designed to help service and maintenance professionals understand the differences between the different base stocks used by air compressor manufacturers.

Productivity, Sustainability & Energy Conservation

Many thanks go to Sullair's Manhar Grewal, who has followed up his very popular presentation at our conference last year with an article titled, "What's Possible When Operating Rotary Screw Air Compressors in Hot Ambient Conditions."

Technology is changing how we can maintain equipment. Our thanks go to Tamturbo for their article titled, "Remote Monitoring Paradigm Shift in Air Compressor Maintenance and Operating Cost."

Thank you for investing your time and efforts into ***Compressed Air Best Practices®.***

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INDUSTRY NEWS

Atlas Copco and Universal Compressed Air Partner to Provide Pipeline Air

Atlas Copco and Universal Compressed Air (UCA) have announced a partnership that will supply world-leading compressed air solutions under the name of Pipeline Air. The Pipeline Air concept is for customers looking to purchase reliable compressed air supplied in a utility-like manner. The partnership is an agreement that covers the USA market. It is designed to ensure a pricing structure that maximizes operational efficiency for customers with large air volume requirements.

By choosing Pipeline Air, large-volume compressed air users benefit from a solution tailored to their specific site requirements utilizing Atlas Copco's centrifugal high-efficiency, oil-free air compressors. As with any utility, customers will avoid the burden of capital investments, as well as related operations and maintenance costs. Pipeline Air gives the customer the option to buy the air, not the equipment.

UCA has one of the most knowledgeable compressed air technical support, installation and operation teams in the world. The UCA team has decades of experience in supplying and managing air supply platforms to large-scale users across multiple industries.

"This really gives our customers the best of both worlds," said Neil Breedlove, Vice President, Oil-Free Air at Atlas Copco Compressors USA. "The expertise of UCA when it comes to designing, maintaining and supplying large-scale air solutions, coupled with the proven reliability and efficiency of the Atlas Copco ZH product range, makes this partnership a very attractive proposition for a wide range of customers."

For Pipeline Air customers, UCA will build and install modularized compressor facilities at a location that is convenient for the customer, then deliver compressed air to feed the customer's distribution system. The operation is managed through UCA's control center, so customers are assured that the installation will keep up with their requirements, cope with changes in production demands and be kept in optimal service condition.

"If you are looking to save energy, space and money, then Pipeline Air is a great option," said Bob Hutchison, UCA General Manager. "Not only do customers benefit from the highly efficient Atlas Copco machines, but they will never have to lose sleep over their compressed air system again. Once installed, we will operate and maintain the equipment and guarantee performance so that the customers can focus on their core business. We are excited about the partnership with Atlas Copco and see a great future ahead."

The Pipeline Air concept is for customers looking to purchase reliable compressed air supplied in a utility-like manner.

About UCA

Previously a division of Universal Industrial Gases' parent company, Universal Air Gases, UCA is an industrial gas company that specializes in producing and distributing compressed air to sites that require utility-like air for around-the-clock operations. Large-volume users of compressed air increasingly find that outsourcing the ownership and operation of compressed air systems is a preferred strategy. UCA designs, builds, operates and maintains complete compressed air supply and distribution systems including compressors, dryers, cooling towers, advanced control systems, substations, power control systems and pipelines. UCA works in cooperation with key suppliers and contractors to execute projects and achieve ultra-high system reliability. For more information regarding UCA and Pipeline Air, please visit UniversalCompressedAir.com.

About Atlas Copco Compressors

Atlas Copco Compressors LLC is part of the Compressor Technique Business Area, headquartered in Rock Hill, South Carolina. Atlas Copco Compressors provides innovative solutions including world-class compressors, vacuum pumps, air blowers, quality air products and gas-generation systems, all backed with full service, remote monitoring and auditing services. With a nationwide service and distribution network, Atlas Copco Compressors is your local, national and global partner for all your compressed air needs. Learn more at www.atlascopco.com/air-usa.

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INDUSTRY NEWS

Charlie Takeuchi, President and CEO, Sullair.

Sullair Announces CEO Retirement and New Appointment

Sullair, an industry leader in innovative compressed air solutions since 1965, announced that Charlie Takeuchi has been named president and chief executive officer. He succeeds Jack Carlson, who retired as president and chief executive officer.

Carlson served as president and chief executive officer from November 2016 to March 31, 2020. Under Carlson's leadership, Sullair substantially grew in sales, market share and profitability. In addition, Carlson successfully led Sullair through the company's acquisition from private equity owner Accudyne Industries to Hitachi in April 2017.

Carlson said, "It was a tremendous honor to serve as CEO of Sullair alongside our dedicated employees around the globe. Sullair has a 55-year legacy of delivering reliability, durability and performance to our customers. As Charlie takes over, I am confident that Sullair will continue its growth trajectory as he and the team build on this strong foundation."

"I am honored to assume the role of CEO and to lead Sullair through its next phase of growth," said Takeuchi. "I look forward to continuing to work with the team to build on our company's history of delivering great products, while working to better meet our customer's needs through product transformation and digitization."

Takeuchi becomes president and chief executive officer of Sullair after serving as chief operating officer and executive vice president since July 2017. In that role, he ensured all integration efforts between Sullair and Hitachi were accomplished, along with the day-to-day global operations of Sullair. Prior to joining Sullair, Takeuchi held numerous manager, director and general manager positions at Hitachi divisions including Industrial Equipment and Components Group, Industrial Equipment Systems Co, LTD (HIES).

About Sullair

Since 1965, Sullair has developed and manufactured air compressors with proven reliability and wear-free durability. Sullair is globally recognized as a leading manufacturer of air compressors for use in manufacturing, oil and gas operations, food processing, construction and more. Sullair has manufacturing capabilities in Michigan City, Indiana; and Shenzhen and Suzhou, China; as well as a JV (IHI-Sullair) based in Suzhou. For more information, visit www.sullair.com. Sullair is A Hitachi Group Company.

Pye-Barker Engineered Solutions Acquires Coastal Air Compressor

Pye-Barker Engineered Solutions announced that they are joining their business operations with Coastal Air Compressor, Inc. to offer an expanded mix of products and enhanced service capabilities to Georgia's manufacturing and industrial market.

Pye-Barker has provided compressed air, pumping, and blower/vacuum systems since 1936. They acquire all of Coastal Air Compressor's assets, employees and customer contracts. This includes their complete line of replacement lubricants, air compressor rental/rebuild services, and their new and pre-owned air compressor, dryer sales and service operations with replacement and original equipment manufacturer (OEM) parts.

INDUSTRY NEWS

"It was time to sell the business, and we were looking for a respected company within the industry that shared our values and commitment to the customer," said Larry D. Rivers, Coastal Air Compressor, Inc. President. "Having competed with Pye-Barker Engineered Solutions for years, I have always known them to provide best-in-class products and services and to operate with the highest integrity. So, we know they are the right choice to offer exceptional service, an expanded product mix and full engineering support to our long-standing customer base."

Known for their personal attention and commitment to quality service work, Coastal Air Compressor, Inc. is a privately-owned business backed by over 30 years of air compressor service and repair experience in Sylvania, Georgia.

"This acquisition is an exciting opportunity to significantly enhance our service team and provide our customers with even more timely response to their repair and maintenance needs, regardless of the product or equipment," said Eric Lunsford, Pye-Barker Engineered Solutions President and CEO. "And our new Service Center already has all the appropriate tools and equipment ready to go. We will also be adding a few more skilled technicians to significantly improve repair turnaround times for our customers."

The building at 452 Industrial Park Rd., Sylvania, GA 30467, will become Pye-Barker's official Compressed Air Service Center for all air compressors and compressed air accessories that can't be repaired in the field. The current service technicians will continue their work out of this location as Pye-Barker team members. All products and services are backed by Pye-Barker's 225 years of combined engineering expertise, certified maintenance and repair services, and their 100% satisfaction guarantee.

"As our Georgia customers look to streamline their operations and optimize equipment performance, they can expect increased availability of service technicians from this acquisition to help them save time and money," said Lunsford. "We look forward to future growth and the opportunity to exceed our customers changing needs."

About Pye-Barker Engineered Solutions

Founded in 1936, Pye-Barker specializes in creating engineered solutions to help industrial companies in Georgia and now Florida with their compressed air, pumping and blower/vacuum systems. With over 225 years of combined engineering experience, they help clients create engineered solutions specific to their needs. Then, they deliver the highest quality products and services possible, all backed by certified maintenance and repair and their unique, 100% satisfaction, risk-free guarantee. With offices in Forest Park and Savannah Georgia and Orlando Florida, Pye-Barker Engineered Solutions is ready to service the needs of local customers quickly and cost-effectively. For more information, visit www.pyebarker.com or call (404) 363-6000.

Coastal Air Compressor, Inc. in Sylvania, Georgia.

Solberg Manufacturing Opens Research and Development Lab

Solberg Manufacturing, Inc. opened a new Research & Development (R & D) laboratory dedicated to discovering new possibilities in filtration, separation, and silencing. The new R & D group uses Auto Desk and Inventor to develop designs, as well as 3D printing to quickly configure and run a variety of tests during the prototyping stage for new products. This includes flow, efficiency, noise reduction, and contaminant removal effectiveness tests. This new technology allows Solberg engineers to closely simulate real world conditions which reduces on-site testing requirements and shortens sales cycles.

"We are now able to quickly verify and validate new designs regarding pressure drop and other performance factors. This investment supports our continuous improvement efforts in product design and development. This ability to get very close to real life experience in a test situation is invaluable," said Mike Carroll, Technical Sales Manager.

The lab fixtures are completely mobile, with every test stand built on wheels to allow for fast reconfiguration and maximum flexibility. A product concept that used to take months

to test and validate can now be evaluated in a matter of weeks, or even days, thus greatly improving response times to customers looking for decision critical information. The new R & D area will serve as the model for other facilities that Solberg plans to set up at its other locations around the world.

About Solberg Manufacturing

Solberg designs and manufactures filtration, separation, and silencing solutions for some of the most well-known companies in the world, supporting original equipment manufacturers, resellers, and end-users in industrial and scientific markets. Filtration expertise and highly diverse application experience make Solberg a true partner, helping customers innovate and discover new possibilities for their toughest filtration related challenges.

Solberg Manufacturing opened a new R & D laboratory.

Solberg's products protect equipment and help make industrial and laboratory working environments safer. Their extensive product line includes high-quality inlet vacuum filtration, liquid separation, and silencing products that protect a wide range of equipment including vacuum pumps, compressors, blowers, engines, fuel cells, and turbines. For more information visit www.solbergmfg.com.

QUALITY, SAFETY & RELIABILITY

Extend Air Compressor Life with PROPER PREVENTIVE MAINTENANCE

By Derrick Taylor, PneuTech USA

Preventive maintenance goes a long way toward extending the life of an air compressor.

When you take care of your air compressor, it will continue to take care of you. Following the recommended preventive maintenance procedures as outlined by the manufacturer will extend the life of your air compressor, save energy costs and reduce the risk of unexpected downtime. Here's what facility managers should know about air compressor preventive maintenance – and when to call the experts.

How Preventive Maintenance Saves Money

Preventive maintenance increases the life of your air compressor and ensures its safe, reliable and efficient operation. It also will save you money in the long term. Cost savings and other benefits include:

- Energy: Overloaded filters, blockages, inadequate lubrication, and other problems cause your air compressor to work harder than it should have

> "Preventive maintenance is a long-term investment in your air compressor. It's worth getting it right, whether you are doing it yourself or calling in the pros."
>
> — Derrick Taylor, PneuTech USA

to. That means you're paying more in energy costs. Maintaining your system for maximum efficiency will show up as savings on your energy bill.

- Equipment life: When you take care of your air compressor and other compressed air system components, they last longer – an automatic savings.
- Repairs: Emergency repairs are almost always more expensive than standard preventive maintenance. Regular preventive maintenance catches little problems, such as a worn belt or an oil leak – before they lead to more extensive (and expensive) damage to your system. You'll also avoid after-hours or overtime charges associated with emergency repair calls.
- Productivity: Regular preventive maintenance will also help you avoid the costs of an unexpected shutdown on your production lines. It can be scheduled for times when they will cause the least disruption to your production schedule. If you have a backup air compressor, you may be able to keep lines running when preventive maintenance is performed.
- Air quality: Airstream contamination from corrosion or fluids in the compressed air system can cause problems for many production processes. Consistent monitoring and proper maintenance of filters, air lines and other air compressor components will prevent buildup of fluids and particulates that can make their way into the airstream.
- Safety: Regular maintenance is also necessary to reduce the (small but possible) risk of a fire or air receiver tank rupture. Misuse or poor maintenance can lead to problems such as short-cycling of the air compressor motor, over-pressurization, failure of relief valves or other problems that make a fire or explosion more likely. These risks can be all but eliminated with proper operation and regular inspection and maintenance of system components.

Check with your air compressor manufacturer or supplier when it comes to routine preventive maintenance procedures.

EXTEND AIR COMPRESSOR LIFE WITH PROPER PREVENTIVE MAINTENANCE

Air Compressor Maintenance: The Checklist

Compressed air system owners should follow all recommended preventive maintenance procedures in their owner's manual. The exact checklist and recommended intervals will be specific to the type and model of your air compressor and your usage patterns. If you are not sure, check with your air compressor manufacturer or supplier.

Routine preventive procedures for compressed air systems include:

- Drain excess fluids daily from the air compressor and air receiver tank (if not using an automatic drain valve).
- Change the oil and replace the oil filter at recommended intervals, typically ranging from 1,000 to 2,000 hours of use for the oil filter, and 4,000 to 8,000 hours for the oil. The oil filter should be checked frequently and changed earlier if it shows signs of excessive loading or pressure drop.
- Change the air filter on a regular basis (will vary depending on air compressor usage and the environment in which it is running).
- Change the air/oil separator annually or every 4,000 to 8,000 hours to reduce pressure drop and allow the air compressor to push the compressed air out to the system easily. Old air/oil separators are not only inefficient but can allow excessive oil carryover which can cause a multitude of other issues.
- Check lubrication of joints, bearings and moving parts and reapply as needed to prevent corrosion and wear.
- Check motor bearings frequently for signs of wear and corrosion and ensure that they are properly lubricated.
- Check belts for wear and ensure that they have proper tension levels.
- Inspect and clean intake vents to prevent dirt from getting sucked into the system.

It is often a good idea to call in an expert for a full preventive maintenance checkup.

- Inspect the air compressor for signs of oil leaks or air leaks.
- Check pressure relief valves to ensure that they are operating correctly and are not blocked or corroded in any way.
- Inspect pipes, hoses, hardware and air receiver tanks for integrity on a regular basis.

You will also want to monitor other aspects of system performance, such as pressure drop, temperatures, vibration, voltage levels and air dryer performance. Anomalies can alert you to a potential problem that may require repair by an air compressor expert.

When to Call a Professional

Daily and weekly maintenance activities (such as draining fluids and checking lubricants) can and should be performed by facility maintenance staff. If your staff has training and expertise in air compressor maintenance, they may also be able to perform more in-depth regular preventive maintenance procedures. However, for most facilities, it makes sense to call in an expert for a full preventive maintenance checkup. A professional certified by your air compressor manufacturer or supplier will pick up issues that non-experts are likely to miss.

Here are some times you may want to call in an expert:

- Diagnosing pressure drop: Pressure drop refers to the loss of pressure between the air compressor and the endpoint where the air is utilized. While some pressure loss is normal, excessive pressure drop may indicate a leak or blockage somewhere in the system. Ignoring the signs of pressure drop or increasing operating pressures to compensate will drive up energy costs and put added strain on the system. A certified compressed air system technician can find and fix compressed air leaks, clogged filters or other issues causing excessive pressure drop.
- Safety inspections: Periodically, your system should be shut down for a complete safety inspection. The inspector will thoroughly examine all parts of the system to look for wear, corrosion, faulty gauges and valves, electrical problems and other issues that could present a safety concern. This should be done by a certified technician who understands what to look for.
- Repairs: While in-house maintenance staff can probably replace an air filter or belt, more complicated repairs should be handled by a trained compressed air system specialist. A qualified technician can identify and mitigate emerging issues – such as minor bearing vibration or corrosion in the air lines – before they become a serious problem. Taking care of these repairs as they emerge will help you avoid a more serious and costly mechanical breakdowns.

What to Look for In a Maintenance Provider

If you don't have someone with specific expertise in compressed air systems on staff, it makes sense to find a certified provider to handle preventive maintenance, safety inspections and repairs. Here are some things to look for.

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- Expertise: Does the provider have specific expertise in air compressor maintenance and repair? Are their technicians certified? What is the level of education, expertise and experience of the technician who will be servicing your air compressor?
- Convenience: Will they work around your production schedule and work with you to minimize costly disruptions?
- Professionalism: Are the technicians who will be working at your site clean, courteous and professional?
- Responsiveness: How fast can they get there if an emergency repair is needed? Can you get someone on the phone or by email if you have questions about your air compressor?
- Service agreements: What kinds of service agreements does the provider offer? Do they have a plan structured around your needs? A good provider may offer multiple levels of service agreements to meet your needs, ranging from simple reminder services, to flat-rate scheduled preventive maintenance procedures, to comprehensive packages that cover all or some of the costs of repairs, rentals and more.

A good service agreement can help you manage your budget and avoid unexpected surprises when it comes to preventive maintenance and repair costs. The level of service you need may depend on the expertise you have on staff, the usage patterns for your compressed air system, and the age of your air compressor and other system components.

Preventive maintenance is a long-term investment in your air compressor. It's worth getting it right, whether you are doing it yourself or calling in the pros. BP

About the Author

Derrick Taylor is the co-owner of Fluid-Aire Dynamics and co-founder and General Manager of PneuTech USA. He brings more than 20 years of direct experience in compressed air service, installation, sales and system design.

About PneuTech USA

PneuTech USA is part of the global PneuTech Group. We specialize in the design, manufacture, and supply of high-performance air compressors, refrigerated dryers, desiccant dryers, nitrogen generators, in-line filtration, condensate separation, tanks, drains, and accessories. PneuTech equipment is available through a growing network of distributors and backed by industry-leading warranties.

Our leaders had a simple vision. They wanted to utilize their many years of industry experience to create a brand that offered a superior buyer journey with quality products, and personal service. We strive to be the preferred global brand for compressed air solutions with best-in-class reliability, value, and support. We are committed to producing positive results through being trustworthy, ethical, and accessible. We are founded in the beliefs that through working together we can continue to transform the industry, while rising to turn challenges into opportunities. For more information, visit https://pneutech.com/usa/.

About Fluid-Aire Dynamics

Fluid-Aire Dynamics is a leading distributor of industrial compressed air equipment in the Chicago, Milwaukee, Minneapolis and San Antonio markets. For more information, visit https://fluidairedynamics.com/.

All photos courtesy of PneuTech USA.

To read more ***Air Compressor Technology*** articles, please visit https://airbestpractices.com/technology/air-compressors.

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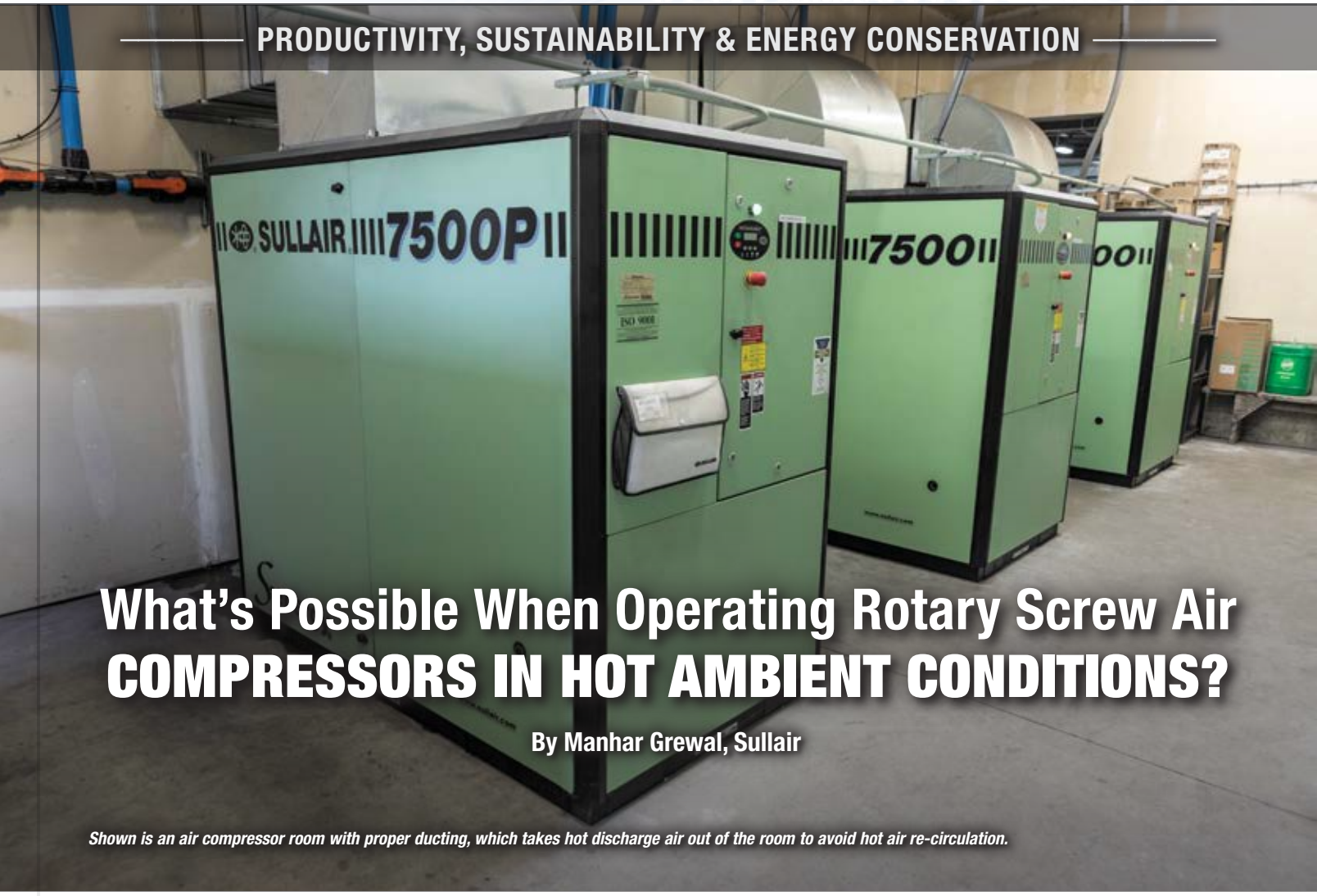

What's Possible When Operating Rotary Screw Air COMPRESSORS IN HOT AMBIENT CONDITIONS?

By Manhar Grewal, Sullair

Shown is an air compressor room with proper ducting, which takes hot discharge air out of the room to avoid hot air re-circulation.

There are times when rotary screw air compressors must operate in high ambient temperatures, leaving questions about the impact on these vital machines. What follows is an overview of what's possible in these conditions, along with advice for ensuring the optimal performance of these air compressors in hot ambient conditions.

A Close Look at Rotary Screw Air Compressor Airends

Before going into detail, we need to first set a baseline. Although all air compressors compress air, there is a difference in how centrifugal, oil flooded rotary screw, oil free rotary screw, piston and scroll machines compress air. Because this article focuses on rotary screw air compressors, it's important to know the difference between oil free and oil flooded air compressors. This can be understood in part by looking at the actual air compressor component, which is often referred to the "airend" (See Figure 1).

The rotary screws that compress the air are in the center of the image shown in Figure 1.

> "The potential impact on rotary screw air compressors of operating above their ambient design point is that it could shorten the life of the motors or cause them to fail."
>
> — Manhar Grewal, Sullair

In oil flooded air compressors, that pocket with the rotary screws is filled with oil, and the oil acts as a seal to help with both the compression and to pull heat out of the compressed air. In oil free rotary screw air compressors, the pocket has no oil and is roughly ~100+ °F hotter than oil flooded air compressors. In both air compressors increasing the ambient temperature will increase working temperature of the air compressor. Like most machinery, air compressors can be prone to failure when continuously operating above the designed ambient temperature.

There is also a jacket around the screws as shown in Figure 1, which only exists in oil free air compressors/airends. This jacket has a coolant acting as a medium to pull as much heat from the airend as possible. The general rule for the cooling medium in modern airends is that oil is used in air-cooled air compressors, or water if the compressor is water cooled. Some air-cooled airends have a special OEM coolant for this jacket, or they simply use fins like an old-style radiator to dissipate the heat. In the end, whether you have an oil free or oil flooded air compressor, make sure you are using OEM engineered oil (and other coolants if required by the OEM) to ensure you are taking as much heat out of the compressed air as possible.

Figure 1: An oil free rotary screw air compressor airend.

Operating above the Ambient Design Point

The potential impact on rotary screw air compressors of operating above their ambient design point is that it could shorten the life of the motors or cause them to fail. Operating any electric motor above its thermal design will likely cause the windings and/or bearings to fail. The grease used on the main motors are designed for a specific maximum ambient temperature. Operating above that design point will require re-greasing in more frequent intervals or an optimum grease to handle the heat buildup to avoid bearing failure. Sullair and most major OEM air compressor manufacturers typically have a "self-preservation" mode on the air compressor that shuts it down based on the hot air or oil discharge temperature. Using a non-OEM oil may not cool the air compressor properly. This will cause the air compressor to operate at an elevated internal temperature and over time lead to failure. This could also lead to internal varnishing of the airend.

A good analogy of varnishing in an air compressor is like plaque building up on teeth. Varnishing, or dirt/particles, build up inside the air compressor. Non-OEM oil will cause buildup on the orifices, rotor/stator clearances, rotors, etc. This can shorten the life of the airend and cause a premature re-build or replacement. This means potentially facing a long and unplanned shutdown with unexpected maintenance costs.

WHAT'S POSSIBLE WHEN OPERATING ROTARY SCREW AIR COMPRESSORS IN HOT AMBIENT CONDITIONS?

The Impact of Ambient Temperature, Relative Humidity (RH) and Pressure

Now that we understand the basics, we need to look at how air compressors react to ambient temperature, relative humidity (RH) and pressure. We can also look at ways to ensure your air compressors can operate efficiently in hot ambient conditions.

Figure 2 looks to be an intimidating equation, but when you boil it, down an air compressor can make a certain amount of airflow – cubic foot per minute (cfm) – at a certain pressure.

It's important to take the marketing promises on CAGI Sheets or OEM marketing material and re-use this formula to calculate the air compressor's capabilities based on the ambient

Conversion of scfm to acfm

$$acfm = scfm \times \frac{Ps}{[Pa - (ppm \times RH)]} \times \frac{(Ta + 460)}{(Ts + 460)}$$

Where:
Ps = Standard pressure, psia (CAGI & ISO use 14.5 psia)
Pa = Atmospheric pressure, psia
Ppm = Partial pressure of moisture at atmospheric temperature
RH = Relative humidity
Ta = Atmospheric Temperature, °F
Ts = Standard Temperature, °F (CAGI and ISO use 68°F)
(CAGI and ISO standard is at zero RH)

Figure 2.

conditions of your actual air compressor room. This doesn't mean the local weather forecast of your plant, but the actual conditions of the air compressor room's installation. I recommend re-calculating the air compressor capabilities for the hottest temperature (including RH) and coldest air temperature in the air compressor room to ensure your air compressor meets your demand of airflow. CAGI sheets are reporting airflow and power consumption at one set of standard conditions. This needs to be recalculated if you are not at the standard pressure-temperature-humidity. Rotary screw air compressors are more efficient in cooler ambient temperatures.

Another important factor that will help maintain the efficiency of your air compressor in a hot room is to properly ventilate the air compressor room. When you have any industrial machinery generating heat, you need to make sure that the room has proper airflow so as not to build a hot box. Having hotter air in the air compressor room will cause extra stress on the air compressor components and

potentially lead to a component failure. This will also negatively affect the performance of the air compressor. Figure 3 illustrates one way of taking hot air created by air compressors out of the room and avoiding the hot air being re-circulated into the air compressor.

Many OEMs also offer an option to have a remote air inlet. This is a great option to feed the compressor's inlet cool air to operate efficiently, but the air compressor room still needs to be properly ventilated to remove the heat generated by the air compressor.

Factoring in Minimum and Maximum Temperatures

As a user of compressed air, it's important to understand the capabilities of your air compressor. Both oil free and oil flooded air compressors, like any air compressor, have a design point for maximum and minimum ambient temperatures.

On the minimum side, most manufacturers require the air compressor to be above freezing unless you add a cold weather package. This package typically consists of heaters, often located on the sump, moisture separates, and in the control box for the electronics. The package also insulates the control and condensate lines in the package to allow water and other fluids to avoid freezing. Lack of a cold weather package option in freezing conditions can cause cold-start failure. The fluids need to be insulated and heated – for example, water in moisture drains – and will expand and cause the moisture drains to leak or crack.

On the maximum ambient temperature side, there are many interesting solutions. Most air compressors are designed for a maximum ambient temperature of 40 °C (104 °F). This should be discussed with your OEM provider as some air compressors will void the warranty if you operate above 40 °C. Some OEMs offer high-temperature air compressor packages for 50 °C (121 °F) and some extreme packages for 55 °C (131 °F). Sullair and other OEMs will consider an engineered solution for almost any design point to meet the customer's needs. The main components evaluated for 50/55 °C are simple. Here's a review of the

WHAT'S POSSIBLE WHEN OPERATING ROTARY SCREW AIR COMPRESSORS IN HOT AMBIENT CONDITIONS?

three main component modules for high-temperature air compressors:

- Cooling system – Fans can change in pitch, size or speed to allow more cooling airflow across the cooler pack. The auxiliary motor for the fan could increase in size and require more power consumption than a standard 40 °C air compressor. The coolers will also be double checked to ensure proper cooling. If not properly done, the air compressor will shut down to high discharge temperature, or it could potentially have a catastrophic failure.
- All motors – I highly recommend you review the main motor technical data sheet. The standard off-the-shelf motor is a 40 °C motor. Almost all motor manufacturers make 50/55 °C motors at an additional cost. Make sure the main motor can handle the environment, as some OEMs use a 40 °C motor in a 50 °C package. Also ensure when replacing the main or auxiliary motor, you replace it with the right ambient temperature rating. The main motor is one of the costliest components in an air compressor. There is a value in monitoring and trending the heat of the motor internally. This can be done with Resistance Temperature Detectors (RTDs) on the windings/bearings. Paying for this inexpensive option is a great long-term strategy to guard against problems.
- All electronics should be reviewed for their ability to handle the heat. This includes Variable Speed Drives (VSDs), PLCs, solenoids, etc. In some extreme cases, control cabinets are equipped with special ventilation or air conditioning modules, but most air compressors do not require this.

Figure 3. An air compressor room with proper ventilation provides cool air for the inlet of the air compressor. It also includes ducting to take the discharge heat out of the room.

When discussing electronics, it is important to note variable displacement and variable speed options can be used in hot environments in a safe manner. If you have a hot air compressor room, it is recommended to use a remote VSD and wire it near the air compressor room in an air-conditioned room.

Some might dismiss this and say it isn't needed. However, the remote VSD in a cool room will help the costly VSD last as long as possible, so you don't have to replace it. I highly recommend you work closely with the technicians installing the remote VSD to avoid electronic noise, or harmonic frequencies. If you have a hot air compressor room, OEMs like Sullair often have other advanced solutions available, such as spiral valve. These other solutions are more practical and better options for customers in hot, humid or dirty environments over a VSD.

A spiral valve allows you to have the turndown of a VSD without the pains of the electronic VSD. Spiral valves often last longer in heat than a VSD. Almost all VSDs are built to operate at 40 °C (~104 °F) The spiral valve is also verified by CAGI as a form of variable displacement. In very simple terms, there is a patented design to increase and decrease the length of the rotor to allow turndown. This is done in a mechanical way instead of a VSD controlling motor speeds based on certain parameters. In turn, users can save on maintenance costs and time using a spiral valve instead of a VSD.

What to Know When Purchasing an Air Compressor

Here are suggestions to consider when purchasing a new air compressor, while taking important factors related to ambient conditions into account:

- Know the air compressor package rating. Is it 40 °C? 50 °C? 55 °C? If operating below 32 °F, you should specify your air compressor needs a cold weather package to avoid condensate drains from rupturing, while also allowing proper start up for the motor and electronics during a cold start.
- Confirm the main/fan motor meets the ambient temperature requirements.
- Understand special maintenance needed for operating above 40 °C/ 104 °F. Do the oil or filters have any special intervals in hot environments? Update all costs in your ROI.
- Vet the types of drains on the package. Make sure you upgrade to a zero loss drain. These ensure no air is lost while draining the unwanted liquid. The advanced zero loss drains also drain based on volume of liquid not based on time. Avoid timer and

manual drains to automate the process of draining liquids properly to avoid water being sent down stream of the air compressor.

- Understand the impact of ambient conditions on dryers. If it's an oil free unit with a Heat of Compressor (HOC) dryer, it's important to know the impacts on dryer temperature inlet. HOC dryers are designed for certain discharge temperatures. Changing the air compressor discharge temperature could cause the dryer to not hit the pressure dewpoint properly and leave downstream moisture in the compressed air system.
- For all air compressors, know how the air compressor approach temperature affects the dryers. Dryers are designed for 100 °F, 100 PSI, and 100% RH. If your air compressor has a hotter discharge temperature, you need to buy a larger sized dryer to adequately cool the air for your needs.
- If you decide to use a water-cooled air compressor, review water quality requirements. This includes gallons of water per minute , pressure, temperature, and water quality parts per million (ppm) requirements, etc.

Some additional items to consider for maintenance:

- Understand the actual air compressor room temperature. Monitor the changes over the seasons. Most are surprised by the actual temperature inside the room and how it changes throughout the seasons.
- Double check the oil system. Make sure you use the right oil and check the oil level and sump filter pressure differential.
- Conduct oil sampling. This is a great indicator on whether an air compressor may fail in the future or if the oil is properly working in your conditions.
- Pay attention to the airend. Is there an abnormal noise or vibration? Ensure the shaft seal is not leaking.
- Understand the maintenance required for the main motor. If it uses a VSD, inspect the grounding brush and clean it regularly. Monitor bearing and/or winding RTDs, if applicable.
- Ensure a clean air compressor cooling system, aided by a ventilation system.

These recommendations and considerations associated with a rotary screw air compressor should help your air compressor deliver the best possible performance in what can be hot and difficult conditions. BP

About the Author

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About Sullair

Sullair, founded in Michigan City, Indiana, in 1965, is a leading global provider of compressed air solutions. The company was one of the first to execute rotary screw technology in air compressors, and its machines are known throughout the world for their reliability, durability and performance. Sullair became a Hitachi Group Company in July 2017. For more information, visit https://sullair.com/en.

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QUALITY, SAFETY & RELIABILITY

Care for Your Air: A Guide to AIR COMPRESSOR MAINTENANCE

By Zack Barnes, Sauer Compressors USA

A strong maintenance program ensures long life and optimal performance of a plant's air compressors.

Your industrial compressed air and gas system constitutes a major investment and a significant contributor to operating efficiently and productively. Keeping your air compressor in peak condition should be high on your list of maintenance activities. Fortunately, these industrial workhorses do not require a lot of costly or time-consuming resources to keep performing year after year. Still, performing a few routine checks, tests, cleanings, and adjustments will go a long way toward keeping your air and gas compressors in fine condition, generating a host of benefits:

- Maximum uptime – Scheduled and preventive maintenance can keep downtime to a minimum, so your facility continues humming along with revenue-generating activities.
- Energy efficiency – A well-tuned air compressor is an efficient air compressor. It requires less energy to do its job. The money you save can be put to use lining your pockets and building your business.
- Longer life – Air compressor maintenance is a cheap insurance policy. Spending a little each month

> "A well-maintained machine will operate efficiently and, in turn, save you money all the while delivering quality compressed air for all your applications."
>
> — Zack Barnes, Sauer Compressors USA

on maintenance mitigates the risk of a catastrophic failure costing you thousands of dollars in repair or replacement costs.

- Operator safety – Ensuring your air compressor is well lubricated, the filters are clean, and parts are in working order will reduce heat, vibration, and the possibility of malfunction that can injure workers.

Proper industrial air compressor maintenance falls into four broad categories: filtration, lubrication, inspection, and stabilization. All control contaminants and ensure air quality, keep the machinery running smoothly, eliminate conditions that detract from performance, and reduce the chances of faults by maintaining the proper operational environment.

Filtration: Protection Against Contaminants

The air we breathe contains millions of particles of dirt in every lungful. Thankfully, our cilia and mucus membranes do a pretty good job of keeping these dust specs from getting into places where they do us harm. But the contaminants in ambient air become much more of a problem when that air is compressed. Water vapor, abrasive solids, and other nasty bits get squeezed together to form masses that can obstruct lines, cause valves to malfunction, and inflict unnecessary wear on air compressor components. In addition, the air compressors themselves can unleash oils and other unhealthy bits into the airstream.

Left unchecked these atmospheric and internal pollutants will limit air compressors' effectiveness, increase energy consumption, and force you to replace parts prematurely. It is imperative to remove these contaminants from the compressed air or gas before and during use.

- Inlet filter cartridges – The equipment's first line of defense, the air inlet filter grabs contaminants as the air compressor sucks in outside air and forces it in a downward spiral through the intake component. The inlet filter picks off contaminants and sends the now mostly clean air on to the actual compression part of the operation. As the filter cleans the air by latching onto dirt and grime, the filter naturally becomes dirty and grimy itself, making it less and less effective. Cleaning the vents weekly and installing new filters per manufacturer recommendations makes the air compressor's job easier, improves energy efficiency and does much of the heavy lifting for filtration stations further down the line. Inlet and air line filters should be changed when their efficiency becomes compromised. A reduction of a few psi is enough to make replacement a worthwhile investment in order to save energy and air compressor wear. If you can't measure this with a differential gauge, replace the filters every 1,000 or 2,000 operating hours (depending on the air compressor series) as per the air compressor series-specific maintenance interval table provided; or sooner in heavier-use environments.

- Air line filters – Connected directly to air compressors and dryers, these filters form an integral part of the air-cleaning systems. Air line particulate filters work as obstacle courses, forcing the air through a series of sharp turns and tight spaces. The solids left over from the air's passage through the inlet filter aren't nimble enough to negotiate all the hurdles and contortions, eventually getting hung up in the filter's fibers. Other air line filters specialize in trapping vapors and aerosols. Coalescing filters work by collecting liquids into larger droplets. Too heavy to be borne by the air, they convert into moisture

CARE FOR YOUR AIR: A GUIDE TO AIR COMPRESSOR MAINTENANCE

traps on the bottom of the unit. Less common, absorption filters use carbon or another media to chemically bond with lubricants, and gasified compounds to prevent their escape.

- Drain traps – As the air compressor's aftercooler refrigerates the air, oil and water vapor condense into liquid. They must be evacuated so they cannot re-contaminate the air stream. This important, but often ignored job, is the function of drain traps. Moisture separators collect the liquids and deposit them in the traps where they can be eliminated from the process. Scale, rust, dirt, and other solids trapped in the liquid can condense and easily attach and cause the drains to become stuck. Stuck in the open position, they allow air to escape and reduce pressure. Jammed closed, drain traps permit liquids to cascade downstream. Dryers, designed to evaporate water vapor, will get deluged by the flood. Inspect, clean, and test drain traps often; damage caused by malfunctioning traps is easily avoidable.
- Oil filters – Some air compressor models require the use of an oil filter, in addition to the internal oil strainer, to remove metal filings, calcium, and other contaminants so they don't get deposited where they can wreak havoc. These filters can easily last six months or more under moderate conditions but should be replaced annually or after every 1,000 hours of operation, whichever comes first, in typical industrial applications. Cleaning the separators along with each oil filter change.

Maintenance Schedule

Refer to the compressor technical manual for step by step instructions on how to complete the maintenance on the new compressor. We offer complete maintenance kits for each compressor's scheduled maintenance interval.

MAINTENANCE	INTERVAL (Operating Hours)															
	50 After Commissioning	50 After Major Overhaul	At Least Yearly if < 1,000 / Year	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000	12,000 = Major Overhaul
Check Screwed Connections	□	□													
Oil Change (Refer to Oil Manual)	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Air Filter Cartridge Replacement (Not Required on Gas Compressors)			□	□	□	□	□	□	□	□	□	□	□	□	□
Check Valves					□		□		□		□		□		
Check Piston Rings									□						□
Replace Piston Pins and Piston Pin Bearings									□						□
Replacing valves															□
Check Pistons and Cylinders															□
Check Drive Bearings															□
Check Coupling									□						□
Grease E-Motor Bearings (Confirm with E-Motor Manufacturer)															□
Clean Condensate Separator (If Equipped)			□	□	□	□	□	□	□	□	□	□	□	□	□

All Sauer Compressors USA units require a 50 hour break-In oil change to be completed

Refer to air compressor manufacturers' guidelines when performing air compressor maintenance.

Keep Lubrication Working Optimally

Oil reduces the friction between moving parts in motors, gearboxes, and bearings. It also mitigates the heat generated in compression chambers, fill gaps to create air-tight seals, and cleans particles and contaminants from moving parts. All these activities gradually break down the oil's viscosity and other properties, reducing its effectiveness. As discussed above, filtering the oil extends its productive life. There are a few other techniques to help the lubricant do its job, but eventually it will need to be changed. Before that time comes, however, keep your lubricant working optimally by following these tips:

- Choose the right oil – Refer to the air compressor manufacturer's guidelines to select the correct lubricating oil for your industrial air compressor. High product quality and long service life can only be guaranteed if the oils listed, such as those in the Sauer Compressors USA Oil Recommendation Manual, are used with due consideration for the conditions of the specific application.
- Lubricate on schedule – Again deferring to the manufacturer's recommendations, calculate the hours your air compressor is in use, motor speed, and other operating conditions to determine how often to lubricate your system. This likely will be anywhere from every two months to once per year.
- Use the correct amount – Small amounts of oil are expelled through the air compressor's automatic drainage system or escape through the air-intake vent. Between oil changes, you need to replenish the supply to compensate for the lost lubricant. Using the air compressor's oil dipstick or sight glass, check the oil level each day before firing up the air compressor.

- Watch for excess oil use – If you find yourself topping off more frequently than seems reasonable, it could be a sign of trouble – inadequate operating/ambient temperatures, curtailed cycle times or oil leakage could be to blame. Running your air compressor with little or no lubricant is a sure way to prematurely burn up both wear and non-wear components. On the other hand, overfilling can cause maintenance issues, as well as excessive wear/damage to the rotating assembly. Drain any excess oil before starting the unit.

When lubricating your industrial air compressor, remember to pay special attention to the motor bearings. Bearings that rotate freely keep the air compressor running smoothly, efficiently converting electric power into air pressure. Grease shields motor bearings from heat, friction, and impact that can cause rust and deformities that prevent them from turning smoothly. Bearings that cannot rotate freely shorten motor life.

Check with the motor manufacturer for information on the motor bearing maintenance intervals, as well as the grade and viscosity of the grease that will optimize your unit's operation.

Commit to Regular Inspections

Visually checking the condition of your industrial air compressor can uncover potential problems before they become costly repairs or replacements. Commit yourself to adhering to a regular maintenance schedule that includes not only changing filters and adding lubricant when necessary but also looking at tubes, valves, fittings, and connectors that might need adjusting after a period of air compressor activity. Three areas warrant comprehensive inspections:

- Air leaks – If you notice reduced pressure at your point of use or a general reduction of air compressor efficiency, you may have an air leak. To find out for sure, perform a timed run to fully charge the system or known-volume storage vessel in a zero demand condition, set the air compressor to stop/off, and record the system/vessel pressure every minute for 10 minutes, contact the manufacturer's service department to discuss the results. If the pressure gauge falls precipitously or the system reactivates automatically, you have a leak and should check valve seals, gaskets, hoses, connections, and point of use equipment for the source. Search for leaks simply by listening for the familiar hissing sound or go high-tech with an ultrasound leak detector. In many cases, a few turns of a wrench and a replacement gasket can generate significant energy conservation and pressure gain. **Under no circumstance should a connection, fastener, etc., be manipulated/altered/disturbed while under pressure. Doing so could result in serious injury and/or death.**
- Oil leaks – If your industrial air compressor's oil level is diminishing more rapidly than usual, an oil leak could be to blame. Chances are the oil is leaking from an unsecured connection, damaged mating surface, worn seal, or compromised gasket. Insufficient piston ring sealing will often result in excessive crankcase pressure, putting added stress on the crankshaft seals, potentially causing them to leak as well as pressurizing oil up through the crankcase vent tube, allowing it to pass through the airstream, potentially to the point of use. Worn seals should be replaced post haste, as insufficient lubrication creates heat, friction, and corrosion that can ruin the air compressor.

When parts break or wear out, seek the help of professionals to get air compressors back up and running without delay.

Check for Temperature Stabilization

Compressing air for industrial use generates heat, and heat is the enemy when it comes to air compressor lifespan and efficient performance. Air compressors use various systems for dissipating heat and stabilizing the temperature around sensitive components. More than 80% of the electricity industrial

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CARE FOR YOUR AIR: A GUIDE TO AIR COMPRESSOR MAINTENANCE

air compressors consume is converted into heat. Cleaning your air compressor's cooling components enables the system to prevent extreme temperatures from detracting from performance. Ambient temperature contributes to operating temperatures, so as the thermometer rises, monitor your air compressor's lubrication closely to ensure it remains within manufacturer thresholds.

Water-cooled units, whether open- or closed-circulation, or an external source as is the case in some shipboard applications that utilize seawater), need to have their water supplies checked regularly. You will want to check not only for the source water's temperature – especially during summer – but also its alkalinity, any chemical additives, and concentration of dissolved solids.

Regardless of whether your air compressor is air- or water-cooled, replacing filters and maintaining all related equipment such as aftercoolers, heat exchangers, cooling towers, etc. is the key to preventing premature wear and unplanned downtime.

Incredible Value for a Tiny Investment

Routine checks, maintenance, and timely repairs will ensure the maximum life and optimal performance for your industrial air compressor. A well-maintained machine will operate efficiently and, in turn, save you money all the while delivering quality compressed air for all your applications.

Schedule maintenance tasks; assign an authority to make sure they get done; record the results so you can measure performance trends; call a professional when parts break or wear out; and make repairs promptly to avoid catastrophic failure, exorbitant cost, or hazardous operation. A strong maintenance program delivers incredible value for a tiny investment of time and money. BP

About the Author

Zack Barnes, Service Coordinator at Sauer Compressors USA, is experienced in air compressor maintenance and preservation. He has over seven years of production and service experience with the Sauer team, email: zbarnes@sauerusa.com.

About Sauer Compressors USA

Sauer Compressors USA specializes in the manufacturing of medium and high-pressure air and gas compressors for naval, commercial maritime, offshore, research and development, and demanding industrial applications. In addition to air, Sauer Compressors is saturated in the CNG, N2, He, and inert gas markets. Sauer USA, located in Stevensville, Maryland, is an affiliate of J.P. Sauer & Sohn, headquartered in Kiel, Germany.

The four product lines – SAUER, HAUG, Girodin and EK – focus on specific fields of application. The SAUER line comprises oil-lubricated high-pressure compressors for a wide variety of applications, while HAUG stands for oil-free and hermetically gas-tight compressors. The Girodin and EK lines offer special compressors for the naval market. Sauer Compressors' modern reciprocating compressors for the compression of air and various gases reach pressures of 290 to 7,000 psi. Besides standard products, it offers customized solutions for individual customers, OEMs and companies that operate on a global stage. With a global network of agents and representatives, Sauer maintains close proximity to its customers. By supplementing the compressor range with high-quality accessories, engineering services, assembly and service concepts, Sauer offers system solutions right up to complete turnkey installations. For more information, visit www.sauerusa.com.

All photos courtesy of Sauer Compressors USA.

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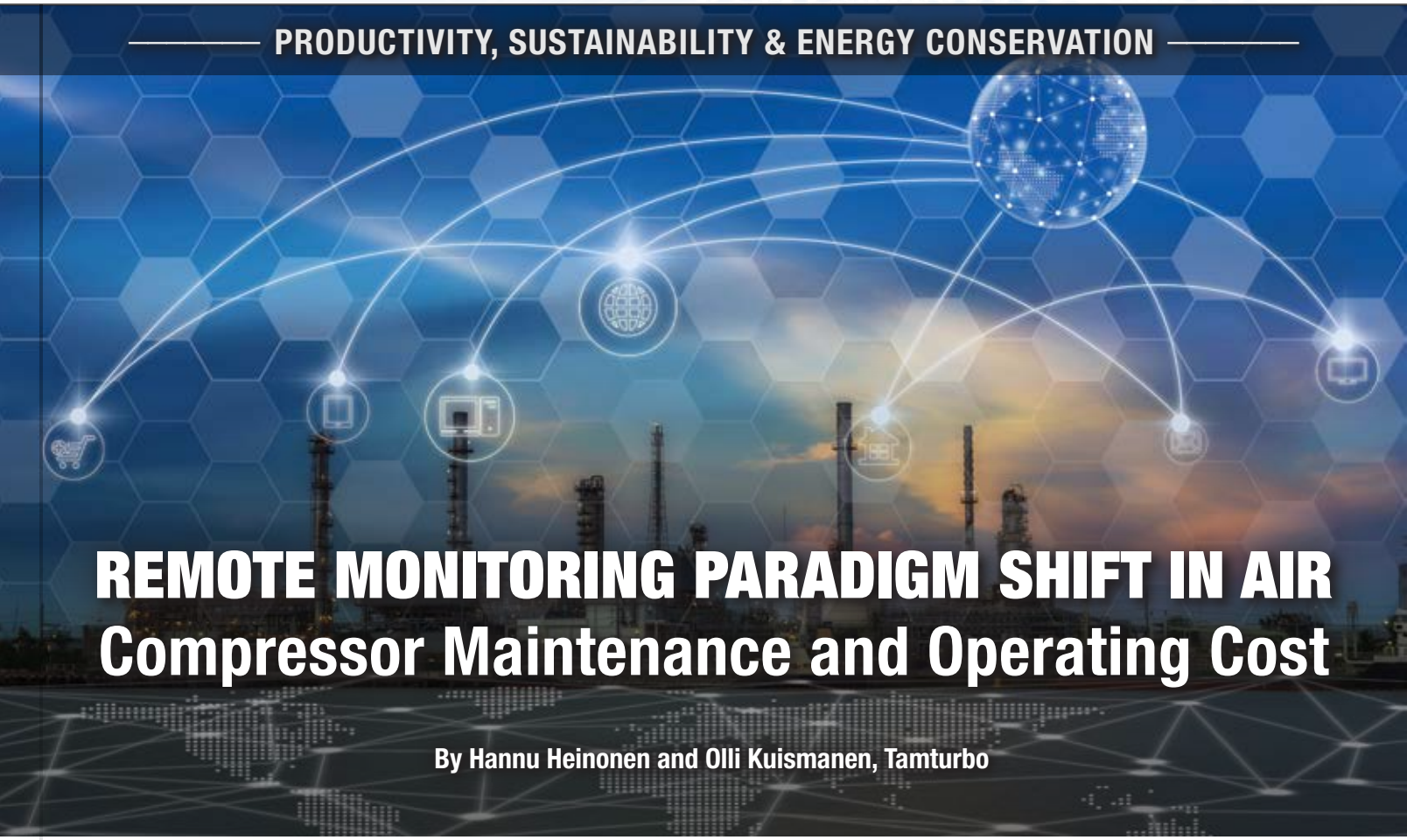
PRODUCTIVITY, SUSTAINABILITY & ENERGY CONSERVATION



REMOTE MONITORING PARADIGM SHIFT IN AIR Compressor Maintenance and Operating Cost

By Hannu Heinonen and Olli Kuismanen, Tamturbo

Everything today is connected – your car, your refrigerator, your phone, you. The cost of online connections is reaching new lows. Technological advancements are substantial for the amount and quality of data available from modern air compressors. Therefore, it is only logical that air compressors have become connected.

End users are increasingly interested in using the air compressors' operating data to support their drive in compressed air best practices. This includes increasing economic and ecological sustainability of their operations and integrating the compressed air systems to their overall factory systems. Advancements in technology has increased the capabilities compressed air system manufacturers are offering. This supports end users' needs to drive improvements in efficiency.

Here's a review of changes taking place with the continued evolution of remote monitoring of air compressor systems and how the technology stands to improve compressed air maintenance – while adding to the bottom line.

Needs-based Approach to Maintenance

With a simple built-in connection, manufacturers of compressed air equipment offer their partners totally new ways of serving end users. Just as we used to change engine oil in our cars at every 3,000 miles, we accept the car telling us when it is time to change the oil. The new technology has enabled the air compressor to do the same.

> "With remote monitoring and access to data, changing compressed air needs are easily identified and the equipment optimized for the changing reality."
>
> — Hannu Heinonen and Olli Kuismanen, Tamturbo

Forget the filter change, tied to a fixed-hour limit, the air compressor will tell you when to make the change.

The paradigm shift is defined as a fundamental change in approach. In air compressor maintenance and operating cost, this means moving from fixed or calendar-based maintenance to a need-based approach. For end users this means optimizing or minimizing their cost of maintenance and service, without jeopardizing the equipment performance or reliability. For air compressor manufacturers and distributors, this means the business model is changing fundamentally.

The remote connectivity enables air compressor manufacturers and distributors to become a different type of partner to their customers. Two-way data connection and communication can easily be utilized to optimize the compressed air equipment usage. This can include changing the air compressor operating parameters when the end user operating conditions or needs change. This happens from a remote location, on a short notice, without having to dispatch a service technician to the site. With remote monitoring and access to data, changing compressed air needs are easily identified and the equipment optimized for the changing reality. This means that compressed air manufacturers and distributors become partners in their customers' operational excellence, consulting them in matters related to this utility.

An example helps illustrate the point: A company with 18 plants and multiple air compressors per site has a modern air compressor, which is remotely monitored by the manufacturer. One day, at 6:26 am, the air compressor sent a text message (SMS) to the monitoring engineer on duty: "Power phase fault." The engineer logged into the air compressor controls and verified loss of power from one of the three phases. He called the plant service office to discuss possible reasons

Remote monitoring of air compressors will continue to evolve to help companies improve maintenance and save operating costs.

REMOTE MONITORING PARADIGM SHIFT IN AIR COMPRESSOR MAINTENANCE AND OPERATING COST

and actions. The plant service tech's reaction: He put the phone down and called his supervisor, saying "Now I know why our plant is down." With the help of this information, the end user's team got on to the root cause of the issue and was able to get the plant up, minimizing downtime.

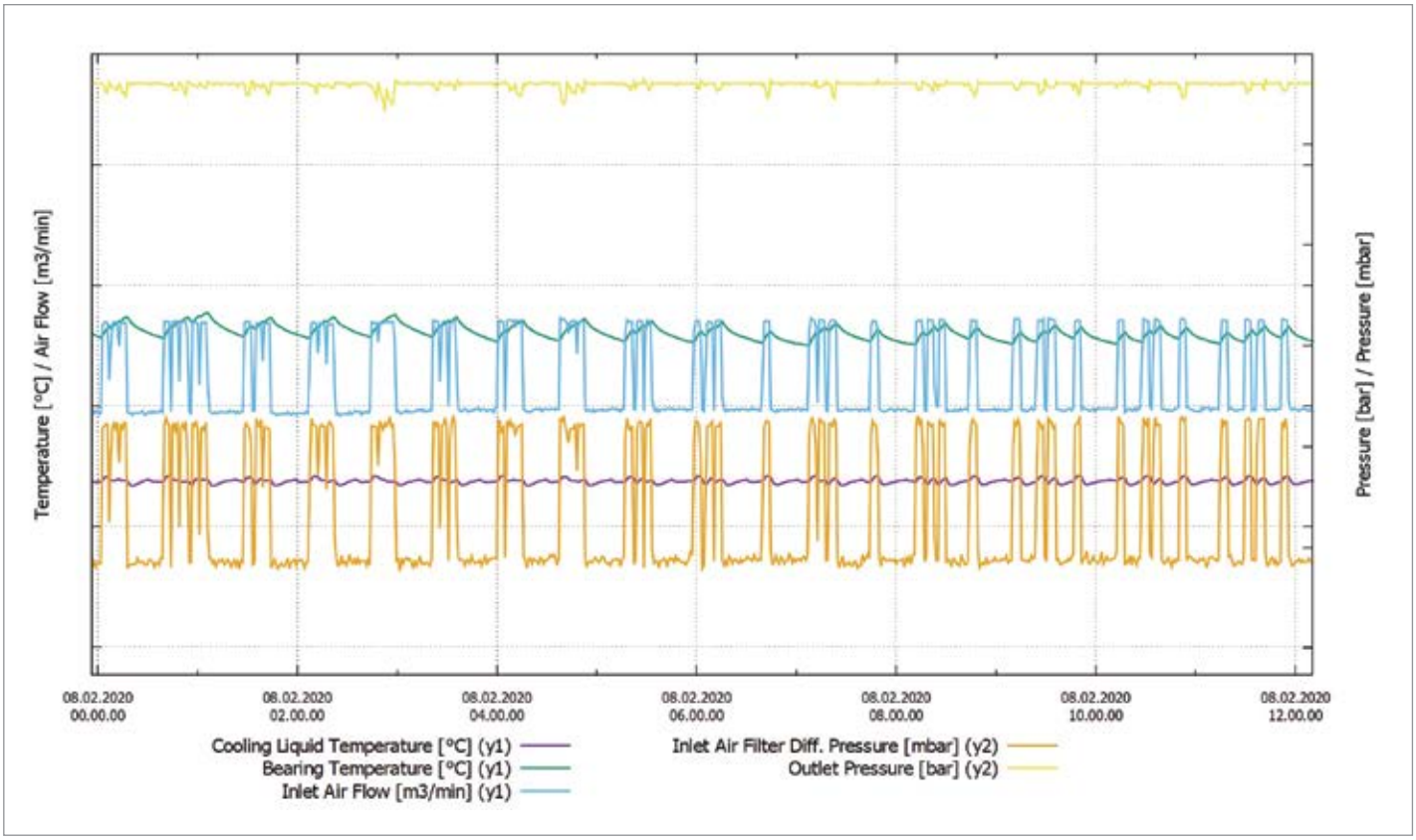
Information Enables Decision Making

The increased sensor-monitoring capabilities with the breath and volume of information available in modern air compressors make it easy to change the service and maintenance mode of operation from Reactive ("If something breaks, we'll fix it") to Predictive ("We'll fix it before it normally breaks") to Preventive ("We'll fix it just before it actually breaks"). This changes the approach from time-based, where maintenance is performed according to a schedule, to a need-based model in which the information enables decision making.

A typical time-based maintenance program may look like this:

- Oil filter change every 1,000 hours (hrs).
- Air filter change every 2,000 hrs.
- Oil change every 4,000 to 8,000 hrs.
- Service of valve seal kits every 24 months.
- Motor re-bearing work every five years.
- Oil-free air end change every 40,000 hrs.

As the new data available enables on-time monitoring of the actual maintenance needs, it's possible to shift from a scheduled maintenance program to a genuinely need-based one. The data indicates when intake filters are reaching end-of-life based on the pd data, which is the pressure differential between the air pressure before and after the intake air filters, indicating the pressure loss from contamination, and replacement can be done when really needed. This technical capability is already available in most high-end air compressors, but not utilized to the full extent. With proper design, air filter changes have been pushed up to 25,000-plus hours without excessive pressure differential or loss of filtration.



Remotely collected and shared air compressor data makes it possible to shift from a scheduled maintenance program to a genuinely need-based one for improved performance and lower maintenance costs.

Emerging Model Drives Data Sharing

With the availability to access the compressed air data remotely, the question "Whose property is it?" becomes relevant. The data could be used to analyze end user's production and changes in it, which would make the information sensitive in most cases.

Currently, remote connection-based air compressor data collected has not been available to the end customer. Emerging business models with connected compressed air equipment drive the propensity of open data sharing with end users, the true owners of the data. Offering related parties free access to collected data with the main objective to help the end user improve their operations should be the baseline of the new partnership approach to the use of the data. However, due to various reasons, some manufacturers may be slow or hesitant to adapt this open data model.

The GSM-based technology offers very fast communication, e.g., air compressors sending text/SMS messages to local operations and maintenance personnel. This amalgamates the air compressors from a "black box" to an integral part of production, capable of providing timely information for better overall production efficiency and cost.

Here's an example for further explanation: In this case, a large global brewing company has a remotely monitored air compressor in one of its breweries. When monitoring their newly commissioned air compressor, the supplier noticed the other (older) air compressors were not used in an optimum way – a large capacity unit was loading and unloading when one of the smaller units would suffice. By changing the system operational parameters remotely and advising the customer to change the running logic of the non-connected air compressors, compressed air production stabilized to run more efficiently. This resulted in substantial unloaded energy consumption savings and much more stable compressed air system.

A New Role for Manufacturers and Distributors

The use of technology-enabled, on-time, true and accurate air compressor and downstream equipment monitoring drives the new business model development. Subscription-based business models are gaining popularity

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and are quickly becoming a reality for companies who are not interested in owning air compressors when they only need the service of compressed air.

Companies are also motivated by wanting to keep their balance sheet light (by not adding capital equipment) and not wanting to allocate resources to deal with the hassle involved with operating the technology. At a fixed price, either based on a per-month, or cubic feet/meter of compressed air-provided arrangement, the end user enjoys the benefits of this new technology while the manufacturer takes care of the rest. This subscription model is parallel to media streaming services – we don't need to buy a DVD player and run to a video store to watch movies on demand. The following table highlights the differences between investing in compressed air technology versus the acquisition of compressed air based on a subscription-based business model:

	CAPEX	Subscription-Model
Capital budgeting required	Yes	No
Budget scrutiny	High	Low
Approval threshold	High	Low
Cost transparency	Low	High
Operational responsibility	High	Low
Flexibility	Low	High
Unexpected service costs	High	None

This means the role of the air compressor distributor is inevitably changing. The new role centers around keeping units running without any disruptions which will be the only way to make money. This makes maintenance and service needs or breakdowns seen as a loss, not as an opportunity to yield profit. However, the same (or actually higher) profit will be made by keeping customers' production running without disruptions instead of fixing it when it breaks down. This, of course, requires new capabilities, as well as a shift in the mindset of all parties involved. For those who may skeptical, think about what happened to DVD-player or portable CD-player businesses.

A 250 horsepower (hp) oil-free Tamturbo turbo air compressor with Variable Speed Drive (VSD) is equipped with active remote monitoring via 4G Modem link.

Thinking Differently About Compressed Air

Remote capabilities discussed here are already in compressed air equipment, enabling and driving the transformation of air compressor companies from a transactional business model toward a subscription-based partnership model. However, this also requires a mindset shift and willingness from end users to change the way they think about compressed air. BP

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About Tamturbo

Tamturbo manufactures and sells industrial air compressors with 100% oil-free technology which is based on VSD controlled, high-speed turbo air compressors with active magnetic bearings making the air compressor wear free with industry's lowest total cost of ownership. Without a single drop of oil in the system, air compressors are completely risk-free from oil adding any contamination in compressed air. For more information, visit www.tamturbo.com.

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QUALITY, SAFETY & RELIABILITY

A Technician's Guide to LUBRICANT BASE STOCKS

By Dave Brockett, Isel Inc.

Laboratory fluid analysis is highly recommended as part of an air compressor maintenance regiment.

Lubricants play a critical role in the safe, efficient, and a reliable operation of oil-flooded rotary screw air compressors. There are many factors to contemplate during the selection process, such as inlet air quality, temperature, and cost. One key factor often not given enough consideration is how the selected product will affect the maintenance cycle, and how these costs can be put into perspective. Presented here a review of available options, and how base stock selection can affect the maintenance of an air compressor.

Available Base Stocks

Modern air compressor lubricants are manufactured using a primary lubricant, and a mixture of additives. The lubricant itself, in its raw form is called a base stock, and once the additive package is mixed with this base stock the result is an air compressor lubricant. Base stocks used in air compressor lubricants are also used in all types of industrial and automotive applications, but air compressor fluid additives are designed specifically for use in air compressors.

> "Environmental factors, applications, and the desired maintenance intervals themselves, are all deciding factors when choosing the appropriate air compressor lubricant."
>
> — Dave Brockett, Isel Inc.

There are a wide variety of base stocks available on the market. The most common types fielded in air compressors are:

1. Synthetic hydrocarbons (PAO's)
2. Polyol Esters
3. Polyglycols
4. Blended Products
5. Less common bases

These formulations represent the bulk of lubricants used in oil-flooded rotary screw air compressor applications. There are still some machines in industry running silicone-based lubricants or mineral oils, but these are rare.

Synthetic Hydrocarbons (PAOs)

The Facts: This is the most common type of lubricant used in industrial applications – including air compressors – and automotive applications and is often referred to as synthetic hydrocarbons. PAOs are produced through the polymerization of linear alpha olefins which are derived from ethylene.

The Maintenance Advantage: PAOs are from the start, engineered to be extremely stable and provide very uniform flow for a wide temperature range. They also mix well with mineral oils and have a low volatility. Most finished air compressor products are rated for continuous operation at 175 ˚F to 200 ˚F for 8,000 hours.

Polyol Esters

The Facts: Polyol Esters (POEs) are the second most common type of base stock used in air compressors. These esters are formed by the process of esterification of a multifunctional alcohol with a carboxylic acid and are therefore not derived from crude.

The Maintenance Advantage: These fluids offer outstanding thermal stability, and have dispersant properties, keeping wetted parts extremely clean. When optimized for air compressor applications using additives, they can easily reach 10,000 or even 12,000 hours of continuous run time in standard conditions, giving the longest life of the group. POEs also dissolve and mix with additives and other base stocks extremely well, making them an ideal component in PAO-and PAG-based lubricants.

The Maintenance Disadvantage: One of this base stock's biggest advantages is also one of its only drawbacks. POE-based lubricants are natural dispersants, which can be damaging to paints and finishes. They can also react with certain rubber or plastic sealing surfaces. Air compressors are for the most part manufactured with this in mind, so this may not be a deciding factor.

Polyglycols

The Facts: Derived from a propylene oxide, or some combination of propylene and ethylene oxide, Polyalkylene gylcols (PAGs), are another type of synthetic base stock. These lubricant base stocks became popular in the air compressor industry due to their inability to create varnish, a common side-effect of oxidized or thermally cracked lubricating oil.

The Maintenance Advantage: PAGs are the safest bet for keeping the inside of the machine clear of deposits and varnish. Most machines have clean wetted parts, even after tens of thousands of operating hours. They are very thermally stable and typically offer 8,000 to 10,000 hours of continuous service under standard conditions.

The Maintenance Disadvantage: Some PAGs are miscible with water and will create an oil

Most full-service air compressor service companies keep an ample supply of lubricants in stock.

A TECHNICIAN'S GUIDE TO LUBRICANT BASE STOCKS

water mixture that does not separate easily. This can be detrimental to bearing life due to decreased viscosity. Some PAGs don't mix with PAO or mineral-based lubricants and can damage a system if mixed by mistake.

Blended Products

The Facts: Virtually all air compressor lubricants, except for silicone fluids, are a blend of one or more base stocks plus additives. The type most seen with air compressor applications are a blend of PAO and mineral oil as addressed here.

The Maintenance Advantage: This is usually the most cost-effective option, as these products are a mixture of an expensive base stock, and a mineral oil then additized. As high-grade base stocks tend to be very expensive compared to basic hydrocarbons, a blended product often has significant cost savings. If there are environmental factors which require a frequent maintenance cycle, this type of lubricant is very attractive. For example, some applications require a very high service interval. This could be due to the placement of the air compressor in a very warm environment, or in an area where the inlet air is contaminated by particulate or chemicals that effect the lubricants ability to function normally. In these situations, these machines require additional maintenance to remain operational and therefore have a short duty cycle for the lubricant. As such, a user might choose to buy a less expensive 4,000-hour lubricant than run an 8,000-hour lubricant at a higher costs if the oil needs to be dumped after 2,000 hours. Depending on the base stock ratios and additives, these lubricants usually offer 4,000 to 6,000 continuous operating hours at standard conditions.

The Maintenance Disadvantage: A high percentage of mineral oil in the formulation will make the lubricant more susceptible to oxidation and thermal breakdown in over-heated applications. Adequate oil analysis is always recommended, but with this lubricant type, it's more of a requirement. These lubricants will not have the same oxidative and thermal stability of some synthetic lubricants and can be more susceptible to failures based on inlet air quality.

Less Common Bases and Considerations

Less common base stocks are used in many machines around the world in application-specific functions, and at times, can be found in incorrect uses. Since they are far less common and are not normally used by most air compressor distributors, with exception to diesters for use with rotary vane air compressor applications.

Diesters: A close relative of the POE, diesters are derived from phthalic anhydride and alcohol. They are more common in rotary vane machines than in oil-flooded rotary screw air compressors. These fluids have great dispersant capability but are not typically recommended for oil-flooded rotary screw machines working in normal conditions as they can behave aggressively with certain types of sealing materials.

Silicone: Once a champion of air compressor lubricants, this fluid is virtually impervious to oxidation, and is the most expensive air compressor lubricant manufactured. This fluid has become less popular as it is extremely aggressive on sealing materials and cost prohibitive. This fluid is also extremely reactive with other base stocks, requiring caution when stored near other lubricant types to prevent cross contamination in the oil system.

Rust & Oxidation (R & O) Oil: Rust and Oxidation (R & O) oil is a very basic mineral derived lubricant popular in gearbox applications. They generally have very light additive packages and are not designed with high-speed rotating equipment in mind and are therefore very uncommon in oil-flooded rotary screw air compressors. Some R & O formulations are built for turbine applications, and have much more robust additive packages, but these lubricants are not commonly found in air compressor rooms. Machines using R & O fluids should be upgraded to an air compressor lubricant as soon as possible.

Hydraulic Fluid: Primarily designed to convey power in a hydraulic cylinder, this fluid is usually derived from a mineral base, and designed for film strength and corrosion control. Some formulations offer additional protection in thermal stability, low temperature fluidity, and high flash points, but none are formulated for optimized performance in an oil-flooded rotary screw air compressor environment. Like R & O fluid, machines running hydraulic fluid should be a maintenance priority.

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Additional Lubricant Considerations

There are a number of other important considerations that must be factored into lubricant selection.

- Oil analysis: Regardless of your choice in air compressor lubricant, a well-established oil analysis program is the key to successfully optimizing the performance of your lubricant. A PAG's inability to varnish prevents visual evidence that something wrong is happening, for example, so the only way to determine the health of the lubricant is through oil analysis. Most oil failures can be prevented with proper analysis, making this the most important tool in the lubricant arsenal.
- Operating environment: It is always important to remember the air surrounding the air compressor is the same gas your air compressor is working to compress. Air that is extremely dirty, contaminated with particles, or chemicals ingested by the air compressor's inlet will naturally have an effect when it encounters the lubricant.
- Extremely wet conditions, or high humidity is not an ideal environment for a PAG. The possibility of natural gas fumes in the inlet air, will create issues with a POE. These are just two examples of how the inlet air quality should play an important role in your selection. Another common situation is poor quality (dirty) inlet air, that requires the fluid to be serviced at frequent intervals. In this environment, a blended product is the best choice. Always take inlet air quality into account before committing to a formulation.
- Manufacturers recommendation: Most air compressor manufacturers offer lubricant as part of their parts portfolio, and consulting the operating manual is always a good idea. These recommendations are normally based on standard operating conditions, so it may be wise to consider the application as well as the operating environment.

Meet the Needs of the Application and Environment

Environmental factors, applications, and the desired maintenance intervals themselves, are all deciding factors when choosing the appropriate air compressor lubricant. All lubricant types have advantages and drawbacks. This leaves the maintenance professional or operations manager the responsibility to choose what is best based on the application and environment. Those in the oil Industry or maintenance profession have a responsibility to recommend the right lubricant for the job, which is the very reason all these options are readily available. When a technician factors in the air quality, humidity, inlet temperature, and desired operating hours between service intervals, the right lubricant for the task can be identified. BP

The importance of using the right lubricant based on the application cannot be understated to ensure efficient air compressor operation – while also avoiding problems. An example is using a fluid for an application that is beyond the fluid's thermal rating, which can cause it to solidify as shown.

About the Author

Dave Brockett of Isel Inc. is an Air Compressor Product Manager with over 20 years in the air compressor business, starting as an air compressor technician following military service. His experience includes project management, product development, maintenance management, and industrial equipment sales.

About Isel Inc.

Isel Inc. has provided custom blended air compressor lubricants around the world for over 25 years. Known throughout the industry as an extremely flexible, customer support-based manufacturer, Isel uses cutting edge chemistry and revolutionary manufacturing techniques to deliver lubricants of unmatched quality and durability. Isel is committed to providing air compressor manufacturers as well as service companies with the most advanced products available. For more information, visit https://iselinc.com/.

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TECHNOLOGY PICKS

Kaeser Introduces Mobilair M500-2 Oil-Free Portable Compressor

The Mobilair M500-2 is built with reliability, fuel efficiency, and flexibility in mind. It delivers up to 1600 cfm, with pressure range of 60 to 150 psig. The M500-2 is powered by a 600 hp Caterpillar C18 diesel engine that meets Tier 4 Final exhaust emission standards.

Kaeser M500-2 high capacity oil-free portable compressor.

M500-2 is designed for heavy industrial, processing, and manufacturing operations including chemical, refinery, midstream/pipeline, food and beverage, pulp and paper, shipyards, mining, and large construction sites. Available for rental or purchase, the M500-2 is ready to supplement plant air during peak production, provide backup for critical applications, or support annual maintenance shutdowns and turn arounds.

Rental yard and onsite handling are easy with its fold-up tow bar and steerable front axle for onsite maneuvering. M500-2 also has fork pockets and lifting eyes for full flexibility. It can run continuously for 12 hours without the need to refuel, and the external fuel connection and external DEF tank further extend operating hours if needed.

The onboard Sigma Control Mobil™ matches air flow to meet varying air demand while maintaining steady pressure. With standard Proemion telematics and GPS/GSM-modem, operating status and maintenance conditions can be remotely monitored via laptop, smart phone, or tablet. Plus, the M500-2 can be started remotely while the geofencing feature can be used to prevent unauthorized use.

About Kaeser Compressors, Inc.

Kaeser Compressors is a leader in reliable, energy efficient compressed air equipment and system design. We offer a complete line of superior quality industrial air compressors as well as dryers, filters, SmartPipe™, master controls, and other system accessories. Kaeser also offers blowers, vacuum pumps, and portable gasoline and diesel screw compressors. Our national service network provides installation, rentals, maintenance, repair, and system audits. Kaeser is an ENERGY STAR Partner. For more information, visit https://us.kaeser.com.

JORC Introduces the SMART-GUARD-MINI with Alarm

The SMART-GUARD-MINI-AL is an electronic zero air loss drain suitable for applications up to 350 cfm. This versatile and compact drain is now available with an alarm feature (potential free relay).

There are two alarm versions (Normally Open and Normally Closed contacts). The product is available in a range of voltage options and is rated up to 230 psi.

With features such as a test button, LED indication and automatic blockage detection, this energy saving electronic drain is the optimum choice for reliable, energy saving condensate removal when space is limited (overall height only 2.9").

About JORC

JORC Industrial is a global condensate management specialist offering condensate drains, oil/water separators and air saving equipment to OEM's, distributors and dealers in more than 100 countries worldwide. JORC Industrial is dedicated to setting the standard in helping its customers manage their condensate management requirements. For more information, visit www.jorc.com.

The SMART-GUARD-MINI is now available with an alarm feature.

RESOURCES FOR ENERGY ENGINEERS

TECHNOLOGY PICKS

Sullair Introduces Next Generation 1600H Portable Air Compressor

Sullair, an industry leader in innovative compressed air solutions since 1965, introduced its next generation 1600H Tier 4 Final portable air compressor. Redesigned with a focus on enhanced usability, the compressor is built with reliability, durability and performance in mind – the three pillars driving the quality of all Sullair compressors since the company's founding.

Sullair next generation 1600H portable air compressor.

"Sullair customers are accustomed to compressors that are reliable and durable," said Rus Warner, Vice President of Rental and Infrastructure Sales and Service for the Americas at Sullair. "On the performance side, we continue to incorporate innovative features to make the day-to-day operation of the compressors even better, especially relating to runtime and serviceability."

The new 1600H compressor is available in three Tier 4 Final emissions compliant, diesel engines: Caterpillar C15, Perkins 2506J and Cummins QSX15. All three options deliver 1600 cfm at 100 to 150 psi and are powered by a legendary Sullair 25-Series air end. These combine to deliver a wide range of pressure and air flow options for an end customer's most extreme demands.

The improved 1600H package design includes multiple service doors with robust, push to close latches. The push to close latches help increase worker safety by preventing unintended door closure. The new service door design also eliminates the center post, allowing easier access to all maintenance items. Aftercooled and filtered models also now include a next generation condensate management system, with no condensate drain required.

These enhancements are all in addition to a compact design for easier maneuverability, storage and transit; an easy-operation external fuel valve to extend runtime beyond 10 hours; and a 7" Sullair Touch Screen Controller providing easy access to all compressor operation data.

About Sullair

Since 1965, Sullair has developed and manufactured air compressors with proven reliability and wear-free durability. Sullair is globally recognized as a leading manufacturer of air compressors for use in manufacturing, oil and gas operations, food processing, construction and more. Sullair has manufacturing capabilities in Michigan City, Indiana; and Shenzhen and Suzhou, China; as well as a JV (IHI-Sullair) based in Suzhou. For more information, visit www.sullair.com. Sullair is A Hitachi Group Company.

AMSOIL Announces the Launch of SevAir Compressor Lubricants

AMSOIL Inc. is proud to announce the launch of SevAir Compressor Lubricants, developed specifically for professional and industrial compressor service companies. The SevAir product line includes high quality, aggressively priced synthetic oils designed to make equipment perform better and last longer. SevAir Lubricants are engineered to meet and exceed OEM performance benchmarks in Rotary Screw, Rotary Vane, Reciprocating Compressors, Blowers and many Vacuum Pumps. SevAir lubricants are manufactured in Superior, WI and stocked in 5 regional distribution centers across the USA for fast, free delivery on pallet-quantities.

About AMSOIL INC.

As a brand of AMSOIL INC., SevAir offers quality and performance you can trust. AMSOIL specializes in developing synthetic lubricants that offer innovative answers to the greatest challenges vehicles and equipment present. The extraordinary performance of AMSOIL synthetic lubricants in a range of markets – automotive, powersports, industrial, racing and more – has made our influence in the industry unmistakable and our brand highly respected. Our commitment to innovation has resulted in legions of brand-loyal customers. More information may be found at www.SevAir.com, email SevAir@amsoil.com, or call 715-399-6325.

SevAir rotary-screw compressor oil.

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Parker Unveils SPE Refrigerated Compressed Air Dryers

Designed to handle compressed air flow rates from 10 – 250 scfm, the new SPE Series of compressed air refrigerated dryers combines quality and efficiency in a reliable design, offering performance in accordance with ISO8573-1, industry-leading low operating costs, and one of the smallest carbon footprints currently available.

The SPE was developed around a state-of-the-art aluminum heat exchanger, called the E-Pack, with a patent pending all-in-one design. The E-Pack was designed to deliver industry-leading low pressure drop and utilizes a smaller volume of refrigerant than other comparable dryers. This makes Parker's SPE Series dryers the solution with the lowest running costs and smallest impact on the environment.

All SPE models are equipped with a digital controller, dewpoint indication, performance alarms and warnings, voltage free alarm contact, maintenance reminder and integrated time-controlled condensate drain. Easy to remove panels and a drain niche with access from both sides makes maintenance of SPE dryers easy.

SPE models 75 scfm and larger are available with cycling operation, an energy saving feature. This optional feature saves users additional energy during times of partial load by cycling the dryer's compressor activity and using the cold reserve stored in the E-Pack mass to cool the inlet air. The SPE combines industry leading quality, performance and efficiency making it the superior choice for any low to medium flow compressed air treatment application.

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Parker SPE Series Refrigerated Dryer.

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A Publication of Smith Onandia Communications LLC
37 McMurray Rd. Suite 106
Pittsburgh, PA 15241

Compressed Air Best Practices® (USPS# 17130) is published monthly except January-February combined by Smith Onandia Communications LLC, 37 McMurray Rd., Suite 106, Pittsburgh, PA 15241. Periodicals postage paid at Pittsburgh, PA and additional mailing offices. POSTMASTER: Send address changes to: Compressed Air Best Practices®, 37 McMurray Rd, Suite 106, Pittsburgh, PA 15241.

TECHNOLOGY PICKS

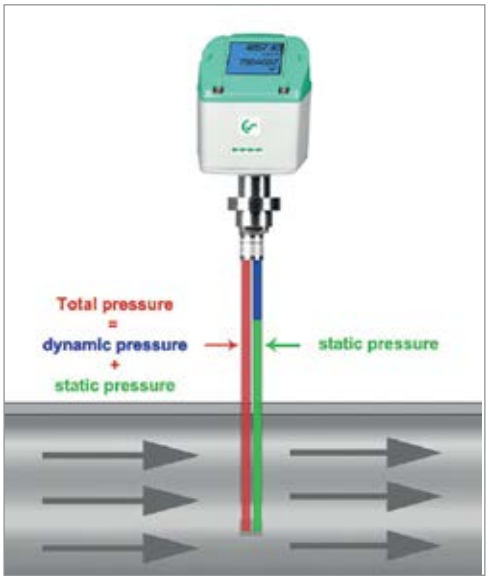
CS Instruments Releases VD 500 Flow Meter for Wet Air

The newly released VD 500 is designed to accurately and reliably measure wet air. Compatible with extremely high flow rates, the VD 500 measures the flow, total consumption, temperature and pressure of moist air with an extremely fast response time of 100 ms. The VD 500 is designed for measuring air immediately after it exits an air compressor and can measure temperatures up to 180 °C or 356 °F. Suitable for a wide range of pipe sizes from DN 20 to DN 500, measuring moist air with the VD 500 is quick, easy and reliable.

The most common types of applications for the new VD 500 moist air flow meter are compressed air audits, air compressor capacity measurements, and efficient measurement of compressed air systems.

About CS Instruments

For years, CS Instruments has been a worldwide leading manufacturer of innovative measuring technology for compressed air and gases. Long-term experience in production, supply, and drying of compressed air contributes to research, development and production of innovative, portable, and stationary measuring instruments. CS Instruments offers field proven and practicable measuring instruments for compressed air such as dew point meters, dew point meters for refrigeration and adsorption dryers (according to ISO 8573), compressed air counters, consumption counters for compressed air and gases, flow meters, leak detectors and mobile analyzers for compressed air stations. For more information, visit www.cs-instruments.com.



The VD 500 Flow Meter from CS Instruments.

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TECHNOLOGY PICKS

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Hycomp compressors are built for 24/7 continuous duty service. Preventive maintenance service is recommended every 8,000 hrs. Preventative maintenance is quick, straightforward and includes changing the oil, replacing the valves and replacement of soft goods (piston rings, gas packing, etc.) When properly maintained, the life expectancy of a Hycomp compressor is over 20 years. They have compressor systems that have been in continuous duty service for over 40 years, in some of the most demanding and critical applications in the world – namely nuclear power production facilities.

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DRYPOINT® XC heatless desiccant dryers offer a convincing, economic solution to the problem: **BEKO TECHNOLOGIES** has developed an adsorption dryer design that is focused completely on reducing energy consumption. By significantly reducing pressure drops and using the most energy efficient components possible, energy savings of up to 80% can be realized when compared to conventional designs. The energy savings alone offer a complete economic payback after an average of only three years.

With all new energy saving controller systems

XCp the premium dryer with BEKOTOUCH
- Industrial PLC with 3.8" HMI
- Animated P&ID
- High quality angle body valves

Available options:
- Outdoor package with freeze protection
- Dew point monitoring/demand
- Low dew point performance
- Stainless steel tubing
- MODBUS communications

XCe the economic dryer with basic controller
- Compressor sync
- Maintenance alarm
- Status LED

Our promise

www.bekousa.com beko@bekousa.com +1 (800) 235-6797

Truth in Compressed Air
Reliable | Efficient | Innovative

BEKO

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Successful plant operations are all about reliability and efficiency. That's why smart managers choose oil-free screw compressors from Kaeser.

With their *Built for a lifetime* engineering, our 2-stage oil-free rotary screw compressors deliver the best combination of efficiency and reliability.

- Flows from 192 to 1,774 cfm
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- Fixed or variable speed models available
- Excellent specific performance (kW/100 cfm)
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- Advanced control and monitoring
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Learn more about how Kaeser's fresh take on oil-free design reduces downtime and increases your productivity. Visit **us.kaeser.com/cabp**.

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