Two Stage System Testing

The heat pump system tested in both Stage 1 and Stage 2 to verify operation. More heating and cooling effect is delivered in Stage 2, but Stage 1 is also effective. The Emerson Copeland scroll compressors deliver about 67% capacity in Stage 1 and 100% in Stage 2. The Copeland 2-stage compressor runs in Stage 1 unless the compressor's Stage 2 solenoid coil is energized to close a gas bypass valve located inside the compressor. To achieve Stage 2 operation, 24VAC is supplied to a connector on the side of the compressor.

Note: The connector contains a rectifier that supplies rectified AC (essentially DC) to the internal coil, because a low-current coil needs less voltage to operate on DC than AC.

Testing with the installed Nest 3rd Generation thermostat (and most modern thermostats) runs the system in Stage 1 unless the set temperature is far away from the room temperature (e.g. over 3 °F) or if the thermostat senses that the system is not moving toward the set temperature fast enough.

Pressure measurements are most significant in Stage 2. When running in Stage 1, the HP gas discharge pressure from the compressor will be lower and the LP gas suction inlet pressure will be higher (as compared to Stage 2 pressures). LP or HP pressure cutouts will predominately occur when running in Stage 2.

The Emerson Copeland Application Bulletin AE4-1311 R8A has the following statements:

- A low-pressure cut-out is recommended on all ZPS*K5 applications for the highest level of system reliability. The low-pressure cutout should be set no lower than 20 psig (1.4 bar) for heat pumps and 55 psig (3.8 bar) for air-conditioning units.
- A high-pressure cut-out is not required for UltraTech applications, but recommended for the highest level of system reliability. If a high-pressure cut-out control is used the maximum setting should not exceed 650 psig (45 bar).

Setup for water-source systems, the Miami HP HPX heat pump pressure cutouts are as follows:

- LP cutout: OPEN below 50 psi, CLOSED above 65 psi
- HP cutout: OPEN above 550 psi, CLOSED below 400 psi

When the compressor has been off for enough time for pressures to equalize (i.e. HP and LP are the same or within a few psi) and the system temperature has stabilized (30 minutes or so), the system pressure is essentially a refrigerant thermometer. For example, a system pressure of 160 psi with R-410A refrigerant means that the temperature of the system is approximately 56 °F. This can be determined by looking up the temperature of 160 psi saturated liquid/vapor R-410A refrigerant on an R-410A Saturation Properties Table. **Note:** Some R-410A tables use psig (psi gauge) and some use psia (psi absolute). Absolute pressure is higher than the gauge pressure by the surrounding atmospheric pressure value – about 14.7 psi.