TROUBLESHOOTING A/C SUPERHEAT, SUB-COOLING & DELTA

In order for our personnel here at Gorman Industries to help you solve air conditioning problems we need some help from you. Giving us the Superheat, Sub-Cooling and the Temperature difference across the coil of a system can help save you lots of time. It is a well known fact in the industry that a large percentage of compressors being replaced are replaced due to improper diagnosis, not compressor failure.

All of the steps below should be checked before any adjustments are made.

To Determine Superheat:

1. Take the low side pressure reading from your gauges and convert it to temperature using chart or gauge.
2. Then take the temperature of the Suction line as close to the condensing section as possible stay at least 6 inches from compressor.
3. Take the difference between the above readings (Suction line temp – Saturation temp)
4. When ambient air temp (Outside air temp) is 75-85 degrees the superheat should be 12-15 degrees, if the ambient temperature is 85 degrees or over the superheat should be 8-12 degrees.
5. If superheat is low then flooding the evaporator. Note: Do not adjust charge yet.
6. If superheat is high then starving the evaporator. Note: Do not adjust charge yet.
7. Do not adjust charge until sub-cooling is checked.

Note: When charging a system using superheat, you are basically charging the unit to the amount of air that is crossing the evaporator.

Note: Do not adjust charge based on superheat on systems with thermal expansion valves (TXV's). TXV's control the superheat. You can, however, check the superheat to see if the TXV is working properly.

To Determine Sub-Cooling:

1. Take the high side pressure and convert it to temperature using chart or gauge.
2. Then take the temperature of the liquid line as close to evaporator as possible before the metering device.
3. Take the difference between the above readings. (Saturation temp – Liquid line temp). Note liquid line temperature at the evaporator should be within 2 degrees of liquid line temp at condensing unit. If not could be restriction or line set too long.
4. Sub-Cooling should be around 12-15 degrees
5. Then using the information from superheat and sub-cooling we can have some idea where to look for a problem.

Example:
Suction line temp is ------- 60 degrees @ condenser
Suction Pressure is ------ 76 psi ---- 45 degrees saturation temperature
60 degrees – 45 degrees = 15 degree superheat

Liquid Pressure is ----------226 psi --------110 degrees saturation temperature
Liquid line temp is ----------95 degrees @ evaporator before metering device

110 degrees – 95 degrees = 15 degree sub-cooling

Possible Diagnosis using Superheat and Sub-Cooling:

If superheat is high and sub-cooling is low:
Charge must be adjusted. System undercharged.

If superheat is low and sub-cooling is high:
Charge must be adjusted. System overcharged

If superheat is high and sub-cooling is high:
Could have blockage in coil, orifice or line set.

If superheat is low and sub-cooling is low:
Orifice could be too big, there is no orifice in the unit of the orifice is stuck and refrigerant is by-passing it.

Superheat is telling you what is going on in the evaporator.

High Superheat = Starved Evaporator

Low Superheat = Flooded Evaporator

Sub Cooling is telling you what is going on in the condenser.

High Sub Cooling = Flooded Condenser

Low Sub Cooling = Starved Condenser

To Determine Delta T (Temperature difference across the coil):

1. While unit is running take the temperature of the air in the supply plenum near the coil (approx 12 inches.)
2. Then, while the unit is still running, take the temperature of the air in the return plenum near the unit.
3. Then take the difference between the above readings.
4. Should be around 15-18 degrees.
5. If to low then coil might not be seated in pan correctly or air bypassing coil. (Assuming superheat and Sub-Cooling are OK.)
6. If too high then you might not be getting enough air across coil. Obviously this can cause the coil to freeze.

Checking a compressor electrically.

Check resistance (ohms) Must remove wires and check directly to compressor or it will back feed through cond fan motor.

Check for open windings.

Common - Run = Medium reading

Common - Start = Lowest reading

Start – Run = Highest reading

So: C-R + S-C should equal R-S

Check for dead short.

Check all terminals to Chassis Ground. You should read nothing (OL) if you get resistance you have a short to ground.