Lubricant-injected rotary screw compressors provide continuous flow without the pressure pulsations typically associated with reciprocating compressors. (Two-stage rotary screw compressors are usually more efficient than single-stage units.)

In general, the efficiency of rotary screw compressors falls off at part-load. A wide range of models and styles are available from various manufacturers. Users should select units that are most efficient based on their specific application/installation requirements. While it's good to compare different styles of compressors at full load, if yours will be operating at partial loads for significant hours, you should carefully consider the energy implications of the compressor-control mode.

Compressor-control mechanisms are used to match the compressed air volume and pressure delivered by the compressor with facility demand. Compressor controls and available storage receiver capacity are often the most important factors determining a compressor's ability to perform efficiently at part load. Controls are frequently chosen and configured poorly. Use of proper control strategies can lead to substantial reductions in energy consumption.

Control types in order of efficiency at part load…

Modulation (throttling) is inlet control that varies the output of a compressor to meet flow requirements. This is the least-efficient mode of operation for part-loaded compressors.

Load/Unload (also known as constant-speed control) allows the motor to run continuously, but unloads the compressor when the discharge pressure is adequate. Various strategies are used for unloading a compressor, but in most cases, an unloaded rotary screw compressor will consume 15 to 35% of full-load horsepower while delivering no useful work. As a result, some load/unload control schemes can be inefficient, especially when system-storage receiver capacity is small.

Auto/Dual provides modulation to a preset reduced capacity, followed by unloading with the addition of an overrun timer to stop the compressor after running unloaded for a pre-set time.

Variable Capacity controls allow some lubricant-injected rotary screw compressors to vary their compression volumes (ratio) using sliding or turn valves. These controls are generally applied with modulating inlet valves to provide more accurate pressure control with improved part-load efficiency to about 50% load, using load/unload mode at lower flows.

Variable Speed control is possible via integrated variable-frequency AC or switched-reluctance DC drives. Compressor discharge pressure can be held to within +/- 1 psi over a wide range of capacity, allowing significant additional system energy savings. This type of control is not appropriate for significant full-load operating hours.

Start/Stop control mode is typically used only for applications with very low-duty cycles in the 30 hp and under range. The advantage of this: Power is used only when the compressor runs. Some compressor controls can automatically choose this mode, if safe to do so.

Learn more about this topic in *Best Practices for Compressed Air Systems,* available at www.compressedairchallenge.org
. There, you can also learn about a February Web-based compressed air fundamentals seminar and other in-person training opportunities across the country.
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