

METROPOLITAN NY CHAPTER Refrigeration Service Engineers Society

Continued Education for the HVAC/R Industry

“Better Service Through Knowledge”

October 2008

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REFRIGERANT MIGRATION

A common cause of premature compressor failure is excessive migration of refrigerant vapor to the crankcase of the compressor during the off cycle. The problem with this is that the refrigerant vapor can condense back into a liquid, mix with the oil and dilute its lubricating properties. On start up the oil/liquid refrigerant mixture is then used to lubricate the bearing surfaces within the compressor. This mixture—being a poor lubricant—causes wearing of the bearing surfaces within the compressor. Depending on the percentage of liquid refrigerant to oil, the bearing wear could be mild to severe. If a sufficient amount of refrigerant has returned to the compressor, it may be possible on start up for liquid to enter the cylinder(s) of the compressor and cause further damage to the compressor as it attempts to compress a liquid.

Refrigerant migration occurs as a result of a difference in vapor pressure between the oil in the crankcase of the compressor and the refrigerant vapor in another part of the system. Normally the refrigerant vapor migrates back from the system's evaporator through the suction line during the off cycle. The greater the pressure difference between the refrigerant vapor in the evaporator and the oil vapor in the compressor, the more likely migration will occur. Migration will continue until there is no pressure difference between the refrigerant vapor in the evaporator and the vapor pressure of the now refrigerant/oil mixture in the crankcase of the compressor.

Normally refrigerant migration is associated with a temperature difference between the refrigerant in the evaporator and the oil in the compressor. This is true because as the temperature of a liquid decreases so does its vapor pressure. If the oil is cooler than the refrigerant in the evaporator, there will be a sufficient

enough difference in the vapor pressures to cause the refrigerant to migrate back to the compressor. Even when there is no temperature difference, some migration may occur. At same temperature refrigeration oil tends to have a lower vapor pressure than refrigerant.

To prevent migration from occurring, it is common practice to keep the oil at a higher temperature than the refrigerant in the rest of the system during the off cycle. This is usually done with some type of resistive crankcase heater. There are several types of crankcase heaters commonly used: a heater can be strapped around the belly of the compressor (commonly referred to as a “bellyband heater”), or a heater can be directly immersed in the oil of the compressor. Another method commonly used is to allow a small controlled current to flow through the start winding and run capacitor of single-phase compressor during the off cycle. Whichever type or method is employed it is important not to overheat the oil—always contact the compressor manufacturer for their recommendations.

Crankcase heaters may not work effectively in applications where the crankcase of the compressor is exposed to extreme cold temperatures. The extreme cold temperatures may overpower the crankcase heater. On these systems a positive way to prevent migration is to incorporate a pump down cycle into the design of the system. This will pump most of the refrigerant out of the evaporator during the off cycle.

Severe refrigerant migration can lead to certain compressor failure, but it is preventable. When deciding how to best to prevent refrigerant migration, it is usually best to follow the guidelines published by the compressor and system manufacturers. <<

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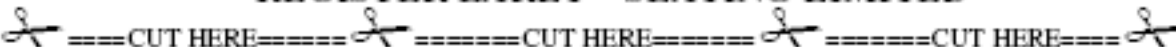
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WE NOW HAVE OUR OWN WEBSITE: WWW.METRONYRSES.ORG CHECK IT OUT

Refrigerant Piping Considerations

When selecting and installing refrigeration piping, the following list of items should to be considered in order to ensure a trouble-free installation:

- Assure the proper amount of refrigerant is fed to the evaporator(s).
- The refrigerant lines should be of sufficient size to prevent an excessive pressure drop.
- Allow for proper oil return to the compressor.
- Prevent liquid refrigerant from returning to the compressor during the off cycle.

COMING EVENTS

Compressor Starting Issues
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If you have any suggestions or requests for future programs, please let us know!

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