

K.S. RANGASAMY COLLEGE OF TECHNOLOGY



TIRUCHENGODE – 637 215



Department of Food Technology

60 FT 603-REFRIGERATION AND COLD CHAIN MANAGEMENT

Components of a Refrigeration System



Evaporator

- Inside the evaporator, the liquid refrigerant vaporizes to a gaseous state. The change of state requires latent heat, which is extracted from the surroundings.
- Based on their use, evaporators can be classified into two categories. **Direct-expansion** evaporators allow the refrigerant to vaporize inside the evaporator coils; the coils are in direct contact with the object or fluid being refrigerated.
- **Indirect-expansion** evaporators involve the use of a carrier medium, such as water or brine, which is cooled by the refrigerant vaporizing in the evaporator coils.

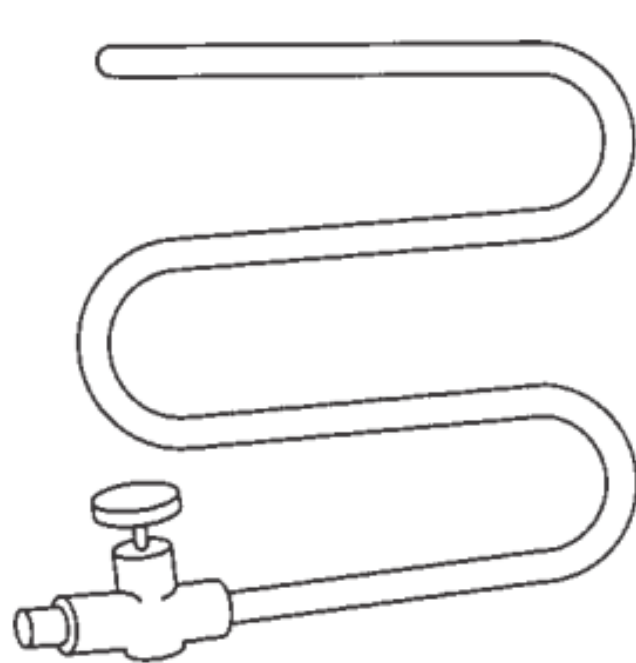


Evaporator

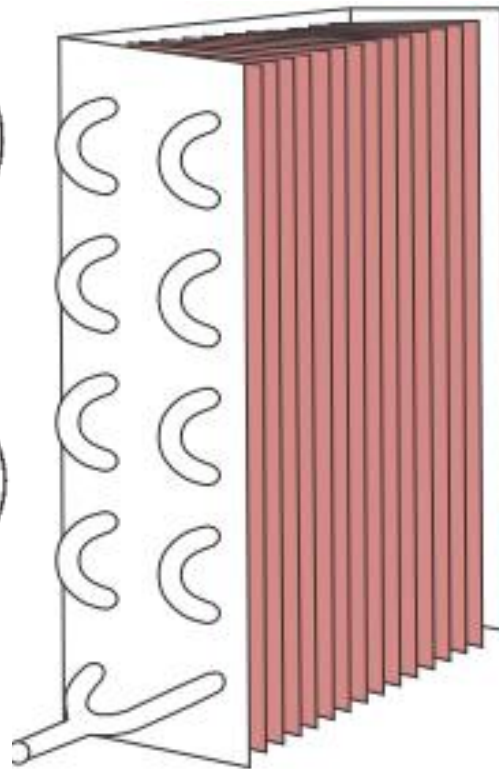
- **The cooled carrier medium is then pumped to the object that is being refrigerated. The indirect-expansion evaporators require additional equipment.**
- **They are useful when cooling is desired at several locations in the system. Water may be used as a carrier medium if the temperature stays above freezing.**
- **For lower temperatures, brine (a proper concentration of CaCl_2) or glycols, such as ethylene or propylene glycol, are commonly used.**

Evaporator

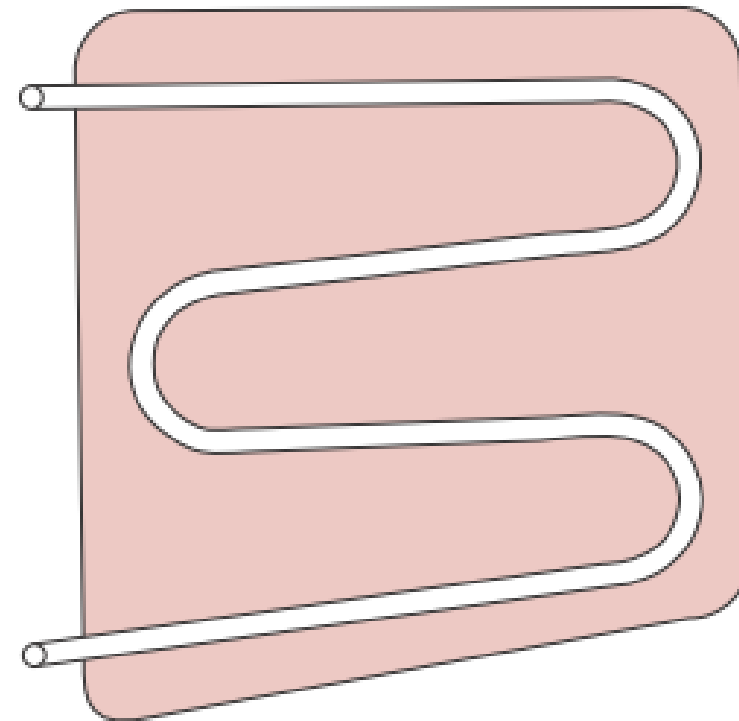
The evaporators are either bare-pipe, finned-tube, or plate type, as shown in Figure



Bare pipe

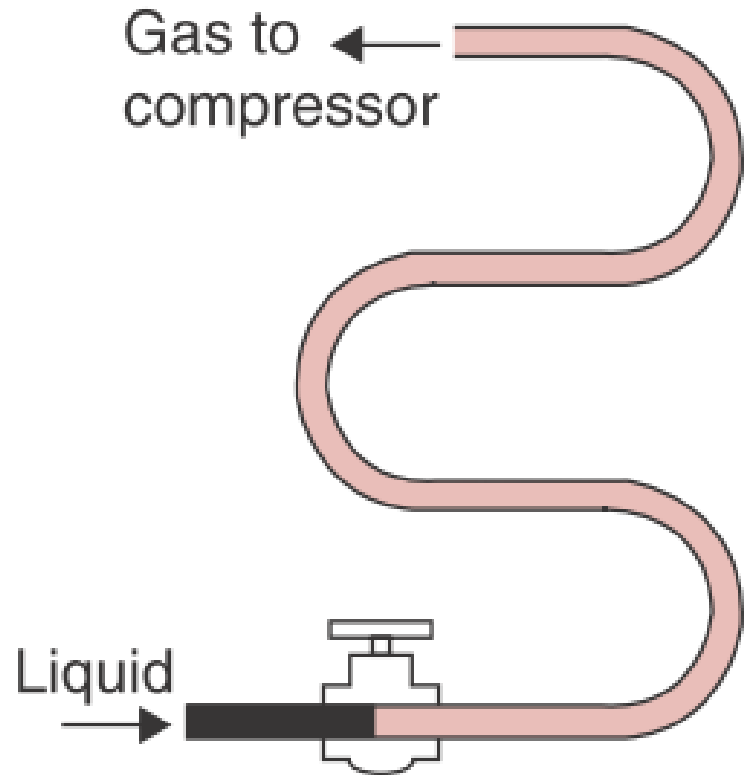


Finned tube

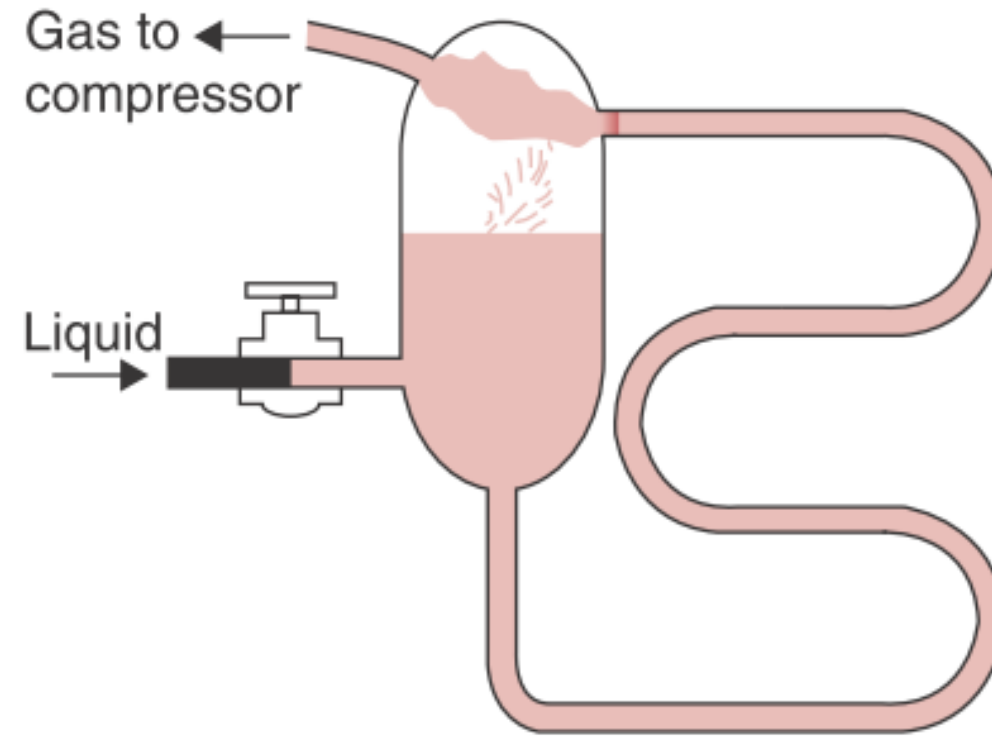


Plate

Evaporator



Direct expansion



Flooded



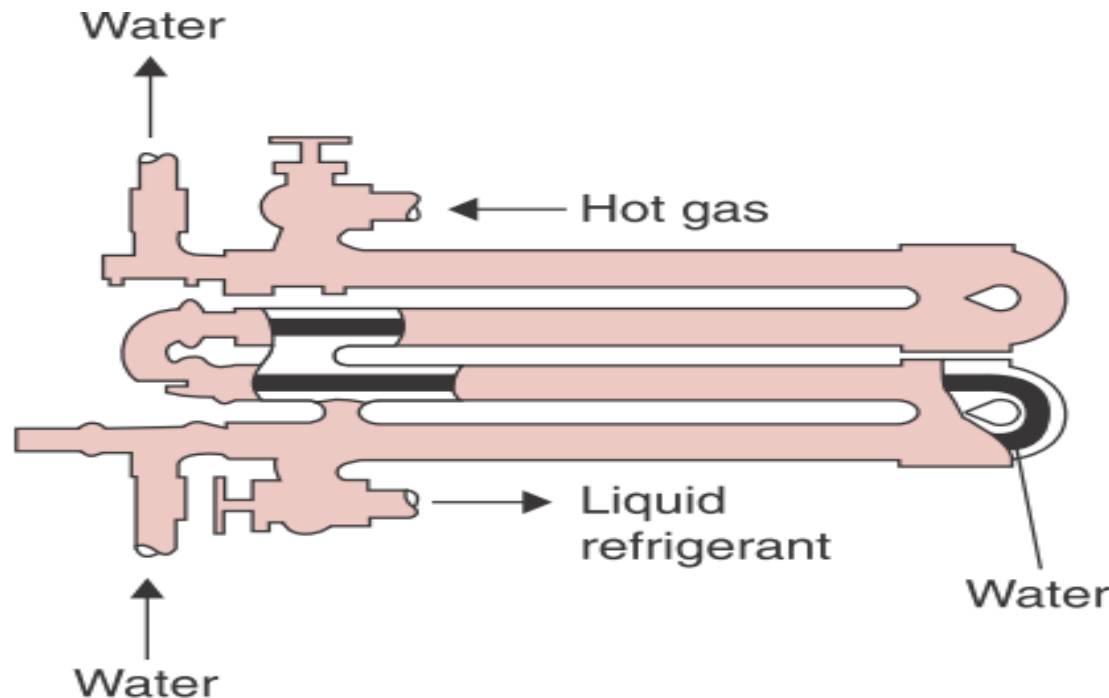
Condenser

- The function of the condenser in a refrigeration system is to transfer heat from the refrigerant to another medium, such as air and/or water. By rejecting heat, the gaseous refrigerant condenses to liquid inside the condenser.
- The major types of condensers used are (1) water-cooled, (2) air-cooled, and (3) evaporative. In evaporative condensers, both air and water are used.
- Three common types of water-cooled condensers are (1) double pipe, (2) shell and tube, and (3) shell and coil.

Condenser

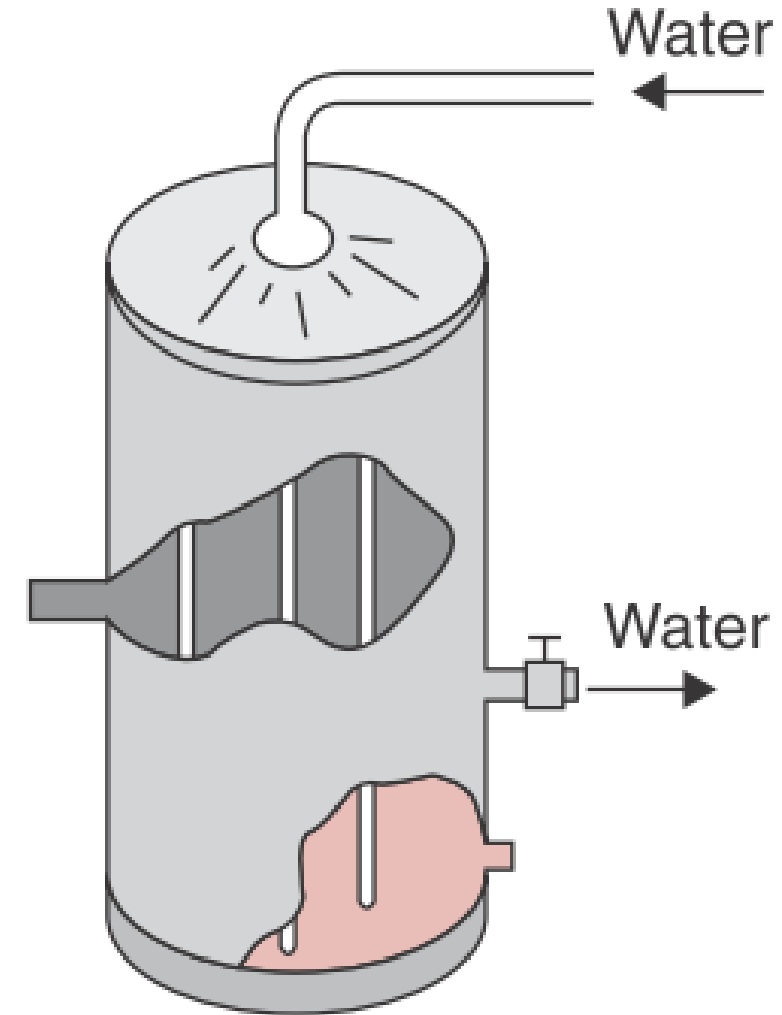


- In a double-pipe condenser, water is pumped in the inner pipe and the refrigerant flows in the outer pipe. Countercurrent flows are maintained to obtain high heat-transfer efficiencies. Although double-pipe condensers commonly have been used in the past, the large number of gaskets and flanges used in these heat exchangers leads to maintenance problems.



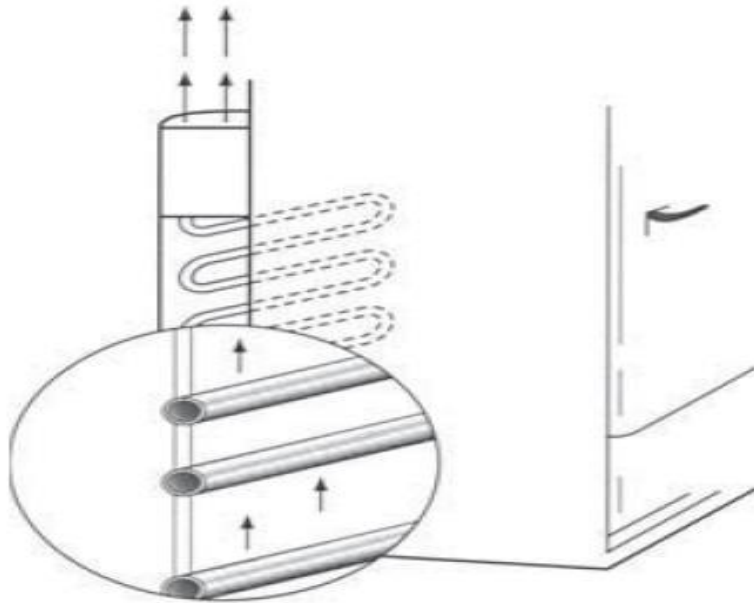
Condenser

In a shell-and-tube condenser, water is pumped through the pipes while refrigerant flows in the shell. Installations of fins in pipes allows better heat transfer. The shell-and-tube condensers are generally low in cost and easy to maintain. In a shell-and-coil condenser, a welded shell contains a coil of finned water tubing. It is generally most compact and low in cost.

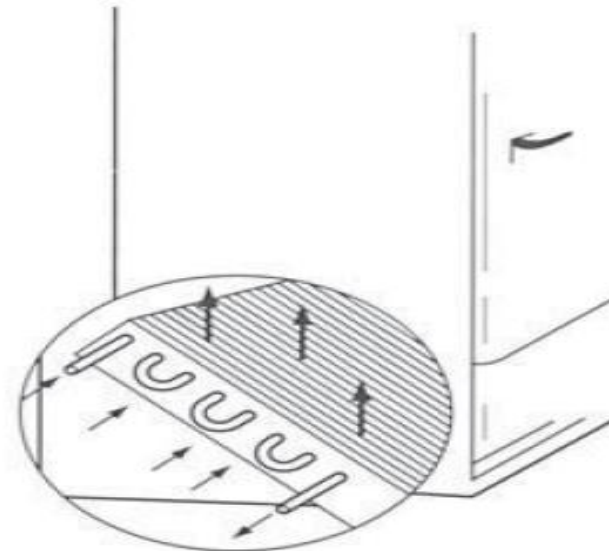


Condenser

Air-cooled condensers can be either tube-and-fin type or plate type, as shown in Figure. Fins on tubes allow a large heat transfer area in a compact case. The plate condensers have no fins, so they require considerably larger surface areas. However, they are cheaper to construct and require little maintenance. Both these types of condensers can be found in household refrigerators.



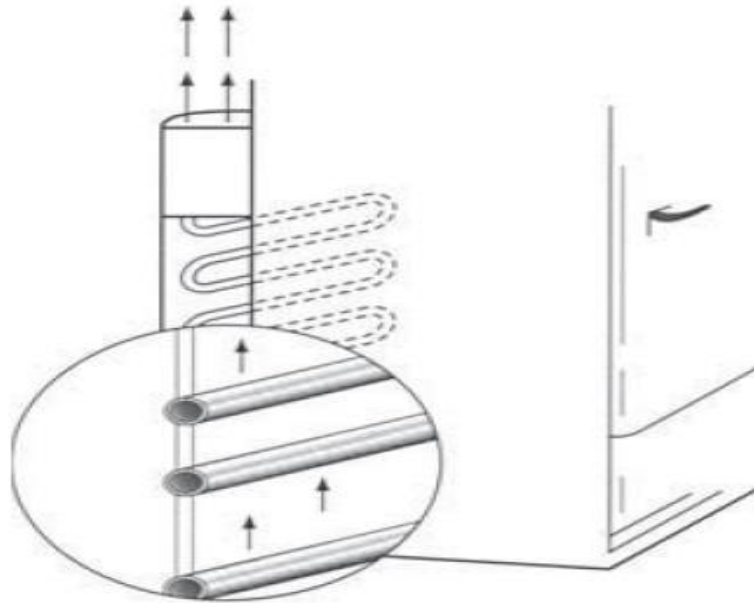
Plate



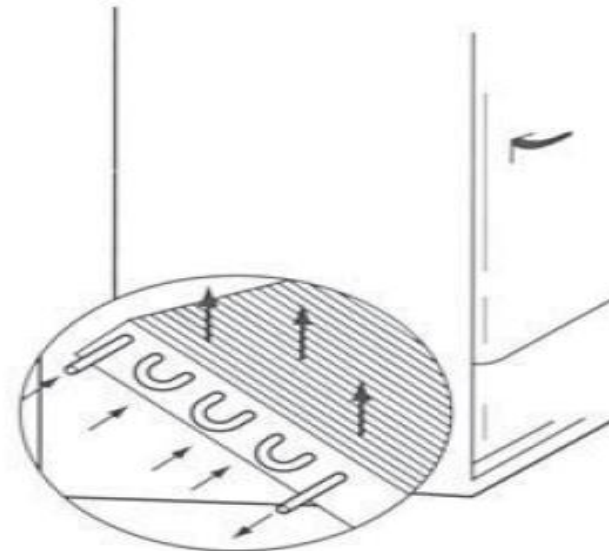
Tube and fin

Condenser

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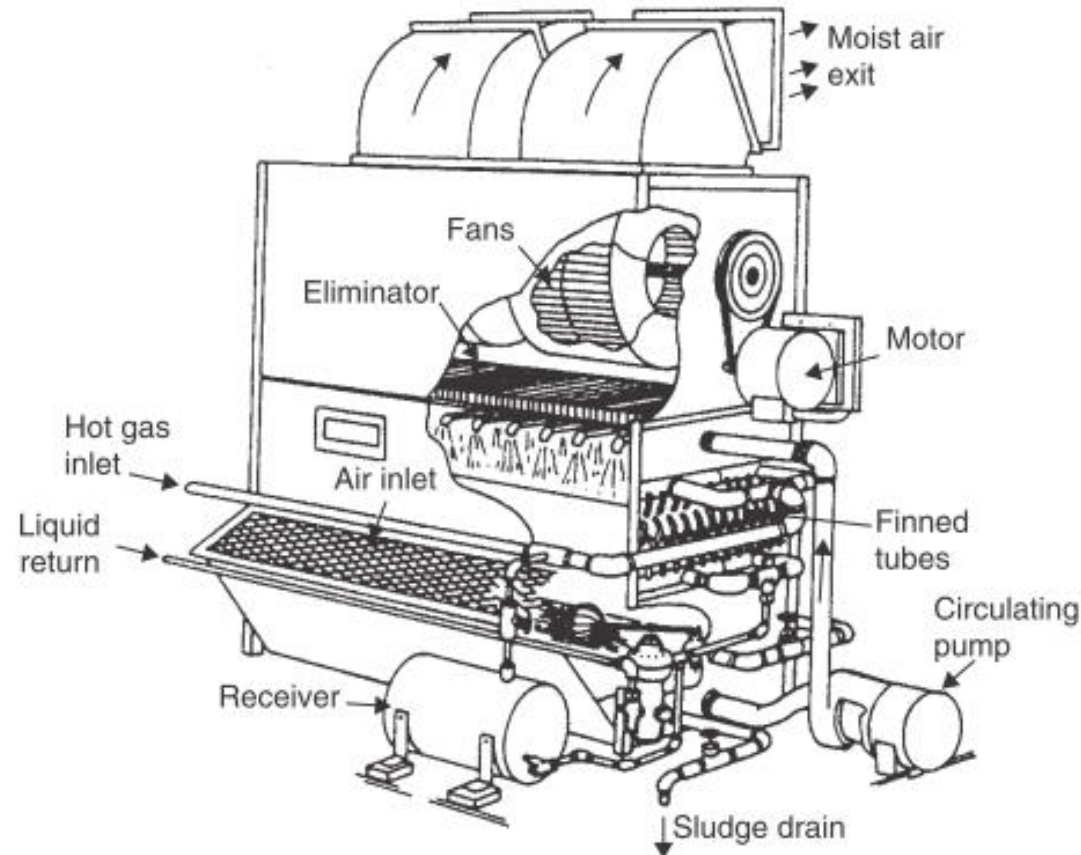
Plate



Tube and fin

Condenser

In evaporative condensers, a circulating water pump draws water from a pan at the base of the condenser and sprays the water onto the coils. In addition, a large amount of air is drawn over the condenser coils. Evaporation of water requires latent heat, which is extracted from the refrigerant. These units can be quite large.





Thank You