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CAGI
Compressed Air & Gas Institute

FAQs

Frequently Asked Questions – Sizing for Compressed Air Supply

Q: How do I estimate the leak load of my system?

A: There are several ways to determine leak loads in compressed air systems. This can be done easily if there are periods of no production, such as weekends or holidays. Methods include:

1) Install (per manufacturer's instructions) a flow meter in the main discharge line and read the amount of flow with all production equipment off.
2) Calculate the volume of storage in the compressed air system, including piping and receivers. Raise the pressure of the system to the unload point of the compressor(s). Turn the compressor(s) off and time the drop in pressure to some lower pressure. The rate of pressure drop can then be used to calculate the flow, and therefore, the leak rate. It is recommended that the pressure only be allowed to drop 10 PSIG as the leak rate will change with changes in pressure.
3) With all production equipment off, and the compressor(s) on, read or estimate the flow being produced to hold a steady pressure in the system. This can be done by timing the load and unload cycles, measuring the vacuum level below the inlet valve plate on modulating compressors (only on some models), or determining the speed of variable speed compressors. Use the rated capacity of the compressor when calculating the flow.

When there are no periods when production is down, the best way is to use an ultrasonic leak detector to examine all connection points on both the supply and demand side of the system. The smallest leak that can be heard in a quiet environment without a leak detector is 8 to 10 CFM. If leaks can be heard during production, the leak rate is substantially more than that.

Q: What is a good safety margin?

A: A good safety margin is one that prevents pressures and flows from falling below the demand required. Sizing the initial system will depend on whether the demand side will be dominated by a relatively steady process requirement or whether it will be dominated by intermittent users. A relatively steady process can be safe with a small safety margin, or fudge factor. In the case of intermittent users, there is the possibility that several processes could happen at the same time and require substantially more flow than a calculated average. Perhaps the most important consideration concerning a safety margin is what happens if a compressor fails. Having a backup compressor can help in the event of a compressor failure and can also cover periods when several intermittent users are demanding air at the same time. Keeping track of the use of the backup compressor can be used to determine when an additional compressor might be needed. In multiple compressor applications it is important to remember to use a master controller. Compressors manually turned on during peak demand periods are often left running when demand drops.

Q: Are there any potential issues with oversizing a compressor installation?

A: Oversizing a compressor can potentially cause problems depending on the type of compressor used and the combination of machines in the installation. For some types of machines, running at low duty cycles or low load levels is not optimal for reliability. (refer to the next question)

Q: What is the best technology for my application?

A: First, consider pressure and flow requirements to determine what technologies meet your criteria. At typical plant operating pressures, reciprocating and scroll compressors are generally available up to about 125 CFM. Rotary screw and rotary vane compressors can be found in the range of 8 CFM to over 3000 CFM. Dynamic compressors (centrifugal and axial) range from as low as 500 CFM to tens of thousands of CFM. Pressures over 200 PSIG may require a specialized compressor or a combination of technologies.

Then, consider duty cycle. If compressed air is only used half of the day or less, a reciprocating (piston) compressor is the best choice. Generally, pressures under 100 PSIG can be handled by a single-stage reciprocating compressor and use multi-stage compressors for pressures over that. Most reciprocating compressors have a "duty cycle". This means that they can run loaded for some period of time and then need some time unloaded or off to cool. Rotary screw, rotary vane, scroll, centrifugal, and axial compressors are all designed to run best fully loaded all of the time. Running these types of compressors at low duty cycles or low load levels is not optimal for reliability. If there are large swings in demand, it is better to use multiple smaller compressors than one large compressor that would run lightly loaded much of the time. Consult a CAGI member or representative for assistance with technology selection.

Q: What is the best way to account for variations in demand when specifying equipment?

A: The most common ways of dealing with variations are by using a variable speed driven compressor combined with multiple smaller fixed speed compressors. It is important to use a master controller with multiple compressors to ensure efficient system operation. Other options may be as simple as adding storage to the system. In some cases, properly sized storage with a system flow/pressure controller can maintain a steady system pressure through large swings in system demand.

Q: What do I need to know about air treatment equipment when sizing my compressors?

A: The ultimate air quality requirement will determine the air treatment used. The drier and the cleaner the air quality requirement, the more pressure drop there will be across filters and possibly dryers. Keep in mind that drying and filtering air beyond what the system requires, unnecessarily adds to the operating costs of dryers, filters, and compressors. Drying to dew points below freezing will require a desiccant dryer. These dryers use purge air during their regeneration cycle. A heatless desiccant dryer typically purges 15% to 18% of its rated capacity. A heated desiccant dryer has a typical purge flow of about 8% of its rated capacity. For these types of dryers the compressors will have to be sized with that loss in mind. For dew points above freezing, a refrigerated dryer may be used and requires no additional compressed air for purge. It is also important to look at the pressure drop through the filters in the air treatment system. The maximum compressor operating pressure will have to take into account the pressure drop through dirty filters and through the dryer. Some dryers also contain filters so do not forget to include those. Add all of the anticipated pressure drops to the minimum system pressure requirement to determine the pressure requirements on the compressor.

Q: When should a compressed air specialist be consulted?

A: Before installing or modifying a compressed air system, no matter how small or large the system is, a compressed air system specialist should be consulted. Specialists can assist in determining the type of compressor, dryer, piping/distribution system options and other features for your system to ensure that your system operates safely and efficiently.