The Root Causes of Compressor Failures: Floodback

By Scott Lanzer | July 7, 2014

Maintenance

I recently stopped by an old friend's house, at which his AC unit happened to be down. He was quick to explain that the AC unit would run fine, until about 4-5 minutes into the call for cooling cycle, in which the indoor blower motor would stop. Knowing that I have been working in the HVACR industry the past 25 years, he asked me to troubleshoot the cause of the malfunction.

In my opinion, indoor fan failure is the worst of the failure modes commonly found in HVAC equipment. If left unchecked, indoor fan failure directly relates to a "floodback" scenario which can lead to a compressor failure. In order to understand this failure scenario a little better, let's take a minute to focus on floodback.

Floodback is simply defined as uncontrolled liquid returning to the compressor while the compressor is operating. Most commonly this liquid is refrigerant that has not boiled off in the evaporator. If the liquid refrigerant entering into the evaporator is not allowed to absorb heat by way of the indoor evaporator coil, it will not receive a change of state to a gas, thus allowing it to return to the compressor as a liquid.

In the case of a scroll compressor, as the liquid enters into the compressor, velocity separation takes place in which the liquid refrigerant is affected by gravity, follows the path of the oil to the bottom of the shell. This liquid refrigerant combines with the oil to produce an oil laden refrigerant mixture. Submersed into oil at the bottom of the shell is the drive shaft oil pickup point. This point is a drilled hole that runs through the center of the entire drive shaft and allows oil, through the use of cross sectioned holes to deliver oil to the bearing surfaces. If this oil laden mixture is allowed to be picked up, (remember refrigerant is heavier than oil) it will be delivered to the bearings. This oil laden mixture containing miscible refrigerant and oil is a poor lubrication mixture and can cause bearing wear to take place.

The air gap between the rotor and stator of the motor is only a few thousandths of an inch, and this can be negatively affected by the wear within the bearings tolerances. If this air gap between the rotor and stator is lost or impacted, the rotor will not rotate correctly causing the motor to essentially become a giant magnet. When this happens, there is a potential for the motor windings to short, causing a motor burn failure.

So what caused the motor to burn? Lightning? Poor wiring? Contactor? Short? Floodback? The answer for this scenario is floodback. But if the technician on the job doesn't realize that the indoor blower is malfunctioning, which causes the domino effect to fail the motor, would he truly understand the solution? This failure is not only limited to an indoor blower malfunction, but any loss of load on the evaporator coil could cause this, blocked air filter, dirty blower wheel, crushed return duct, or the blower motor run capacitor.

In the case of my friend's unit, with the unit power off, I felt the indoor blower motor with my hand. The high temperatures of the motor's casing led me to believe it was tripping on internal overload after 4-5 minutes of run time. I inspected the run capacitor utilized by the blower motor and found it was leaking the dielectric oil from the capacitor casing. Replacing this capacitor solved the problem and prevented the unit from failing from a floodback scenario.

- See more at: http://www.ac-heatingconnect.com/root-causes-compressor-failures-floodback/#comments