Review of the Heat Pump Using R-134a Refrigerant

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Abstract-*The heat pump is made in order transfer heat source to heat sink. The heat pump basically consists of a compressor, condenser, expansion valve and an evaporator. Using low operating pressure conditions, we have reviewed the components of the heat pumps.Also the R134a refrigerant has low GDP and low ODP.*

Keywords-heat source, heat sink, low operating pressure

I. INTRODUCTION

A mechanical heat pump basically uses a volatile condensing and evaporative fluid known as 'refrigerant'. In the first stage, it compresses the fluid making it hotter and highly pressurized before sending it to condenser. The condenser rejects the heat which can be stored to heat the space or water. Later it passes through an expansion valveand then to the evaporator where it gains the heat or absorbs the heat from the space or surrounding providing a refrigerating effect.

Many have debated over the usage of the refrigerants causing hazard to the environment. R134a is an ideal refrigerant as it has low GWP and low ODP. Also, use of hermetically sealed compressor has avoided the mixing of oil with the refrigerant.

II. COMPONENTS

Hermetically Sealed Compressor: This eliminates the problem of sealing the drive shaft, and the bearings are simplified. The motor gets cooled by the refrigerant gas. These units have been popular only in very small or fractional KW power application and that also fluorinated hydrocarbon refrigerant.The suction gas gets heated while cooling the motor winding. Therefore, they are most commonly used in domestic refrigerators, room air conditioners etc. Since, the motor is in the refrigerant circuit, the efficiency of hermetic compressor based systems is lower as the heat dissipated by the motor and compressor becomes a part of the system load.

Shell and Tube Type Condensers: Shell-and-tube condensers are the largest power version with a water-cooled condensers with a capacity from 10 up to 10 000 tons. They work on the same principle of "Shell-and-Coils, capacitors; i.e., with water flowing inside the pipes refrigerant flows outside the tube. There is water on the shell side of the condenser and refrigerant is on the tube side of the condenser. Water makes several passes through the condenser, flows along down and back as many times as capacitor design approvals. The other two types of water cooled condenser cannot be disassembled for cleaning. These are Tube-in-tube and shell and coil type condensers.

Tube Type Evaporator: Tubular Forced Circulation Evaporators employs an axial circulation pump which navigates the flow of liquid in a circular motion through the system's heat exchanger in which it is superheated. Thereafter, when the liquid reaches the separator the liquid pressure decreases dramatically, forcing a portion of the liquid to be rapidly boiled off. This design is specifically for products and particulates with a diameter of over 2mm. As the evaporation action occurs only in the separator and not in the heat exchanger, fouling is reduced despite higher levels of turbulence in the design. Alternatively, the circulation pump regulates the liquid velocity flow and optimizes the design parameters.

Capillary Tube: The capillary tube is an expansion device in a refrigeration system. It is the best suitable for a system with less than 3 Tons of refrigeration capacity viz. domestic refrigerators and window air-conditioners. The usual dimensions of a typical capillary tube are 0.5 mm to 2.0 mm internal diameter and 1.0 m to 6.0 m length. Any generalized method is not available to decide the dimension of a capillary tube for a particular system. However, a few correlations with limited applicability are available. The capillary tube has certain benefits viz. easy availability, low price and low initial torque of compressor. The capillary tube in a refrigeration system allows equalization of pressure across the capillary tube during off cycle, which results a low initial torque.

R-134a Refrigerant: CH2FCF3 is the chemical name of R-134a refrigerant.The molecular weight is 102. The freezing point is -101oC. The critical temperature and pressure is 101.30C and 40.56 bar. 1,1,1,2-Tetrafluoroethane is a non-flammable gas used primarily as a "high-temperature" refrigerant for domestic refrigeration and automobile air conditioners. These devices began using R-134a refrigerants in the early 1990s as a replacement for the more

environmentally harmful R-12 and retrofit kits are available to convert units that were originally R-12-equipped. It is also used in plastic foam blowing where it is used as a cleaning solvent, a propellant for the delivery of pharmaceuticals (e.g. bronchodilators), wine cork removers, gas dusters, such as Dust-Off, and in air driers for removing the moisture from compressed air. 1,1,1,2-Tetrafluoroethane has also been used to cool computers in some overclocking attempts. It is the refrigerant used in plumbing pipe freeze kits. It is also commonly used as a propellant for airsoft airguns. The gas is often mixed with a silicon-based lubricant. The color code of R-134a is light blue.

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