Compressed Air Systems Tips

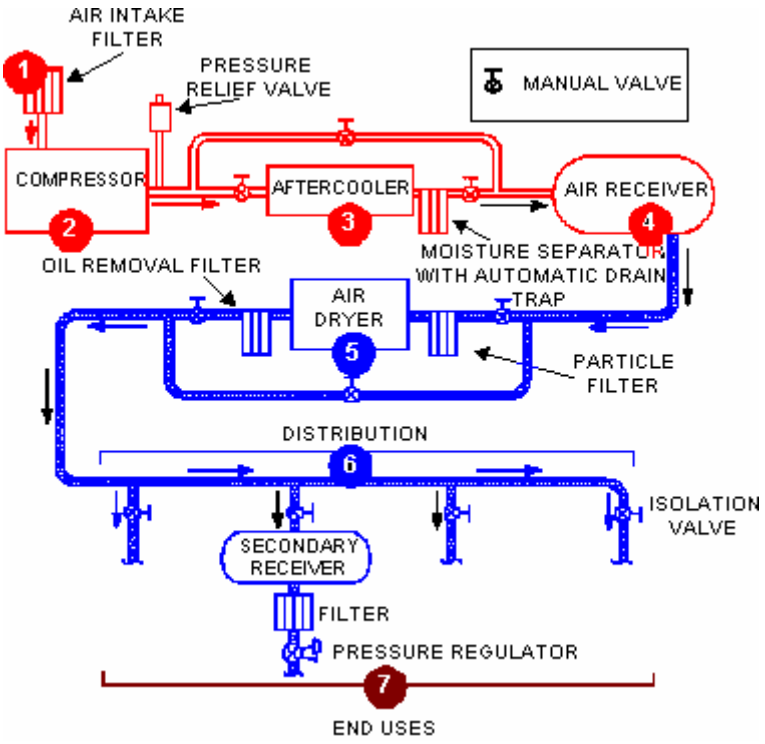
Compressed air is widely used throughout industry and is considered one of the most useful and clean industrial utilities. It is simple to use, but complicated and costly to create. To realize its full potential, an understanding of basic compressed air systems is required. This Equipment Guide provides a quick tutorial on systems in manufacturing and industrial facilities, covering the following topics:

Identification of the primary components of a compressed air system, with an illustration of system flows, showing compression cooling, dryer, storage and distribution.
Typical applications for industrial compressed air systems.

Key field observations to help identify key components and characterize the compressed air system.

Basic maintenance tips to retain efficient operation of compressed air systems.

Compressed Air System Components



A typical compressed air system consists of compression, cooling, storage, and distribution equipment.

Intake Filtering: Incoming air must be filtered to remove dust and other contaminants.

Compression: The filtered air is compressed (typically to 80 to 110 psi) with motor-driven screw, centrifugal, or reciprocating compressors.

Cooling: Compressing air raises its temperature dramatically, so cooling is required. Much of the energy "lost" in making compressed air is in the form of removed heat. Cooling is also important in the process of drying air. Much of the water vapor condenses as the air is cooled, making it easy to drain away.

Air Storage: A tank called an air receiver typically is placed downstream of the cooler to provide surge capacity for the system. Some systems provide additional receiver tanks in the process area to accommodate widely variable demand.

Drying: Cooled, pressurized air still carries a significant amount of moisture and lubricants from the compression process, virtually all of which must be removed before the air can be used. Drying compressed air can be very energy intensive.

Distribution: A system of distribution pipes and regulators convey compressed air from the central compressor plant to process areas. This system includes various isolation valves, fluid traps, intermediate storage vessels, and even heat trace on pipes to prevent condensation or freezing in lines exposed to the outdoors. Pressure losses in distribution typically are compensated for by higher pressure at the compressor discharge.

Point of Use: At the intended point of use, a feeder pipe with a final isolation valve, filter, and regulator carries the compressed air to hoses that supply processes or pneumatic tools.

Typical Applications

Compressors

The type of compressor most likely to be used for an industrial compressed air system depends largely on size, cost, and reliability requirements:

Rotary screw compressors in sizes up to 500-600 hp are very popular because of their high reliability and low maintenance requirements.

Centrifugal compressors are often used in sizes ranging from about 150 hp up to over 10,000 hp. The larger size models are relatively low in cost and small in physical size compared to reciprocating compressors.

Reciprocating compressors are one of the oldest air compressor technologies, but are commonly used today only in sizes up to 25 hp or so. These compressors are often used for light-duty applications or in startup industrial enterprises because they are reliable and low cost.

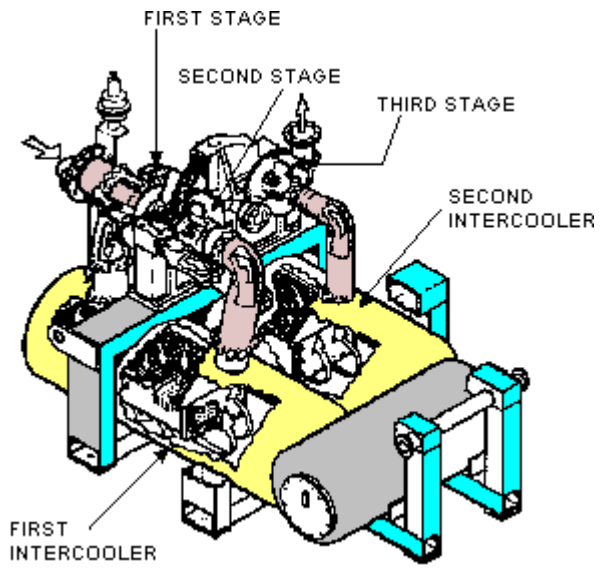
Rotary vane compressors are not commonly used as they tend to be energy inefficient and require higher maintenance than other compressor designs.

Dryers

Application criteria for dryers include climate, the degree of air dryness needed, and cost and reliability:

For facilities where there is no concern about freezing, refrigerated air drying is often used. If freezing is a concern, regenerative desiccant dryers will be used.
If air must be very dry, regenerative dryers will be used.
If cost is a primary concern, as in the case of a young company or a light-duty industrial process, the deliquescent dryer is more common. This type is less common in moderate- or heavy-duty industry because of a perception that its performance is less reliable than other types under varying conditions.

What to Look for in the Field



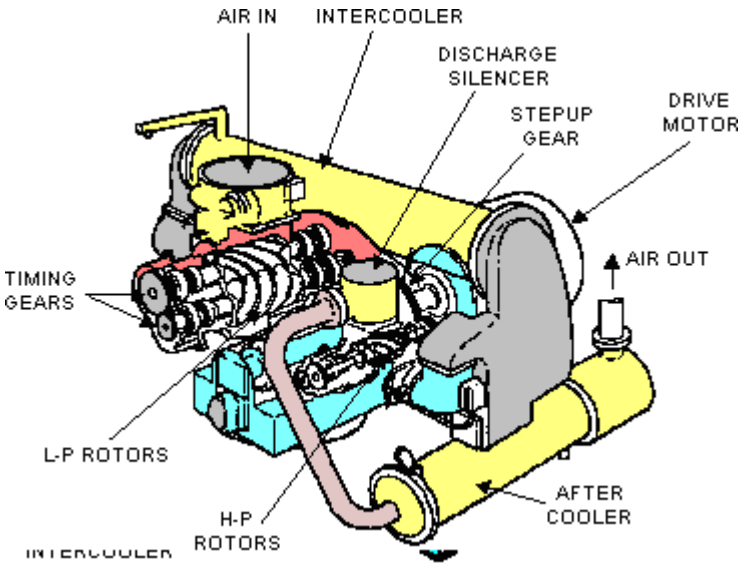
To assess an industrial compressed air system, you must identify the key system components and understand how the system is designed to perform. The following equipment should be identified and inspected:

Air Compressors: There will be at least one air compressor, and often multiple compressors. The most common types of large industrial air compressors are centrifugal, rotary screw, and rotary vane. Multi-compressor systems may mix types.

Air Dryers: Almost all systems have at least one air dryer, and some will have multiple air dryers. Refrigerated air dryers are very common in warmer climates or where there is no concern about condensate freezing in air lines. Desiccant-type dryers, in general, can remove more water than refrigerated dryers, and so are used in facilities that need extremely dry air or have air lines exposed to freezing.

Tips for Efficient Operation and Maintenance

Following are a few tips for efficient operation and maintenance of industrial compressed air systems.



Lubrication: Compressor oil pressure should be visually checked daily, and the oil filter changed monthly.

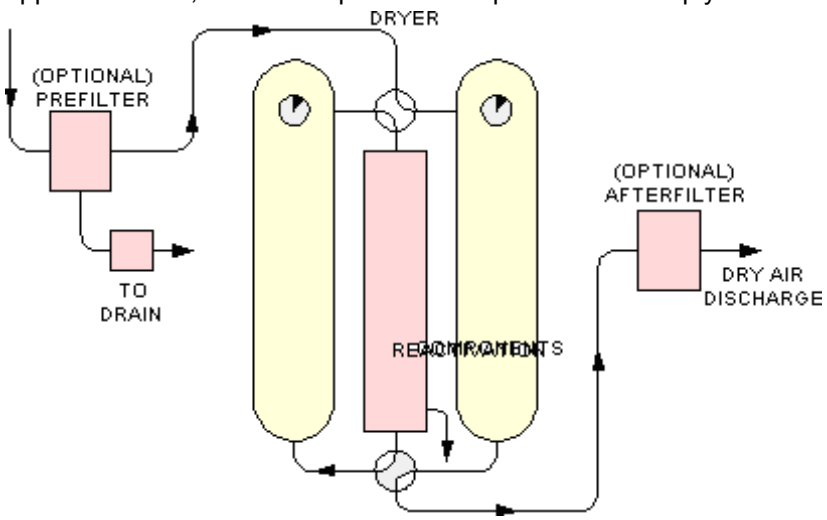
Air Filters: The inlet air filter can easily become clogged, particularly in dusty environments. Filters should be checked and replaced regularly.

Condensate Traps: Many systems have condensate traps to gather and (for those traps fitted with a float operated valve) flush condensate from the system. Manual traps should be periodically opened and reclosed to drain any accumulated fluid; automatic traps should be checked to verify they aren't leaking compressed air.

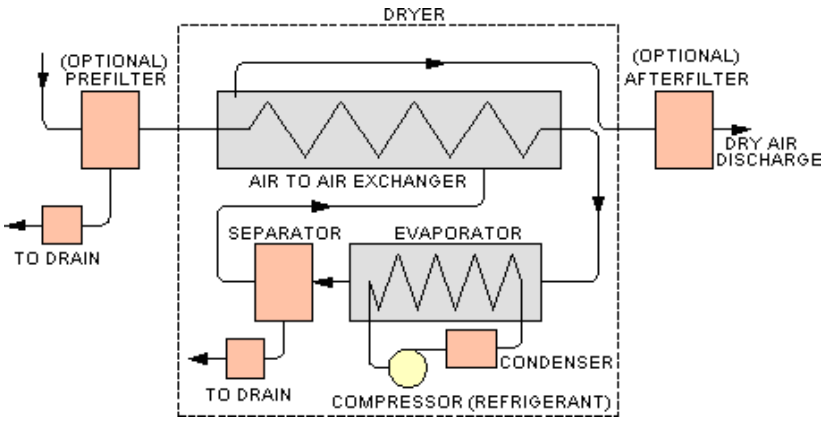
Air Dryers: Drying air is energy-intensive. For refrigerated dryers, inspect and replace prefilters regularly as these dryers often have small internal passages that can become plugged with contaminants. Regenerative dryers require an effective oil-removal filter on their inlet, as they will not function well if lubricating oil from the compressor coats the desiccant. The temperature of deliquescent dryers should be kept below 100°F to avoid increased consumption of the desiccant material, which should be replenished every 3-4 months depending on the rate of depletion.

Compressor Controls: Air compressors become inefficient when they are operated at significantly below their rated scfm output. To avoid running extra air compressors when they are not needed, a controller can be installed to automatically turn compressors on and off, based on demand. Also, if the pressure of the compressed air system is kept as low as possible, efficiency improves and air leaks are reduced.

Plugging Leaks: In many facilities, as much as 40% of the compressed air produced is never usefully applied. Rather, a lot of expensive compressed air simply leaks back into the atmosphere through poorly maintained valves, holes in hoses, and worn fittings. Compressed air at 100 psi that leaks continuously through an 0.25-inch orifice can cost $9,000 a year. Finding compressed air leaks is accomplished using an ultrasonic leak detector that senses the noise compressed air makes as it escapes. Ultrasonic leak detectors are available from the PG&E Energy Center Tool Lending Library.



Application Efficiency: Despite the high cost of making dry compressed air, often it is wasted because it is used inappropriately. Common examples of this include using compressed air for sweeping floors or work spaces, using more compressed air than is necessary to accomplish a task, or simply keeping a compressed air system operating when it is not needed. Each compressed air application should be evaluated to ensure that only the minimum amount of compressed air is used to accomplish the task. Also, regulators and other compressed air controls should be periodically checked for proper operation



Reference:

http://www.pge.com/biz/rebates/express_efficiency/useful_info/compressed_air_guide.html