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Refrigeration Compressor Systems transfer heat from an area where it is unwanted to a place where it is unobjectionable. This is accomplished by using an exchange medium (refrigerant) and a compressor to input the work needed to accomplish the heat transfer. This process is known as the refrigeration cycle.

The refrigeration cycle consists of four components:

1. A Liquid Metering Device
2. A Compressor
3. An Evaporator
4. A Condenser.

The cycle begins with the refrigerant in a liquid state at high pressure (see Figure 1). The liquid metering device acts as a valve controlling the amount of refrigerant entering the evaporator, which is at a lower pressure. In the evaporator at lower pressure, the refrigerant changes state (into a gas) by absorbing heat from the area where it is unwanted (load). The refrigerant gas then goes through the compressor, raising its pressure. Next, the high pressure gas discharges the unwanted heat to the unobjectionable place (the atmosphere) by changing states back to a liquid in the condenser. The cycle then begins again.

Refrigeration Types. Although refrigeration units utilizing commercial refrigerants follow the cycle outlined above, there are various types and configurations. The various types are categorized by the mechanical compressor used during the compression portion of the cycle. The majority of units are:

1. Centrifugal
2. Rotary Scroll
3. Reciprocating
4. Screw.

Operational Requirements of Compressors. The compressor operation requires a controller to handle a varying load by increasing the speed of the compressor during high demand. Starting torque must be considered in selecting a drive, as refrigerant density is often much higher at start-up than at operating conditions.

Reciprocating Compressors. Typically, 160% starting torque is required to start the compressor. It is necessary to oversize a standard drive by one horsepower size. Note: Some multi-cylinder reciprocating compressors are equipped with unloaders that would affect this requirement.

Centrifugal, Rotary Scroll, Single-Screw and Twin-Screw. Low starting torques are accomplished by closing discharge valves, sideload valves and pre-rotation vanes at shutdown and opening hot gas bypass valves and liquid refrigerant drain lines. Oversizing of the drives is not necessary, due to the low torque demands at start-up. The OEM installed controller for the unit performs the proper sequence for start-up and shutdown.

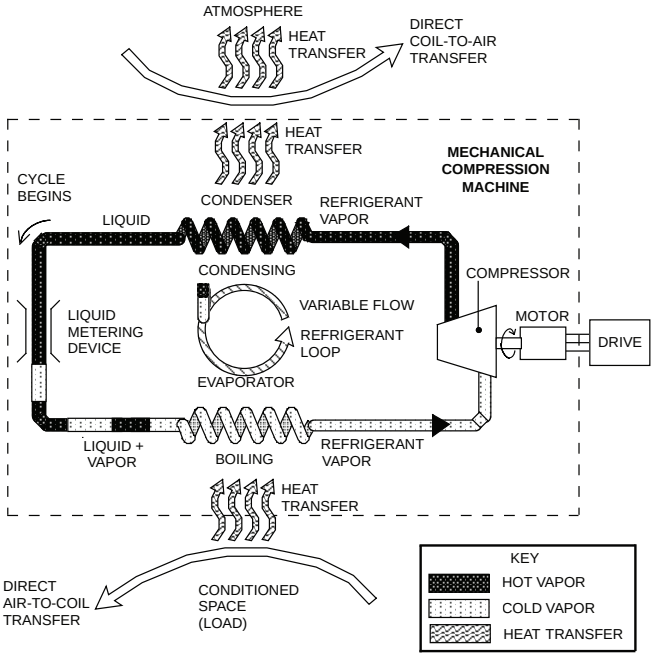

Figure 1. Direct Expansion Configuration

There are also two basic configurations in which the refrigerant cycle is applied. They have to do with how the “cooling effect” is supplied to the desired location. Direct expansion (DX) is the first configuration, which involves placing the evaporator directly in the space requiring cooling. Thus, the refrigerant is directly expanded into the space needing conditioning via the metering device and the evaporator coil. The heat flow path is from the space to the refrigerant to the atmosphere (see Figure 1).

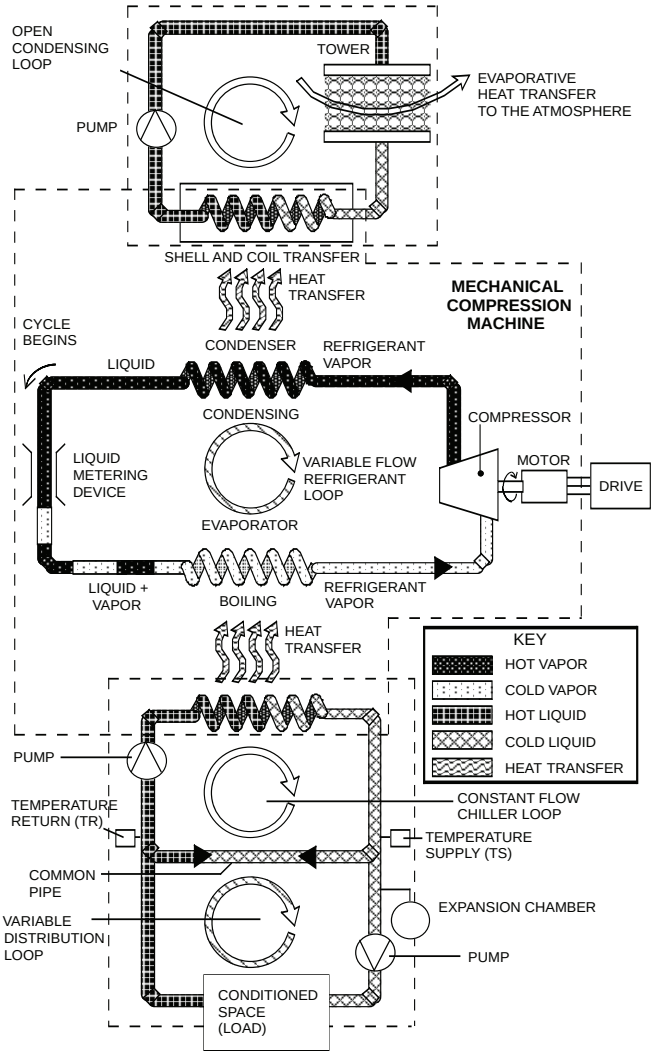

Figure 2. Chilled Water Cooling System

The second configuration is where a cooling medium, such as water, is used to deliver cooling to one or more locations needing it. This is accomplished by utilizing the evaporator to cool the water, which in turn is pumped to the desired locations(s). The heat flow path is from the space to the chilled water to the refrigerant to the atmosphere (see Figure 2).