6 SPECIALIST SERVICES — MECHANICAL VENTILATION, AIR CONDITIONING, LIFT INSTALLATIONS, ESCALATORS AND FIRE FIGHTING INSTALLATIONS

MECHANICAL VENTILATION

Introduction

The interiors of buildings are ventilated in order to provide environmental conditions in which the occupants may operate with comfort, safety and efficiency. By the provision of ventilation we may ensure that:

(a) Sufficient fresh air is available for respiration — the amount consumed by the occupants will be influenced by their natural metabolic rate, and this in turn is determined by the characteristics of the individuals and their rate of activity.
(b) Provision is made for the extraction of pollutants which may accumulate
   (i) naturally (for example, carbon dioxide),
   (ii) through the processes of occupancy (for example, tobacco smoke), or
   (iii) through the production processes undertaken by the occupants (for example, fumes from industrial processes).
(c) The level of internal relative humidity can be controlled.
(d) A suitable environment is created with respect to air temperature.
(e) Air is available to support the processes of combustion (for example, to support complete burning of gas fuel at a domestic gas fire).
(f) Fumes and smoke arising from accidental fires can be controlled.

The geometry of large buildings and, in particular, their plan shape will prevent complete ventilation of the enclosure space through perimeter fenestration. The physical distance between central areas and the windows will mean that air stagnation is most likely to occur in the central areas of the building, and to relieve this situation mechanical ventilation can be employed.

When mechanical ventilation is applied to buildings, the systems used may be:

(i) systems which deliver air which is unheated;
(ii) plenum systems which heat the air for buildings which have no other heating system (figure 6.1);
(iii) tempered air systems in which the air is heated for buildings which have also a separate heating installation.

When considering the deployment of natural or mechanical ventilation to a particular premises, the criteria considered in respect to the air are generally quality, quantity and controllability. If natural ventilation is contemplated, the following limitations should be appreciated:

(i) precise control of air supplied by natural ventilation is not possible, and
(ii) the occupier of a building can introduce a variable into the provision of fresh air supplies by opening and closing windows in an unpredictable way.
An Introduction to Building Services

Figure 6.1  Plenum ventilation for a factory building

Mechanical ventilation will be necessary:

(a) where spaces within the building cannot be naturally ventilated;
(b) in premises where it is necessary to remove pollutants (such as fumes or dust);
(c) in special premises such as hospitals where a sterile environment is required.

The use of mechanical ventilation will allow provision to be made for the control of air temperature, humidity and purity, in addition to helping control air movement.

Buildings of different use will demand different quantities of fresh air for their occupants. This may be expressed in terms of litres/s (dm$^3$/s), or in terms of room air changes per hour. A key factor in the assessment of the extent of air required within rooms is often the extent of tobacco smoke produced. The CIBS guide$^1$ suggests that the quantity of fresh air needed can vary from 8 litres per person per second in fairly smoke free environments, to as much as 25 litres per person per second where heavy smoking is anticipated.

The method by which air is brought into a building gives rise to a classification of the type of system which may be provided:

(i) natural inlet — natural outlet;
(ii) natural inlet — mechanical outlet;
(iii) mechanical inlet — natural outlet; and
(iv) mechanical inlet — mechanical outlet.

Figure 6.2 illustrates this classification.

Figure 6.2  Classification of ventilation systems