



Maintenance of Compressed Air Systems for Peak Performance



Compressed Air Systems Fact Sheet #5

Like all electro-mechanical equipment, industrial compressed air systems require periodic maintenance to operate at peak efficiency and minimize unscheduled downtime. Inadequate maintenance can have a significant impact on energy consumption via lower compression efficiency, air leakage, or pressure variability. It can also lead to high operating temperatures, poor moisture control, and excessive contamination. Most problems are minor and can be corrected by simple adjustments, cleaning, part replacement, or the elimination of adverse conditions. Compressed air system maintenance is similar to that performed on cars; filters and fluids are replaced, cooling water is inspected, belts are adjusted, and leaks are identified and repaired.

All equipment in the compressed air system should be maintained in accordance with manufacturers' specifications. Manufacturers provide inspection, maintenance, and service schedules that should be followed strictly. In many cases, it makes sense from efficiency and economic standpoints to maintain equipment more frequently than the intervals recommended by manufacturers, which are primarily designed to protect equipment.

Basic Maintenance Checklist

- 9 **Inlet Filter Cartridges.** Inspect and clean or replace per manufacturer specifications. Required frequency is often related to operating conditions. Dirty filters increase energy consumption.
- 9 **Drain Traps.** Clean out debris and check operation periodically.
- 9 **Compressor Lubricant Level.** Inspect daily and top-off or replace per manufacturer specifications. Change lubricant filter per manufacturer specifications.
- 9 **Air Lubricant Separator (Lubricant-injected Rotary Screw Compressors).** Change per manufacturer specifications, or when pressure drop exceeds 10 psid, whichever is less.
- 9 **Lubricant Selection.** Select compressor and electric motor lubricant per manufacturer specifications.
- 9 **Belt Condition.** Check belts for wear and check/adjust tension per manufacturer specifications.
- 9 **Operating Temperature.** Verify that operating temperature is per manufacturer specification.
- 9 **Air Line Filters.** Replace particulate and lubricant removal elements when pressure drop exceeds 2 to 3 psid. Inspect all elements at least annually regardless of pressure drop indication.
- 9 **Water Cooling System.** For water-cooled systems, check water quality (especially pH and total dissolved solids), flow, and temperature, and clean/replace filters and heat exchangers per manufacturer specifications.
- 9 **System Leaks.** Check lines (especially joints), fittings, clamps, valves, hoses, disconnects, regulators, filters, lubricators, gauge connections, and end-use equipment for leaks.
- 9 **System Cleanliness.** Check system for compressor and motor lubricant leaks and cleanliness.

One way to tell if a system is being maintained well and is operating properly is to periodically benchmark the system by tracking power, pressure, and flow. If power use at a given pressure and flow rate goes up, the system's efficiency is degrading. This benchmarking will also let you know if the compressor is operating a full capacity, and if the capacity is decreasing over time. On new systems, specifications should be recorded when the system is first set-up and operating properly.

Maintenance issues for specific system components are discussed below.

Compressor Package

The main areas of the compressor package in need of maintenance are the compressor, heat exchanger surfaces, air lubricant separator, lubricant, lubricant filter, and air inlet filter.

The compressor and intercooling surfaces need to be kept clean and foul-free. If they are dirty, compressor efficiency will be adversely affected. Fans and water pumps should also be inspected to ensure that they are operating at peak performance.

The air lubricant separator in a lubricant-cooled rotary screw compressor generally starts with a 2-3 psid pressure drop at full-load when new. Maintenance manuals usually suggest changing them when there is about a 10 psid pressure drop across the separator. In many cases it may make sense to make an earlier separator replacement, especially if electricity prices are high.

The compressor lubricant and lubricant filter need to be changed per manufacturer's specification. Lubricant can become corrosive and degrade both the equipment and system efficiency.

For lubricant-injected rotary compressors, the lubricant serves to lubricate bearings, gears, and intermeshing rotor surfaces. The lubricant also acts as a seal and removes most of the heat of compression. Only a lubricant meeting the manufacturer's specifications should be used.

Inlet filters and inlet piping also need to be kept clean. A dirty filter can reduce compressor capacity and efficiency. Filters should be maintained at least per manufacturer's specifications, taking into account the level of contaminants in the facility's air.

Compressor Drives

If the electric motor driving a compressor is not properly maintained, it will not only consume more energy, but be apt to fail before its expected lifetime. The two most important aspects of motor maintenance are lubrication and cleaning.

Lubrication. Too much lubrication can be just as harmful as too little and is a major cause of premature motor failure. Motors should be lubricated per the manufacturer's specification, which can be anywhere from every 2 months to every 18 months, depending on annual hours of operation and motor speed. On motors with bearing grease fittings, the first step in lubrication is to clean the grease fitting and remove the drain plug. High quality new grease should be added,

and the motor should be run for about an hour before the drain plug is replaced. This allows excess grease to be purged from the motor without dripping on the windings and damaging them.

Cleaning. Since motors need to dissipate heat, it is important to keep all of the air passages clean and free of obstruction. For enclosed motors, it is vital that cooling fins are kept free of debris. Poor motor cooling can increase motor temperature and winding resistance, which shortens motor life and increases energy consumption.

Belts. Motor v-belt drives also require periodic maintenance. Tight belts can lead to excessive bearing wear, and loose belts can slip and waste energy. Under normal operation, belts stretch and wear and, therefore, require adjustment. A good rule-of-thumb is to examine and adjust belts after every 400 hours of operation.

Air Treatment Equipment

Fouled compressed air treatment equipment can result in excessive energy consumption as well as poor-quality air that can damage other equipment. All filters should be kept clean. Dryers, aftercoolers, and separators should all be cleaned and maintained per manufacturer's specifications.

Automatic Drain Traps

Most compressed air systems have numerous moisture traps located throughout the system. Traps need to be inspected periodically to ensure that they are not stuck in either the open or closed position. An automatic drain trap stuck in the open position will leak compressed air; a

drain trap stuck in the closed position will cause condensate to backup and be carried downstream where it can damage other system components. Traps stuck in the open position can be a major source of wasted energy in some plants.

End-Use Filters, Regulators, and Lubricators

Point-of-use filters, regulators, and lubricators are needed to ensure that a tool is receiving a clean, lubricated supply of air at the proper pressure. Filters should be inspected periodically because a clogged filter will increase pressure drop, which can either reduce pressure at the point of use or increase the pressure required from the compressor, thereby consuming excessive energy. A filter that is not operating properly will also allow contaminants into a tool, causing it to wear out prematurely. The lubricant level should also be checked often enough to ensure that it does not run dry. Tools that are not properly lubricated will wear prematurely and use excess energy.

Leaks

Leak detection and repair is an important part of any maintenance program. For more information on finding and fixing leaks, see the Fact Sheet titled *Compressed Air System Leaks*.

Establishing a regular, well-organized maintenance program and strictly following it is critical to maintaining the performance of a compressed air system. One person should be given the responsibility of ensuring that all maintenance is performed properly, on schedule, and adequately documented.