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## HEATING VENTILATION AND AIR-CONDITIONING (HVAC)

### 9.1. INTRODUCTION

*Heating ventilation and air-conditioning* is based on the principles of thermodynamics, fluid mechanics and heat transfer. The three functions of heating, ventilation and air conditioning are closely inter-related. All seek to provide thermal comfort, acceptable indoor air quality and reasonable installation, operation and maintenance costs. Heating, ventilation and air-conditioning (HVAC) contributes upto 35% of energy used in manufacturing facilities. Refrigeration deals with the transfer of heat from a low temperature level at the heat source to a high temperature level at the heat sink by using a low boiling refrigerant. HVAC refers to the equipment, distribution network and terminals used either collectively or individually to provide fresh air, heating, cooling and humidity control in a building.

### 9.2. HEATING

Heating systems may be divided in these two categories :

1. Central heating system.
2. Local heating system.

Central heating is often used in cold climates to heat buildings. This system contains boiler, furnace or heat pump to heat water, steam or air, all in a central location such as a furnace room in a building. The system also contains piping or ductwork to distribute the heated fluid and radiators to transfer this heat to the air. Forced air systems send heated air through ductwork. The forced air can also be filtered or put through air cleaners. Heating can also be obtained from electric or resistance heating using filament that becomes hot when electricity pass through it.

The invention of central heating is often credit to ancient Romans, who installed a system of air ducts in the walls and floors of public baths and private house. The ducts over is fed with hot air from a central fire.

### 9.3. VENTILATION

*Ventilation process* supplies or removes air from a space by natural or mechanical means. Replacement of air is done to remove moisture, odours, smoke, heat, dust and airborne bacteria. Ventilation includes both the exchange of air to the outside as well as circulation of air within the building. Outside air must be brought to a certain temperature by make-up air units for maintaining acceptable indoor air quality in buildings. Ventilation is the process to remove excessive moisture, unpleasant smells, introduce outside air to prevent stagnation of the interior air.

There are two methods used for ventilation purpose :

1. Mechanical or Forced.
2. Natural.

**1. Mechanical or Forced Ventilation.** For controlling indoor air quality 'mechanical' or 'forced' ventilation is used. While using outside air, excess humidity, odours and contaminants are often controlled via dilution or replacement.

Humid climates require much energy to remove excess moisture from ventilation air. For example : kitchens, bathrooms should have strong mechanical exhaust to control odours and sometimes humidity. In designing of such system there are two major factors, one is flow rate (which is a function of fan speed and exhaust vent size) and the second is noise level. If the ducting for the fans traverse unheated space, the ducting should be insulated as well to prevent condensation on the ducting.

Heat recovery ventilation systems employ heat exchangers to recover some heat from exhausted air, to preheat the incoming outside air. Ceiling fans and table fans are very effective in circulating air within a room.

**2. Natural Ventilation.** Natural ventilation is the ventilation of a building with outside air without the use of a fan or any other mechanical/forced system.

Natural ventilation can be achieved with operable windows. In more complex systems hot/warm air in the building can be allowed to rise top and then flow out from upper openings to the outside thus forcing cool outside air to be drawn into the building naturally through openings in the lower areas.

### 9.4. AIR CONDITIONING

*Air-conditioning* is done through the removal of heat. Heat can be removed through the process of radiation, convection and conduction using mediums such as water, air and special refrigerants (*e.g.*, freon). In order to remove heat from something, we use colder medium. An air conditioner provides cooling, ventilation and humidity control for all or part of a house.

*Sensible heat* is any heat that raises the temperature but not the moisture content of the substance. Because it raises the temperature it is felt by the senses that's why it is called *sensible heat*.