

## Refrigeration 101: Back to Basics

Whether you're new to Refrigeration or just want to brush up on your basics, the following information may be useful:

### Part One: The Refrigerating Cycle:

Simply put, refrigeration systems solve a problem. The problem is how to convey heat from an area of a given temperature to an area of higher temperature. As a matter of physics, heat never does this on its own. In order to achieve this, a catalyst must be employed to facilitate the "heat transfer." Refrigerants known as HFC's (Hydro-fluorocarbons) are commonly used.

Refrigerants help perform what is called the compression/expansion cycle. Although refrigerants are commonly thought of as gases, they are, for the working cycle, a liquid.

Figure 1 illustrates the thermodynamic cycle of temperature vs. entropy.

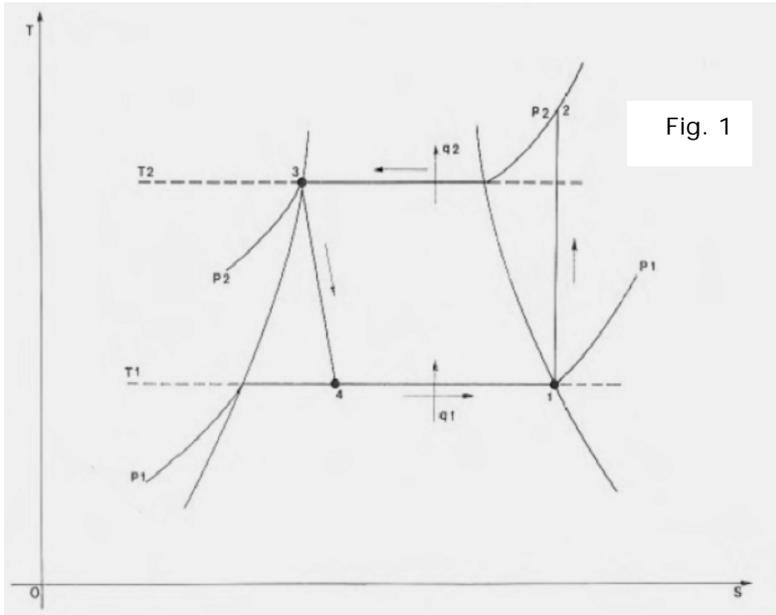
The thermodynamic cycle consists of four phases:

**Phase 1:** Compression of the low pressure vapor from  $P_1$  to the pressure at  $P_2$

**Phase 2:** Condensation of the high pressure vapor ( $P_2$ ) to liquid refrigerant at constant pressure  $P_1$

**Phase 3:** Isenthalpic expansion of the liquid from pressure  $P_2$  to  $P_1$

**Phase 4:** Evaporation of the liquid at constant pressure  $P_1$



The refrigerant absorbs a quantity of heat at pressure  $P_1$  during phase 4 and then gives off the gained heat quantity when it condenses at pressure  $P_1$ . The amount of heat transfer accomplished depends on the electric power used to compress the gaseous refrigerant from  $P_1$  to  $P_2$ .

## Part Two: Basic Components of a Refrigeration Circuit

The components of a refrigeration system, as described in part one (see fig.2), consist of:

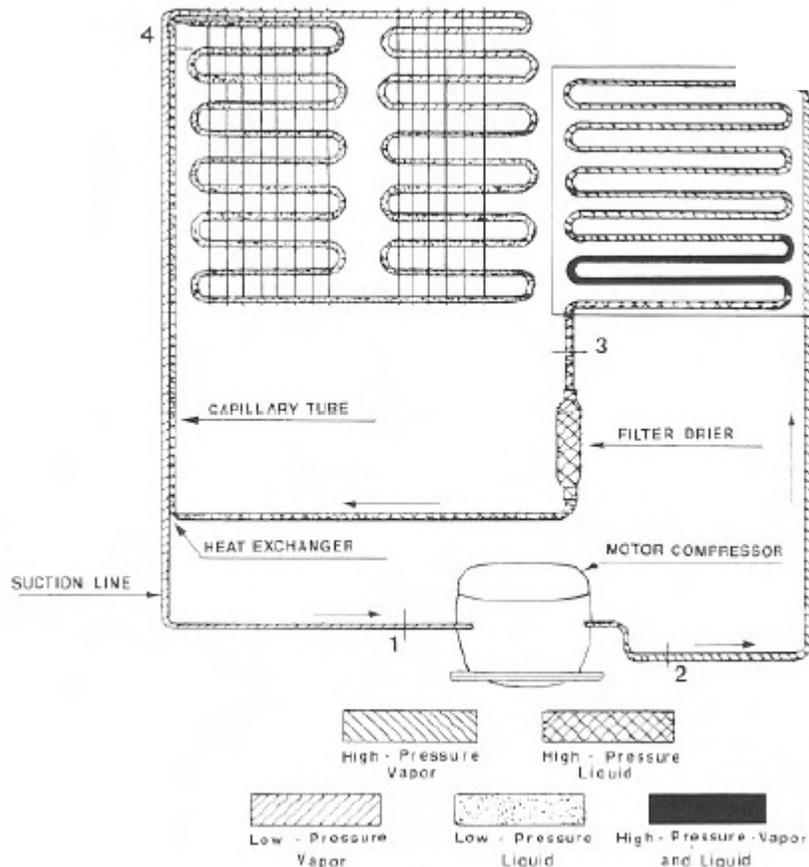


Fig. 2

- Compressor, the purpose of which is to compress the vapor (Phase 1)
- Condenser, in which the vapor is condensed to liquid (Phase 2)
- Filter Drier, which is used to keep the refrigerant free of moisture and other substances
- Capillary tube or expansion valve where the expansion occurs (Phase 3).
- Evaporator, in which the refrigerant boils off and releases the absorbed heat (Phase 4, back to Phase 1).

*This article is excerpted from VTech's publication "High Vacuum and Refrigeration Industry"*