COMAIRCO
COMPRESSED AIR SPECIALISTS
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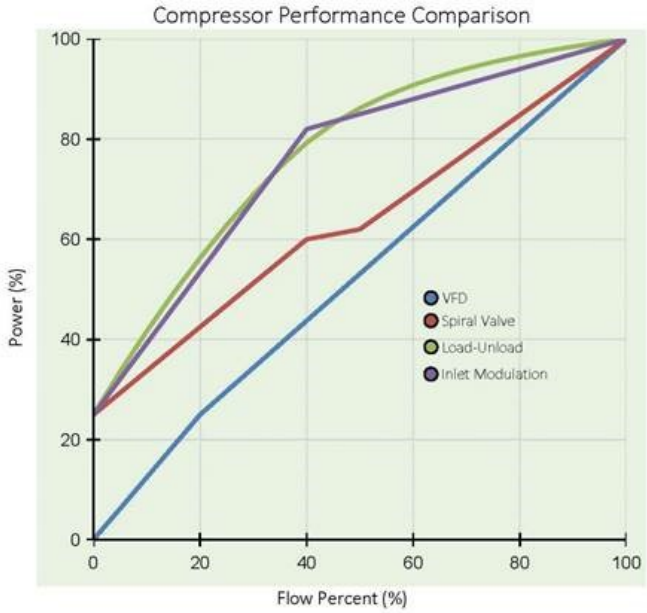
ARE VARIABLE SPEED AIR COMPRESSORS SUITABLE FOR ALL FACILITIES?

When managers and executives look over their sites to find energy savings their compressed air systems always stand out. Compressed air is a necessary evil for many industries: a vital utility, but also a huge expense. As expensive as purchasing and maintaining an air compressor can be, the cost to power that compressor will be three times as much!

While there are many technologies on the market that can yield significant energy savings, many of these technologies have been developed for clean environments and cannot stand up to the excessive heat, dust, oil mists, or fumes, that are found in many environments. So before buying anything it's important to understand how you can save energy without hampering reliability.

The most common type of industrial air compressor is the lubricated rotary screw. These are oil-injected, positive displacement compressors, designed for very little mechanical wear or internal corrosion. At full load flow, the specific power is typically 17 kW/100ACFM at an operating pressure of 100 psig, but when partially loaded the specific power will depend greatly on the compressor control system. The following graph compares the performance of four different control types from 0% to 100% full load flow.

This graph clearly shows that variable speed compressors offer the best part-load performance of the four control types. These compressors use a variable frequency drive (VFD) to vary the speed of the compressor's main motor. However, it should be considered whether this is appropriate technology for the conditions at your facility.



On top of the heat load produced by heat of compression, the VFD produces its own heat load that must be removed to protect the drive from premature failure. In fact, most variable speed compressors won't even run if the VFD temperature is too high. This heat load is removed via an aluminum heat sink and small cooling fans, and so the quality of the ambient air is vital to the long-term health of the VFD.

If the heat sink becomes coated in dust or oil mists its performance will quickly degrade. Even in a relatively clean environment, estimated VFD life is 7 years, which will typically fall outside the manufacturer's warranty period. Replacing a VFD could easily cost 25% of the cost of a new compressor, which can kill any ROI expected from energy savings.

Keeping this in mind, consider the relative merits of the spiral valve technology. This is a mechanical solution, a single valve driven by either a rack and pinion mechanism or a stepper motor, so the quality of the ambient air will not affect the reliability. The energy efficiency is nearly equal to VFD above 50% load, and the cost is much lower.

Consider the following example system at 200HP, where the existing compressor is using inlet modulation controls. The following table shows the annual energy usage and cost for each compressor, assuming an average flow of 700 ACFM, 24/7 operating hours, and $0.10/kW energy rate.

Control Type	Annual kWh	Energy Cost	Energy Savings	ROI
Base Case	1,382,710	$138,271	--	--
Spiral Valve	1,149,800	$114,980	$23,291	5.0 years
Variable Speed	1,084,447	$108,445	$29,826	5.5 years

The VFD compressor has the lowest energy usage, as expected, but the spiral valve system is not far behind. While the VFD saves 28 % more than the spiral valve system it will cost at least 30 % more to purchase, and so the ROI will be about the same. With the spiral valve compressor, we also don't have the risk of a premature drive failure, which would significantly increase our costs.

When considering major changes to your compressed air system it is important to make careful considerations of all the options available. The first step in this is to conduct a compressed air audit on your system and discuss the pros and cons of each option with your auditor.

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