TECHNICALLY SPEAKING

By Ed Brink, Meier Supply Training and Technical Specialist

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Meier Supply Co., Inc., 123 Brown Street, Johnson City, NY 13790

www.MeierSupply.com EBrink@MeierSupply.com 607-797-7700

Compressor Overheating

There are many reasons why a compressor fails: Refrigerant Flood Back, Lack of Lubrication, Flooded Starts, Liquid Slugging and Overheating. All can cause premature failure of compressors. Fortunately for us, each has a specific cause and identifiable wear patterns or failure characteristics. This bulletin will focus on causes of compressor overheating.

Overheating is caused when the compressor discharge temperature taken 6" from the outlet of the compressor is in excess of 225°F. At 250°F the compressor is in danger of causing permanent damage and at a temperature of 275°F and above, failure of the compressor is likely.

It is recommended that the discharge superheat not exceed 225°F (taken 6" from the outlet of the compressor) and is measured under lowest load conditions using a contact thermometer or heat tape.

When a compressor is running in an overheated condition for a prolonged time, the compressor's life decreases dramatically. The excess heat created in the discharge portion of the head makes the oil break down, causing the oil to lose its lubricity – during this process, acid and carbon are created. This causes premature wear of the rings, cylinder walls and motor windings. When the rings wear down, this can cause the crankcase to become pressurized. On compressors that utilize an oil return check valve, this pressure causes the crankcase check valve to close. When this valve is closed, it causes oil to collect in the motor section and the oil level in the crank case to drop. When the compressor cycles off, the pressures in the compressor equalize and the check valve opens. When this happens, the oil level in the sight glass will rise as the oil stored in the motor section enters the crankcase. Overheating also causes discoloration of the valves, piston head and the discharge portion of the valve plate. If the condition is severe enough carbon residues will be deposited on the compressor components.

There are many reasons why a compressor overheats including high compression ratio, high superheat, high discharge temperature, misapplied refrigerants and inadequate compressor cooling.

Let's briefly look at each of these causes:

Compression ratio is defined as Absolute Discharge pressure divided by Absolute Suction pressure. Compression Ratio changes depending on application; Low temperature applications have a higher compressor ratio than High temperature compressors. Compression ratio is affected by a drop in suction pressure or a rise in head pressure. The compressor is less tolerant of lower suction pressures than a slight rise in head pressure. So, in order the keep the compression ratio down and prevent overheating, the suction pressure needs to be maintained. There are many factors that cause low suction pressure, which in turn cause high compressor ratios and lead to

overheating. If you suspect the system is operating with a low suction pressure – as a start, check for misadjusted TEV, undersized or dirty evaporators, improper charge or system restrictions.

High suction gas temperature can cause overheating (high in = high out). Your first step is to check the evaporator superheat and make sure that it is within the manufacture's specifications. Then check total superheat at the inlet of the compressor. If high, this needs to be addressed. To determine the minimum and maximum return gas and superheat required for a specific compressor, refer to the manufacturer's published operating envelope data. If you need assistance getting this information, check with your local Meier Supply representative. In certain applications where an uninsulated suction line runs through a hot space, it may be necessary to insulate the suction line to help cool the compressor.

Keeping the compressor cool is vital to extend the life of the compressor. If the compressor is **refrigerant cooled**, this is accomplished by maintaining proper compressor superheat and the use of head cooling fans when saturated evaporator temperatures are below 0°F. These fans move approximately 1000CFM of air across the compressor to keep it cooled. On **air cooled** compressors, the compressor is cooled mechanically by the condenser fan. The condenser fan moves air across the compressor at approximately 650CFM to cool the compressor. If a condensing utilizes multiple fans and a fan cycling switch is added to maintain head pressure in low ambient condition, it is recommended NOT to cycle the fan that pulls air directly over the compressor, doing this will cause inadequate cooling of the compressor and possible cause overheating.

In conclusion, when a compressor is running with discharge temperature in excess of 225°F the compressor is in danger of overheating. When a field tear down is performed, overheating is identifiable by discolored or carbon buildup on valve plates, pistons tops and valves, worn rings, scored cylinder walls and a pressurized crankcase.

In order to prevent the compressor from overheating: the compressor has to be adequately cooled, compression ratios need to be kept to a minimum by keeping suction pressure as high as possible and head pressures low, proper superheat needs to be maintained, equipment must be properly sized and the refrigerant must be matched and approved for the application.

Next month's article will focus on slugging.

**** For additional support contact Meier Supply at any of our locations ****

If you have any questions, please contact:
Ed Brink, Meier Supply Technical and Training Specialist
email: EBrink@MeierSupply.com
phone: 607-797-7700

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