

Compressed Air Buyer's Guide

Choosing the Right Air Compressors



The Compressed Air Buyer's Guide is an easy-to-read guide designed to explain how to compare and evaluate air compressors and provides consumers with the tools to make any purchase a wise investment that addresses a company's specific needs.

This Guide is divided into three sections.

- Section 1 introduces compressed air basics and provides an overview of the alternative choices in compressors.
- Section 2 focuses on screw compressors, the best choice for many industrial applications. The evaluative process in this section will help consumers make a final selection with confidence.
- Section 3 provides recommendations on the maintenance, service and installation of compressed air systems that will improve their performance and prolong their efficient operation.

Section 1

Compressed Air Basics and Alternative Choices in Compressors

It is understandable why compressed air is often overlooked as a utility. Compressed Air is typically produced within a factory or industrial facility. It does not come from an outside source like gas, water and electricity, which is why it is often known as the phantom utility.

The right compressor, properly maintained and utilized, saves labor, energy costs, and often generates a boost in productivity. With increasing electrical rates and a trend toward smaller maintenance teams, the best choices in air compressors operate with the efficiency and reliability to work better, longer and with less maintenance.

Compressed air is simply common air contained in a smaller space, which increases the pressure. That pressure is measured in pounds per square inch (PSI) and inches of mercury (*HG). For most industrial air applications, the pressure should be between 100 and 175 PSIG (pounds per square inch gauge).

Compressed air is also measured according to the amount of air per unit of time the compressor can produce. This is stated in cubic feet per minute (CFM). An air compressor's power source determines how much air it can deliver at an absolute pressure. For a 15-HP compressor that is approximately 60 CFM at 100 PSIG, while a 100-HP compressor can deliver approximately 475 to 500 CFM at the same 100 PSIG.

Compressed air is a labor-saving utility, since the cost of a compressor and its operations is minimal in relation to the savings and increased productivity. Compressed air offers several advantages compared to electricity and hydraulic. For instance, air compressors have fewer parts and require less maintenance.

FACT:

The cost of electricity for a two-shift operation of a new compressor is more than the purchase price of the compressor during the first year of operation.



How Air Is Compressed

There are two basic methods to compress air: dynamic and positive displacement. The dynamic method uses the action of rotating impellers or vanes to increase the speed and pressure of the air. In positive displacement compressors, successive volumes of air are confined in a closed space. As the space is decreased, the air pressure increases.

One type of positive displacement compressors is the rotary screw. Air is trapped between mating male and female rotors and compressed to the required discharge pressure.

Another type of positive displacement compressors is reciprocating which may be either single-stage or two-stage (multi-stage). Each type may be single or double acting.



Section 2

Comparing Screw Compressors

Rotary screw compressors can offer low initial cost, lower sound levels, require less maintenance and operate simply and efficiently. They serve the majority of industrial applications in the 15-500 HP range.

Low horsepower and demanding applications are an excellent fit for reciprocating compressors. They offer high efficiency for heavy-duty, continuous use.

The evaluation process begins with understanding the factors that influence a purchase.

- Quality factor: Efficiency, reliability/durability and performance.
- Total cost of ownership factor: Compare more than the price of the compressor, since power consumption is 65% of an air compressor's total cost.
- Service & Support factor: Compare manufacturers and distributors.

The Quality Factor

To compare the quality factors of air compressors, it's helpful to understand four parts of a rotary screw machine:

1. Air End Components
2. Other System Components
3. Capacity Control Systems; VFD Drives
4. Drive Methods (direct, gear and belt)

Air End Components

There are three specifications of air end components that are critical to any buying decision.

- Rotor size and speed: Small, high-speed, fast-running air ends and large, slow-running air ends are available in the same HP size, which means each will deliver a similar volume of air at the same pressure. Either one works well; however, larger air ends are typically more efficient.
- Bearings: The distance between rotors limits the size of an air end bearing. A small air end with a smaller bearing is apt to be less durable. Compressors with larger rotors will have larger bearings that last longer. Larger bearings are also less affected by foreign particles that enter the housing.
- Air end/motor connection type: The C or D flange motor connection assemblies keep the motor and air end aligned, reduce vibration and coupling wear and make the operation of the air end smoother.

Other System Components

The air filter, air/oil separator system, air/oil cooling system and control piping also have an impact on performance.

- Heavy-duty air filters with a large surface area and a low filter micron rating of 10 are best.
- An air/oil separator system with a large filter surface area, adequate storage capacity and low oil carryover rates is found on the better air compressors.
- An air/oil cooling system that can reduce air temperature within 15° of ambient and includes a thermal mixing valve are highly recommended.
- Safe, corrosion-resistant, stainless steel control lines and galvanized fittings will provide maximum durability.

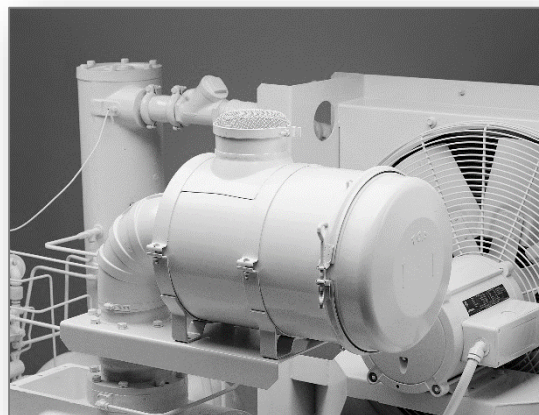
Capacity Control Systems

Since every facility has unique compressed air requirements and energy is the largest cost of operating an air compressor, a compressor buyer wants a unit that can operate at maximum potential in relation to his or her needs and a unit's various load cycles. That is the function of capacity control systems.

They regulate air output when the unit is operating at less than full-load capacity and make sure the compressor is supplying air as efficiently as possible.

Understanding these systems allows for comprehensive comparisons, based on the advantages of a single unit vs. multiple units. It is often beneficial to operate a base compressor at full load and supplement it with additional units to manage load variations.

To select the air compressor with the right capacity control system, first determine the plant load cycle and then evaluate the various types of control systems according to that cycle.



Capacity control systems are of three basic types:

1. Inlet throttling, which can have either a modulating inlet control or an on line/off line control.
2. Rotor length adjustment, which operates with either a turn value or poppet values.
3. Variable frequency drive, which varies the speed of the rotary screw airend to match air supply to air demand.

The turn value capacity control system is more energy efficient than modulating control, which is particularly inefficient at capacities at less than 80%. Combinations of capacity control systems can also be used. Variable frequency drive, often referred to as variable speed, can save even more energy and ultimately cost depending on the application.

Drive Methods (direct, gear and belt)

Rotary air compressors come with a V-belt, direct-driven or gear-driven air ends.

- V-belt driven air ends are typically found on smaller compressors of 50 HP or less, requiring minimal belt maintenance.
- The direct type connects the motor shaft to the compressor drive shaft with a flexible coupling. Without a belt or gear, there are no maintenance and replacement costs. A direct-driven air end is the best type for medium-size compressors, from 50–150 HP.
- If a rotary compressor of more than 200 HP is required, then the gear-driven air end is the best choice. It transmits power both to the motor shaft and the compressor drive shaft.

The Total Cost of Ownership Factor

The major factor in selecting an air compressor is the total cost. This is the purchase price as well as the operating/energy costs and the service costs, including regular maintenance and replacement parts.

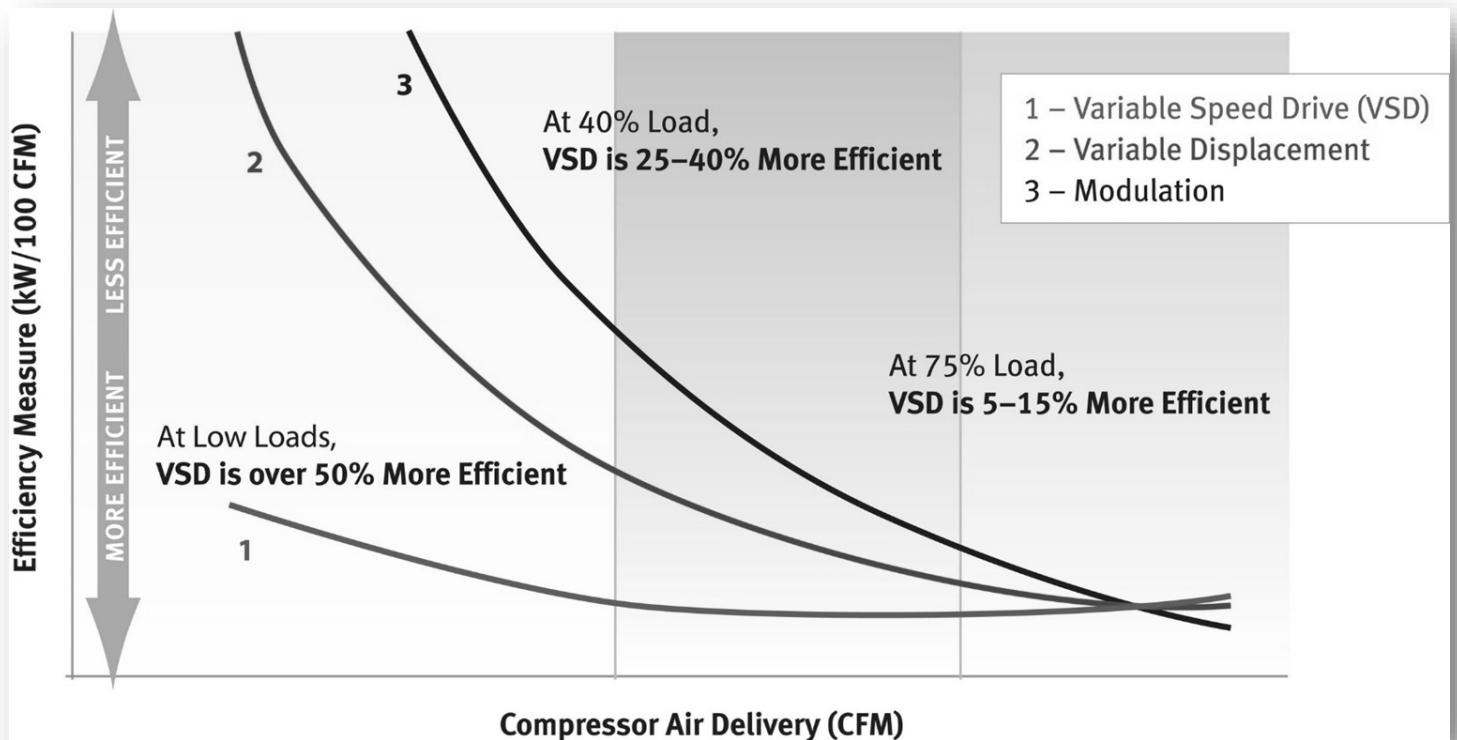
The following equation can be used to calculate yearly energy costs for a base load application:

$$\text{BHP @ full load} \times .746 \text{ kW/BHP} \times \text{electricity cost/kWh} \times \text{hours of operations/yr}$$

The Service and Support Factor

Service and support have a direct bearing on the total costs of the air compressors under consideration. Every compressor buyer should ask the following questions and many others:

- How solidly do the manufacturer and distributor back their products?
- Do they have factory-trained technicians?
- Are parts available?
- How good is the warranty?
- What stipulations are placed on extended warranties?



Section 3

Compressor Maintenance, Service and Installation

Choosing the right air compressor also means choosing the company that does more than just sell the unit. Typically, air compressor manufacturers and distributors that stand behind their products offer a solid warranty, support their customers during installation, are available to answer maintenance and service questions and provide all the parts and products required for the long-term operation of their compressors.

Proper compressor maintenance will enable any unit to operate at peak efficiency and at reduced cost. The owner's manual is recommended as the first source of precise information on appropriate compressor care and maintenance. As with other well-made machines, compressors signal impending trouble well in advance of failure. Addressing smaller problems as they arise will help prevent large ones from occurring.

- During installation, the top manufacturers and distributors will suggest methods to avoid putting various types of strains on the system; to install pipes, so they drain toward a drop leg or moisture trap; and to plan for emergencies.
- The wise compressor buyer will want to do business with a manufacturer and distributor that share energy-saving tips for compressor operation. For example, the loss of 2 PSIG of compressed air equals approximately one percent of total energy costs; or a compressor will operate more efficiently with a clean inlet filter, which should be cleaned every 50 to 150 hours, depending on dust conditions.
- The pros also know the right compressor lubricants to use. Synthetic lubricants are generally recommended; and although they are more costly, they are worth the investment because they improve operating efficiency and safety conditions and lower the cost of maintenance.
- The best manufacturers and distributors also share vital maintenance recommendations. These include inspecting and replacing the inlet filter regularly, which reduced component contamination and air end wear; troubleshooting unusual noises and vibrations whenever they occur to correct minor problems and avoid major repairs; and periodically checking all lines, connections and valves for air leaks, which can increase costs and reduce longevity.

Prospective air compressor buyers are encouraged to refer to this Guide throughout the decision-making process to help them make a wise investment in equipment that is vital to the success of their companies.

