METROPOLITAN NY CHAPTER
Refrigeration Service Engineers Society

Continuing Education for the HVAC/R Industry

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October 2015

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Oil Management on Multiple Compressor Systems

When multiple compressors are piped together with a common suction and discharge header such as with the arrangement of a parallel rack configuration, oil return to each compressor is a major concern. Typically, oil recirculation rates are dependent on three factors:

1) Compressor's run time;
2) Size of the compressor;
3) Wear on a compressor – a worn compressor will circulate more oil per pound of refrigerant pumped per hour.

On a parallel rack each of these factors affects how oil is returned to individual compressors. Not all compressors operate at the same time, so run times will affect how oil is returned to individual compressors. Ideally, the same amount of oil pumped from a compressor will be returned to that compressor. This typically will not occur, as multiple compressors are cycled "off" and "on" at differing rates.

The size of the compressor is also a factor in how much oil recirculates. A new properly functioning reciprocating compressor will circulate approximately 1% to 3% of oil per pound of refrigerant pumped every hour. A typical 15-HP compressor operating at 110°F condensing temperature with a 15°F evaporator recirculates approximately 1,790 pounds of refrigerant an hour; or, at a 1 percent recirculation rate, 17.9 pounds of oil. A typical 5-HP compressor operating at the same conditions recirculates approximately 445 pounds of refrigerant per hour; or, at a 1 percent oil recirculation rate, 4.5 pounds of oil per hour. Some rack systems are built with varying size compressors, so the overall recirculation rate is not evenly divided among all the compressors. Some of the compressors may get more or less oil returned.

All compressors eventually wear. This affects the oil circulation rate of a compressor. For instance, as our 15-HP compressor wears, its pumping rate can easily increase to 5%, meaning our original recirculation rate of 17.9 pounds per hour will increase to 89 pounds of oil an hour.

If no other components are added to this system, oil will return to each compressor at different rates. This will cause the oil level on some compressors to become too low, while other compressors will become overcharged with oil. Both scenarios can lead to compressor damage, resulting in a failed compressor.

To ensure each compressor maintains the correct oil level, an oil separator, reservoir and oil level controls are added to the rack.

The oil separator is used to limit the amount of oil in circulation. It is designed to separate a major portion of the oil from the refrigerant as it is pumped from the compressor. As the refrigerant/oil mixture is discharged from the compressors to the discharger header, it travels to the oil separator. The velocity of this mixture is slowed down by the use of internal baffles and impingement screens. Slowing it down causes a major portion of the oil to drop out of the mixture and fall to the bottom of the oil separator.

At the bottom of the oil separator is a float assembly connected directly back to the oil reservoir. As the oil level at the bottom of the separator increases, the float will cause a valve to open and send oil to the reservoir. The purpose of the reservoir is to store oil not currently needed by the compressors.

To limit the pressure of the oil and vapor in the reservoir, a copper line with a spring-load check valve that is attached between the top of the reservoir and the suction header. This check valve has a 20 psi setting and will permit the high-pressure vapor coming from the separator to the reservoir to bleed off to 20 psi above the suction pressure. From the oil reservoir another refrigerant line is connected to each oil level float assembly directly connected to each compressor. Each compressor has its own float assembly which feeds oil to the compressor as needed to maintain a proper oil level. The 20 psig difference in pressure will cause the oil to flow from the float assembly into the compressor's crankcase when the float opens. This control will "make up" for oil that is not returning through the suction manifold. On a properly balanced system, a large percentage of oil returns to the compressor through the suction line. The oil level control will make up for moderate differences in compressor oil pumping rates due to size or wear, different oil return rates due to turbulence in the suction manifold and for compressors which are cycling "off" and "on" at different rates.

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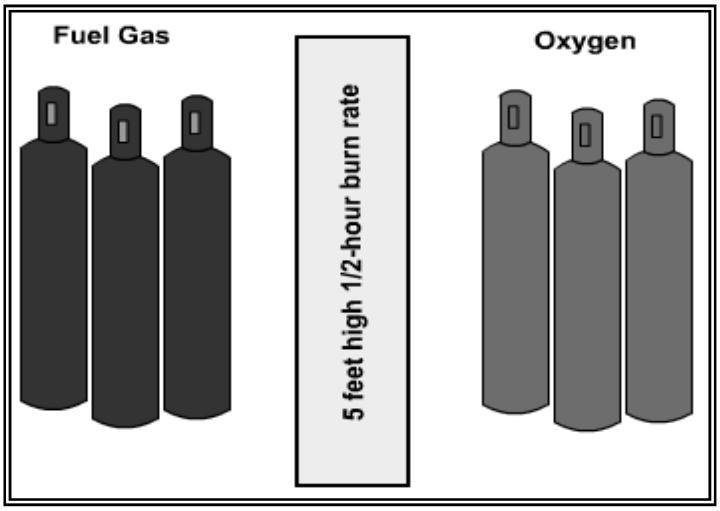

Wednesday October 14th, 2015 at 7:30pm

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By

Howard Kellman—The Edison Company

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