

 UNIVERSITI TEKNIKAL MALAYSIA MELAKA	No Dokumen TB/MT/T2/BMCT2123/4	No Isu./Tarikh 1/6-07-2009
	THERMODYNAMICS 1 HEAT PUMP	No Semakan/Tarikh 0

OBJECTIVES

1. Define and describe the concept of mechanical heat pump
2. Determine the C.O.P_{hp} and C.O.P_{ref} of the mechanical heat pump

THEORY

There is no difference in principle between a heat pump (Figure 1) and a refrigeration system (Figure 2). In a heat pump the heat which is rejected by the condenser or heat exchanger is used for heating purposes. The condenser is therefore located within the space to be heated, such as a room within a building. On the other hand, the evaporator is located externally and draws its supply of heat from a source at a lower temperature than that in the condenser. In practical, the heat source of heat pump is often the atmosphere, but sometimes a river or soil is used instead.

The only difference with air conditioning/refrigeration system is that the heat pump system intended to cool a separate source of heat and disposes the heat into the occupied area. Rating of heat pump is done by the ratio of heat output to electrical input, which is called the Coefficient of Performance (COP).

Both of those systems can be summarized in figures below.

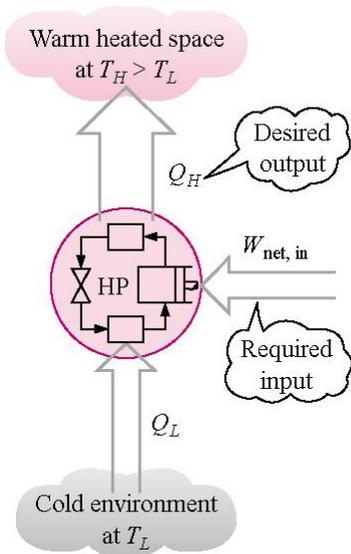


Figure 1 Heat Pump System

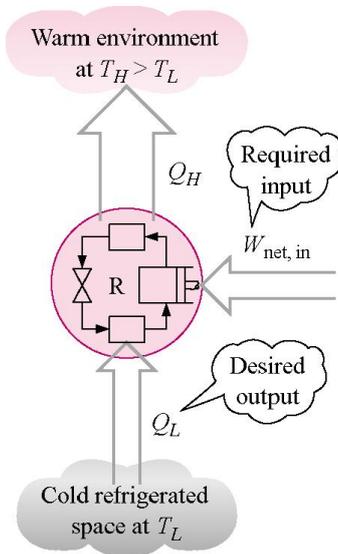


Figure 2 Air Conditioning/ Refrigeration System

APPLICATION

Heat Pumps in Industry

Industrial heat pumps are used to recover or make best use of heat in manufacturing processes or in public utilities such as energy generation & distribution. They vary enormously in both size and concept, but most are specially designed for the application. In the UK the best seller is the dehumidifier/dryer for batch drying ovens, e.g. for textiles or wood, where duties of a few kW are typical. In Japan, Sweden and the Netherlands, multi-

MW heat transformers operating on the absorption cycle are used for waste heat recovery in petrochemical and steel works.

Domestic Heat Pumps

Heat pumps are a feature of many homes in, for example, Switzerland, Norway and the Netherlands, but not many systems have been installed in the UK.

Domestic heating only heat pumps can compete environmentally and economically with gas heating. Reversible heat pumps, which can also provide summer cooling, are not as efficient as those designed for heating only and are likely to result in higher heating bills and overall greater environmental impact compared to other fuels. The output of currently available domestic heat pumps is limited to approximately 5 kW so they are best suited to small or very well insulated properties.

APPARATUS

Mechanical Heat Pump (CT-1715B HPT).



Figure 3 Mechanical Heat Pump (CT-1715B HPT)

PROCEDURES

1. Ensure the pipe from the water supply is connected to the inlet of the stainless steel reservoir tank.
2. Ensure the other pipe from the outlet of the condenser is connected to the drain.
3. Fill the tank with water until the ball valve cut off by itself.
4. Switch ON the main switch for a few seconds.
5. Switch ON the pump and allow the water to flow within the condenser.
6. Adjust the volume flow rate to 12 L/min using the flow control valve. The flow rate is displayed by the Digital Flow-meter.
7. Look for the fan selector and switch ON to "1 FAN".
8. Switch ON the compressor when the water temperature T_1 (inlet), and water temperature T_2 (outlet), is almost equal.
9. Record the reading of the water temperature T_1 and T_2 and compressor power consumption from the indicators after 2 minutes. Fill in the Table 1.
10. Repeat for flow rate of 10 L/min, 8 L/min, 6 L/min, 4 L/min, 2 L/min. Allow at least 3-5 minutes gap between each flow rate.
11. Repeat step 7 to step 11 the experiment with the fan selector to "2 FAN".