

Evaporators

Dr. M. Zahurul Haq

Professor
Department of Mechanical Engineering
Bangladesh University of Engineering & Technology (BUET)
Dhaka-1000, Bangladesh

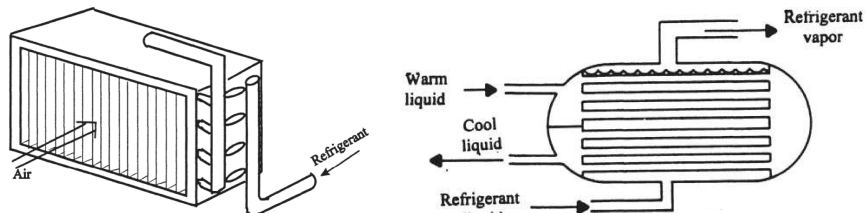
zahurul@me.buet.ac.bd
<http://teacher.buet.ac.bd/zahurul/>

ME 415: Refrigeration & Building Mechanical Systems



Classifications

- 1 **Air Cooler:** cools the air directly in a refrigerated space. Conditioned air is then distributed through air distribution systems.
- 2 **Liquid Cooler:** - chilled water is cooled to a lower temperature and is pumped to remote air handling units (AHUs), fan coil units (FCUs) or other terminals for air conditioning or other purposes.



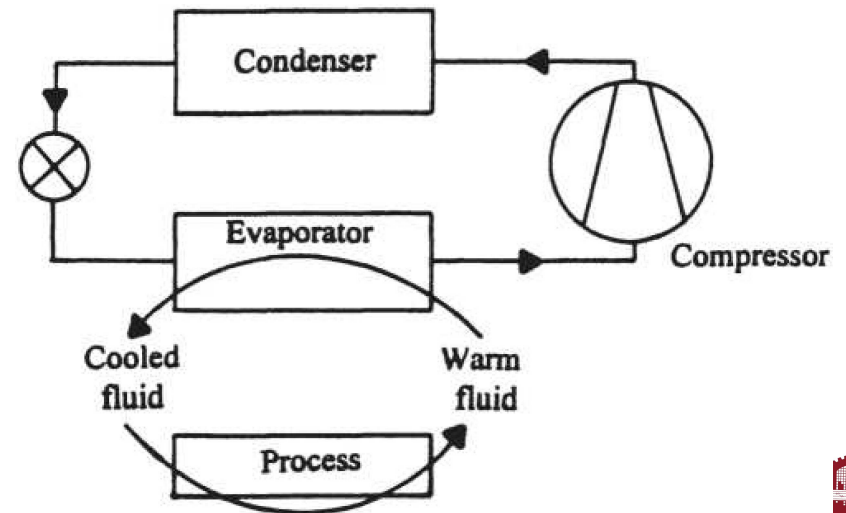
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A liquid cooler is an evaporator, a component of a refrigeration system, whereas a **chiller** is a refrigeration package to produce chilled water.



Evaporators



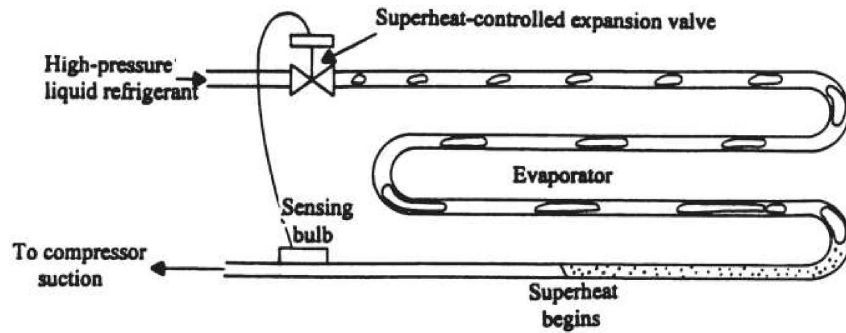
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Refrigerant Feed Methods in Evaporators

- 1 **Dry/Direct Expansion (DX):** amount of refrigerant feed into the evaporator is limited to that which can be completely evaporated by the time it reaches the end of the evaporator.
- 2 **Flooded Refrigerant Feed:** relies on natural convection to circulate more refrigerant through the evaporator than what evaporates. All inside surfaces of the evaporator are thus wetted with liquid refrigerant to enhance heat transfer. Vapour formed is separated in the surge drum and flows to the suction line.
- 3 **Liquid Overfeed:** liquid from either a mechanical pump or a gas-pressure pumping arrangement is supplied to the evaporators.



Dry/Direct Expansion (DX)

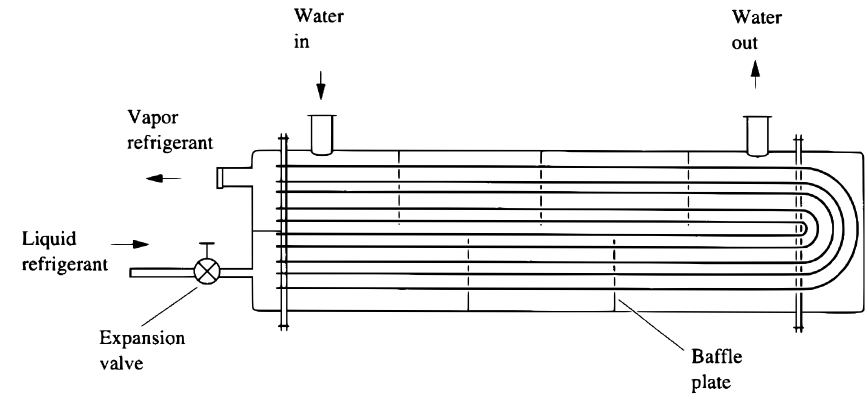


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While DX evaporators are somewhat less efficient, these are usually simpler in design, are lower in initial cost, are much more compact, require a much smaller refrigerant charge. For these reasons, the DX evaporator is the most popular type.



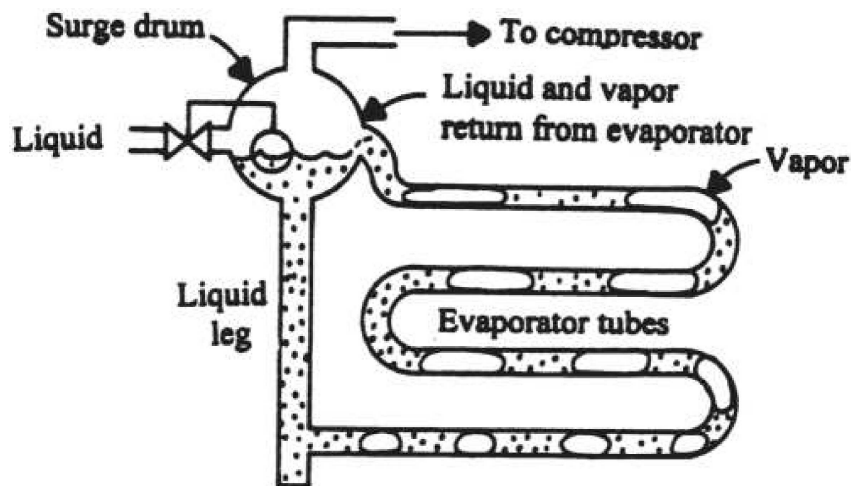
DX Liquid Cooler



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Flooded Evaporator



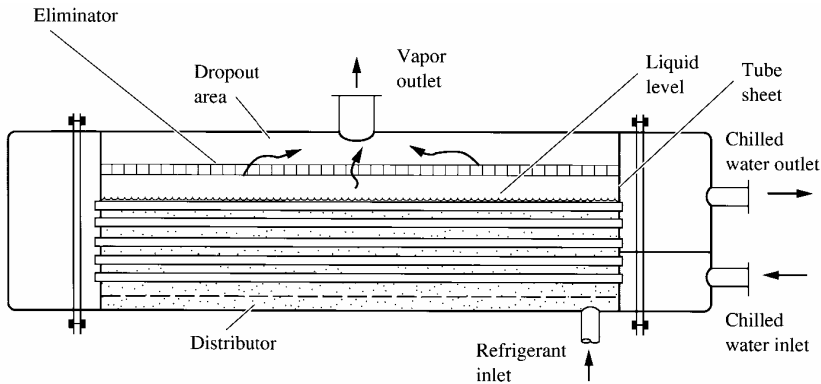
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- The flooded evaporator is operated completely filled with liquid refrigerant, a condition that provides the greatest amount of interior wetted tube surface and consequently the highest heat transfer rate.
- Saturated vapour rather than superheated vapour enters the suction line, so the temperature of suction gas entering the compressor is likely to be lower, which also reduces the discharge temperature from the compressor.
- First cost is higher.
- More refrigerant is needed to fill the evaporator and surge drum.
- Oil is likely to accumulate in the surge drum and must be periodically or continuously removed.



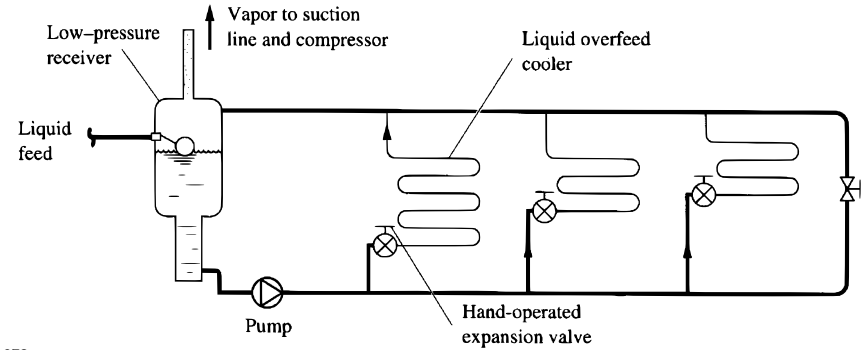
Flooded Liquid Cooler



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Liquid Overfeed Cooler

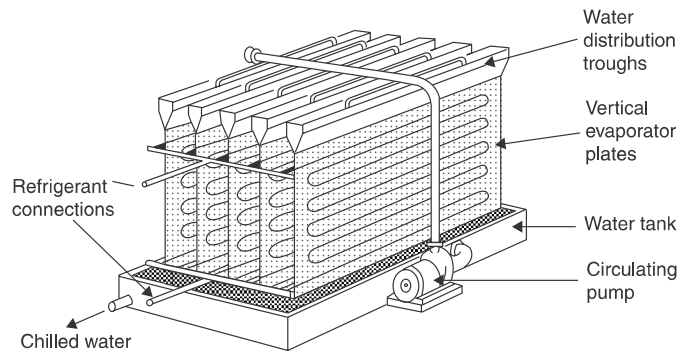


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A liquid overfeed evaporator is one wherein the amount of liquid refrigerant circulated through the evaporator is considerably in excess of that which can be vaporized. These systems are most commonly and economically employed in multiple evaporator systems.



Baudelot Cooler

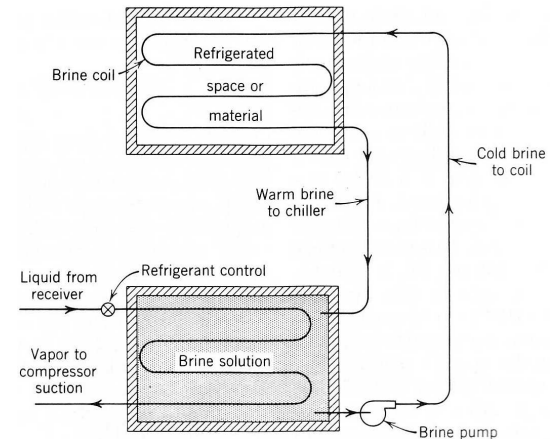


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It consists of a series of horizontal pipes which are located one under the other and are connected to form a refrigerant circuit. The liquid flows down over the tubes by gravity from the distributor located at the top of the cooler and is collected in the trough at the bottom. These are widely used to cool milk, wine and for chilling of water.



Secondary Refrigerant Based Indirect Systems



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Water or brine is chilled by a DX refrigerant in a liquid chiller and then pumped through appropriate piping to the space or product being refrigerated.

