Large refrigeration systems often contain multiple compressors operating in parallel. These compressors can be controlled to maximize the efficiency of the entire system. This is particularly important with screw compressors. Based on University of Wisconsin research, one large refrigerated warehouse in Wisconsin could save 5% to 15% annually by improving compressor control.

**PART-LOAD PERFORMANCE**

**Screw compressors**
Most screw compressors can modulate their capacity from 10% to 100% of full load. This is most often accomplished by using a slide valve to shorten or lengthen the suction volume. A typical screw compressor unloading curve is shown in Figure 1. Below about 50% of full-load capacity, the efficiency of a screw compressor decreases significantly. At full-load capacity, screw compressors generally perform better than reciprocating compressors, though their performance decreases at part-loads. This means that proper sizing and control is critical.

**Reciprocating compressors**
Reciprocating compressors unload more linearly than screw compressors. A typical unloading curve is shown in Figure 1. At full-load, reciprocating compressors do not perform as well as screw compressors, especially as the refrigeration temperature is lowered. However, reciprocating compressors are better suited for systems that have high load variability.

**OPTIMAL LOAD SHARING**
If there are two compressors in your refrigeration system, how you split the load between them can affect both energy use and operating costs. The following rules assume that the two compressors have a similar design.

**Screw compressors**
*Equal-sized compressors.* For system loads less than 65–70% of full capacity, the load should be split equally between the two compressors. Once the system load is greater than 65–70% of full capacity, one compressor should be fully loaded and the other should meet the balance of the load.

*Unequal-sized compressors.* Because screw compressor performance deteriorates at less than 50% full-load, try to avoid running any individual compressor at less than 70% load. For intermediate loads, the smaller compressor should be fully loaded. For large loads, the larger compressor should be fully loaded. Further research is needed to develop guidelines if the side-inlet economizer ports are active. However, the general rule still holds that these compressors should be as fully loaded as possible.
Equal-sized compressors. Reciprocating compressors have little performance degradation when unloaded, so the relative load distribution between two equal-sized compressors is not very important. Splitting the load to equalize pressure losses in the dry suction line yields the optimal performance because this will minimize suction line losses.

Unequal-sized compressors. When unequal-sized reciprocating compressors are running in parallel, the load should be split proportionally to minimize the pressure drop in the dry suction lines.

Screw and reciprocating compressors used together
When both reciprocating and screw compressors operate together, baseload the screw compressor and use the reciprocating compressor to meet the varying load.

LEARN MORE
Find out more about performance optimization of industrial refrigeration systems:


Learn other ways to save compressor energy in the fact sheet Cutting Energy Waste in Large Refrigeration Systems.