Applications Of Thermodynamics In Engineering

Applications of Thermodynamics

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I. Introduction to Thermodynamics

Thermodynamics is a branch of physics concerned with heat and temperature and their relation to energy and work. It defines macroscopic variables, such as internal energy, entropy, and pressure, which partly describe a body of matter or radiation. It states that the behavior of those variables is subject to general constraints, which are common to all materials, not the peculiar properties of particular materials. These general constraints are expressed in the four laws of thermodynamics. Thermodynamics describes the bulk behavior of the body, not the microscopic behaviors of the very large numbers of its microscopic constituents, such as molecules. Its laws are explained by statistical mechanics, in terms of the microscopic constituents.

Thermodynamics applies to a wide variety of topics in science and engineering. Historically, thermodynamics developed out of a desire to increase the efficiency and power output of early steam engines, particularly through the work of the *French physicist Nicolas Léonard Sadi Carnot* (1824) who believed that the efficiency of heat engines was the key that could help France win the Napoleonic Wars. The Irish-born British physicist Lord Kelvin was the first to formulate a concise definition of thermodynamics in 1854:

"Thermo-dynamics is the subject of the relation of heat to forces acting between contiguous parts of bodies, and the relation of heat to electrical agency."

Thermodynamics is actually based on some of the basics processes which are:

Isobaric process	(Pressure remains constant)
Isothermal process	(Temperature remains constant)
Isochoric process	(Volume remains constant)
Adiabatic process	(Without transfer of heat or matter)
Isentropic process	(Entropy remains constant)
Isenthalpic process	(Enthalpy remains constant)
Reversible process	(cycle without entropy production)
Irreversible process	(Cycle with entropy production)

Table 1: Process of Thermodynamics

The combination of these processes generates different cycles. Approximately all the applications of thermodynamic do follow the combination these processes by arranging them in to a specific pattern.

Heat transfer process in nature (without any device) is in the direction of decreasing temperature, that is, from high-temperature regions to low-temperature ones. The reverse process (i.e. from a low-temperature region to a high-temperature) however, does not occur by itself. Such process requires special devices called refrigerators. Refrigerators are cyclic devices. The working fluids used in the refrigeration cycles are called refrigerants. Another device that transfers heat from a low-temperature medium to a high-temperature one is the heat pump.

Refrigerators and heat pumps are essentially the same devices; they differ in their objectives only. The objective of a refrigerator is to maintain the refrigerated space at a low temperature. Discharging this heat to a higher-temperature medium is merely a necessary part of the operation, not the purpose. The objective of a heat pump, however, is to maintain a heated space at a high temperature. This is accomplished by absorbing heat from a low-temperature source, such as well water or,

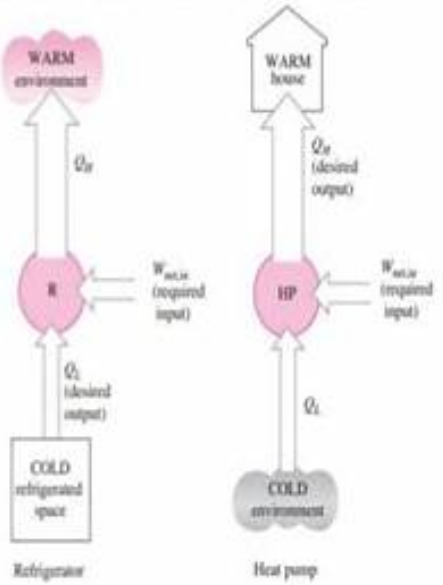

Figure 1: Refrigeration and Heat Pump cycle

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Thermodynamics Wikipedia
Thermodynamics is the branch of physics that has to do with heat and temperature and their relation to energy and work.The behavior of these quantities is governed by the four laws of thermodynamics, irrespective of the composition or specific properties of the material or system in question.The laws of thermodynamics are explained in terms of microscopic constituents by statistical mechanics.

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Chemical Thermodynamics Wikipedia
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