

leading off

Rescued by Pressure-Enthalpy



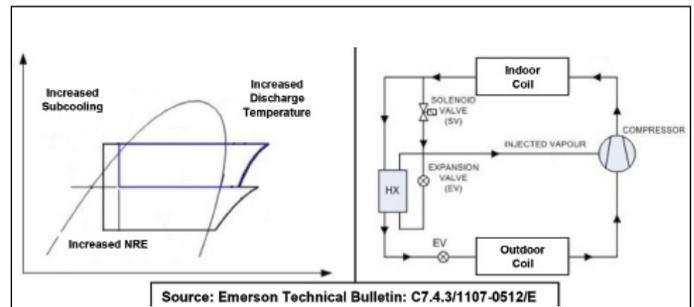
As the push, via incentives, for air-source heat pumps and geothermal for colder climates, especially north of the 49th parallel, increases, we need to look at some of the developments that are giving heat pumps the ability to provide increased heating capacities with higher coefficient of performance (COP) values under low ambient temperatures.

The use of 2-stage compressors came first, using high stage for heating (increasing heating output), while low stage provides necessary cooling without system oversizing.

The next, and by far most versatile design, is the use of a compressor inverter. The inverter allows the compressor to change its speed to match the cooling load while over-clocking the compressor speed during low ambient temperatures to increase the heating output.

The latest technology (adapted from compound refrigeration) is to inject intermediate pressure vapor into the compressor to increase both capacity and COP. The process involves taking liquid from the “indoor coil” which passes through a heat exchanger (HX) where it is “flashed” through a metering device, adding subcooling to the liquid going to the “outdoor coil” while the superheated vapor leaving the HX is injected into the scrolls part way through the compression process, increasing heating capacity at a higher COP. During the cooling mode the injection vapor flow can be stopped to reduce mass flow rate to match the cooling load.

This is where the Ph (pressure-enthalpy) diagram comes to the rescue. Once the system is sketched out and the process plotted—it all makes sense how higher capacity and COP happens as a result of vapor injection.



Source: Emerson Technical Bulletin: C7.4.3/1107-0512/E

⚡ The pressure-enthalpy diagram.

Using the Ph diagram to understand the operating characteristics of a system, and for troubleshooting, is becoming more important as manufacturers find new ways to tweak system designs and maximize the thermodynamic properties of refrigerants to increase capacities and efficiency levels. A little knowledge goes a long way.

Thank you, Mr. Denison, CMS for instilling Ph diagrams into many of us. Cheers! 🍷

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