



THE THREE “Ps” OF PROPER MAINTENANCE: TECHNIQUES TO MAXIMIZE ROTARY SCREW AIR COMPRESSOR PERFORMANCE

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Your rotary screw compressed air system does more than power your operation, it keeps your entire business moving. Proper, consistent maintenance ensures it runs reliably and efficiently, minimizing downtime, reducing repair costs, and extending the compressor's lifespan. To achieve this, focus on the “three Ps” of air

compressor care: preliminary maintenance, or the steps one can take before installation; predictive maintenance, which provides a picture of the compressor's peak performance; and, finally, preventive maintenance, the routine, ongoing review and upkeep of your compressor. Together, these steps prevent problems and address issues before they escalate.

Maintenance Begins Before Installation

While it might seem counterintuitive, a top-flight maintenance program begins long before the compressor comes through the door. Choosing the right machine and determining its ideal location will impact a compressor's performance.

Size is a critical first step: simply put, users need to select the right compressor for the job. An undersized compressor can overtax the machine and shorten its lifespan. Similarly, a compressor too large for your operation— even if accounting for future growth — may be less efficient. An air audit by a certified professional can help you determine the correct capacity for your operation.

Location also matters. Your operating environment plays a critical role in compressor maintenance. Do you operate in scorching deserts, or are you in more frigid locations? Is your facility sited in an arid climate or one where rain or snowfall are frequent visitors? Does your facility generate significant dust and particulates, such as found in paper mills, or do you operate a pristine pharmaceutical operation? All these location factors will play a role in your maintenance processes and schedule. As you can guess, the dirtier the environment, the more frequent your service calls need to be and the more vigilant you need to be tracking filter and cooler cleanliness.

Predictive Maintenance: Staying Ahead of Problems

Once your compressor is installed, predictive maintenance becomes key. This involves establishing a baseline for the compressor's fluid and vibration profiles.

Vibration analysis tests and tracks a compressor's optimum vibrations. Every compressor has a unique vibration signature and identifying that signature when first installed provides a baseline for the life of your compressor. Over time, if excessive vibration or other deviations from the machine's normal profile are detected, potential problems which can shorten the lifespan of your compressor may be brewing. Higher vibrations for example, can be traced to anything from failing bearings or gears, or if the rolling element, inner or outer race, or the cage of a bearing are beginning to decay. Higher vibrations can also be traced to misalignment, motor faults, mechanical looseness, or broken motor mounts.

Ideally, a baseline vibration measurement should be recorded within the first few weeks or months of operation. A solid predictive maintenance program should include annual vibration measurements.

Fluid sampling is another predictive tool. Regular sampling of your compressor fluid can reveal issues like bearing wear, fluid breakdown and ingestion of contaminants. Again, establishing a baseline soon after installation allows you to spot deviations that might indicate a developing problem.

Preventive Maintenance: Routine Checks for Optimal Performance

Beyond preliminary and predictive is preventive maintenance. Guidelines for proper preventive maintenance can be found in your air compressor's manual — but keep in mind the manual is only a guide and proper maintenance depends on your unique operating circumstances. Your certified compressor maintenance technician can help set up a program that fits your specific needs.

Key preventive maintenance areas to monitor include:

- **Lubricants:** Use OEM-recommended lubricants to avoid issues like varnishing and overheating (more on this below).
- **Filters:** All filter elements have a maximum usable saturation point and eventually need replacing. Over time, contaminants build up on filter elements (including coalescing filters, as some solid particles, however small, are always present). Eventually, this buildup reduces the efficiency of the element. This efficiency loss causes larger pressure drops and allows more contaminants to pass through.
- **Coolers:** Coolers should be cleaned as often as needed. If your compressor is located outside near pollinating trees, or indoors in a dirty, dusty environment, you may need to clean your coolers more often to keep your efficiency in check.
- **Cooling Water:** In water-cooled compressed air systems, the cooling water needs to be checked at regular intervals and maintained to a certain standard—such as a certain pH and sediment value.
- **Condensate System:** If a condensate drain fails — which it can do — water can make its way into the downstream process and potentially damage sensitive equipment. Air can also escape through the drain, leading to reduced efficiency.
- **Valves and Couplings:** The minimum pressure check valve (MPCV) should be disassembled and cleaned on a quarterly basis and rebuilt once a year. If the MPCV is not adequately maintained, you can run into all sorts of issues, such as the compressor not starting or unloading properly. Coupling elements should also be

inspected regularly (quarterly) and replaced as needed. Couplings can fail and cause excessive vibrations, as well as damaging the pump and motor.

- **Motors:** Electric motors have bearing greasing requirements spelled out by the manufacturer unless equipped with sealed bearings. Even sealed bearings need to be monitored through routine predictive vibration measurements. Proper greasing can keep contamination out, temperatures down and repairs manageable.

Lubricants

Lubricants have three primary functions in rotary screw air compressors: they coat bearings, seal rotors, and reduce or dampen heat. Other important functions include the prevention of varnishing, or the formation of crystals that can raise internal compressor temperatures. Heat and varnish are the two primary enemies of rotary screw air compressors, and the two are directly related. High temperatures create more varnish, which in turn creates more heat. It can become a vicious circle.

Use only OEM recommended lubricants in your system since they are specifically engineered for your machine. There are hundreds of compressor lubricants, dozens of lubricant manufacturers and even more resellers. To begin, start by considering the components of which the lubricant is made. Each lubricant has a primary ingredient, commonly referred to as a base stock. Each of these base stocks has different properties and pros and cons:

- Hydrocarbons (mineral oils)
- Hydrotreated Hydrocarbons

- Synthetic Hydrocarbons (PAO)
- ‘Polyglycol Blends’ / Diesters
- Polyglycol/Polyol Esters (PAG/POE)

Ideally, you should choose a polyglycol lubricant whenever possible. These products are the crème-de-la-crème of compressor lubricants. While they have a higher upfront cost, they are the premier lubricants and come with virtually zero downside. Air compressors using these lubricants produce biodegradable condensate, reducing a company’s environmental footprint and costs for condensate disposal. Polyglycol lubricants also do not varnish and, in fact, remove existing varnish that may have been built up in the compressor. This helps create a more energy-efficient machine and prolong your compressor’s life.

Detecting & Preventing Air Leaks

In addition to the preventative maintenance checklist above, identifying and repairing air leaks should be an ongoing focus in any facility. Air leaks can significantly increase energy costs and reduce efficiency. In the August 2017 edition of Plant Engineering, Bob Vavra states 50 percent of compressed air generated is wasted. Of this wasted 50 percent, 33 percent is attributed directly to leaks, with another 8 percent wasted due to elevating the system pressure to compensate for leaks. As a point of reference, a quarter-inch air line leaking to 100 psi (7 bar), can cost thousands of dollars a year and reduced efficiency.

To find leaks, many manufacturers conduct air audits. Regularly auditing your system for leaks – especially during quieter times when they’re easier to detect is best. The audible frequency range of hearing for the human ear is 20 Hz to 17 kHz;

ultrasonic sound begins at 20 kHz. The suggested setting of ultrasonic leak detectors used for compressed air leaks is 40 kHz — higher than what can be heard by the human ear.

Many users find that most leaks are small, and only located by using an ultrasonic leak detector.

Maintaining Your Maintenance Plan

Finally, maintaining a solid preventive maintenance program requires good record-keeping. Writing detailed logs can help you stay ahead of potential issues. Consistent logging helps you spot patterns in machine performance and helps you manage your total cost of ownership.

If you are keeping good logs, users can share that information with their service tech to be sure he/she has a full picture of your compressor’s health. Typically, a service tech should be servicing your compressor roughly every quarter for routine maintenance. But you should also inspect your compressed air system daily (if possible) to make sure things are running as they should.

As air compressor technology becomes more advanced, the importance of routine inspections and a robust maintenance program – including preliminary, predictive and preventive steps – are essential for keeping your system running at peak performance.