TECHNICALLY SPEAKING

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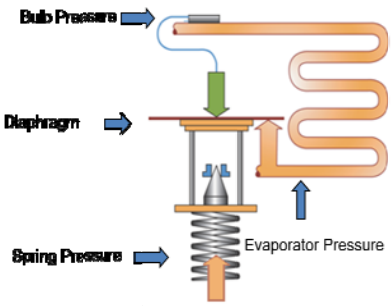
TEV Trouble Shooting

With the increase in SEER ratings of residential air conditioning systems, Thermostatic Expansion Valves (TEV) are becoming more commonplace. I often get calls looking for help on troubleshooting TEV problems. In order to effectively troubleshoot TEV problems the technician needs to have an understanding of the operation and forces which affect the operation of the valve. It is also imperative to have a thorough understanding of superheat, sub-cooling and the measurements required to calculate them.

First let's take a look at what a TEV is. A TEV is a refrigerant metering device that automatically adjusts refrigerant flow over varying loads to achieve complete vaporization of the refrigerant and maintain a constant superheat at the outlet of the evaporator. There are three forces that act on a TEV, each has an effect on refrigerant flow. These three forces are: Bulb Pressure (Opening Force), Spring Pressure (Closing Force), and Evaporator Pressure (Closing Force). Evaporator pressure can be referenced either internally or externally to the valve with the use of an external equalizer line attached to the outlet of the evaporator.



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In order for the valve to maintain the proper superheat the valve must be supplied with sub-cooled refrigerant. Sub-cooled refers to the temperature of the refrigerants below its saturation temperature for the pressure it is under. If a refrigerant is sub-cooled it is 100% liquid and no vapor is present. Sub-cooling is also an indication of how much liquid is in the system. Sub-cooling will vary depending on outdoor air temperature and load on the evaporator. Typical sub-cooling at 95ºF outdoor air temperature with an adequate load on the evaporator is 10ºF.

In order to measure sub-cooling you will need the following measurements: High side pressure at the TEV, (Condensing temperature converted from a PT Chart), and Liquid line temperature at the TEV (measured with a thermometer). **Sub-Cooling** = High side saturation temp. - Liquid line temp.

If the TEV is supplied with the proper amount of sub-cooled liquid it should maintain a constant superheat at the sensing bulb mounted at the outlet of the evaporator. Superheat refers to the temperature of the refrigerants above its saturation temperature for the pressure it is under. If a refrigerant is superheated no liquid is present (only a gas can be superheated). Superheated gas normally exists in the suction and discharge lines. Normal superheat for a TEV depends on its application; here are some normal superheats for different applications:

- Air conditioning 8-15ºF at outlet of evaporator,
- Refrigeration 6-10ºF at outlet of evaporator,
- Low temperature 4-8ºF at outlet of evaporator.

"If a refrigerant is sub-cooled it is 100% liquid and no vapor is present."

In order to measure superheat you will need the following measurements: Suction line temperature (measured with a thermometer near the sensing bulb) and Suction pressure (Low side Evaporator saturation temperature converted from a PT chart).
Superheat = Suction Line Temperature – Evaporator Saturation Temperature.

While most residential TEV are non-adjustable, some allow adjustment of the superheat by changing the spring pressure. Adjustment of the valve is not recommended, but if adjustments are made, the following precautions must be followed:

- Verify that the proper sub-cooling is available
- Allow system to equalize before adjusting superheat
- Wait at least 10 minutes between adjustments
- Make small adjustments
- Head pressure should be raised to simulate an OAT of 90ºF during low ambient conditions (Block condenser discharge air until high side saturation temperature is between 110 -120ºF)
- There must be an adequate load on the evaporator
- Set superheat at design set point for the specific application

In conclusion, troubleshooting a TEV can be quite simple. The first step is to verify that the valve is being supplied with the proper amount of sub-cooled liquid. Then check the superheat of the valve at the sensing bulb. If the superheat is high and there is adequate sub-cooling then the problem lies in or after the valve. If superheat is high and there is no adequate sub-cooling then the problem lies before the valve.

Be sure to read my next newsletter to see a handy reference for troubleshooting TEV's!

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TYPICAL TEST POINT LOCATIONS