

cleaned regularly before it becomes excessive. Water spray should not touch the steam heating coils as they will quickly become coated with scale. The preferred practice is to install sprays between coils and eliminator plates.

Sound Control, Filters, Fans and Motors

Problems of sound control should be jointly considered by the acoustical and air conditioning engineer for satisfactory results. Many installations require noise levels which are relatively low and for that reason equipment must be selected having a very low noise rating. In central systems consideration should also be given to the lining of ducts for the reduction of noise levels within an enclosure. Often reduced speeds of equipment and low air velocities are helpful in eliminating undesirable noise conditions. Information is given in Chapter 32 with regard to acceptable noise levels for various types of rooms and methods are outlined for computing length of duct lining materials.

For a discussion of air cleaning devices and for the selection of all types of air filtering equipment refer to Chapter 28. The selection of fans, motors and their control may be based on data available in Chapters 29 and 35.

Automatic Control

The control of an air conditioning system is very important. A simple comfort cooling or heating installation requires a minimum of control, whereas a more complex installation justifies a more complete control. In this connection, there are many patents allowed and pending on air conditioning equipment including control, and the designer should consider these factors in selecting equipment. Refer to Chapter 33.

Static Pressure

The static pressure against which the fan must operate is the sum of all pressure losses through all parts of the complete system. Resistances of equipment such as coils, washers, filters, and grilles are obtained from data given in the manufacturers' catalogs. Pressure drop in the duct is calculated as shown in Chapter 31.

SPECIAL CONSIDERATIONS

In designing a central system for air conditioning there are a number of special considerations not referred to previously which must be considered. Certain features of building constructions are important. The building must be suitable in construction so that the desired conditions can be maintained economically.

For instance, excessive sun load on roofs or glass windows may not only cause excessive heat gain to be absorbed by refrigeration, but direct sun radiation heating converts a surface into a panel heater. This radiant heat is not absorbed until it strikes another mass such as a building wall, or a person. It is therefore possible to have comfortable air conditions surrounding a person, and yet have him uncomfortably warm from radiant heat from a hot wall, window, or ceiling near him. As another example, it is much better to provide hoods over steam tables, coffee urns, etc., than to try to remove this heat by mechanical refrigeration.

Another problem is presented with winter conditioning for maintaining satisfactory relative humidity. If 30 to 40 per cent is desired at all times, no matter how cold it is outside, excessive condensation may collect on

single glass windows, or on hardware which connects to the outside such as latches and hinges. Condensation on windows can sometimes be prevented by applying a small amount of local heat under the window. In other cases double glass or storm window construction is used. Refer to Chapters 3 and 5 for condensation temperatures.

In many cases, different zones of a building will require entirely different treatment. In some buildings where offices are exposed on all four sides to sun and wind effect, cooling is required on the sunny side and heating is required on the shady side simultaneously, in spring and fall seasons. The central system must be carefully zoned to apply cooling or heating as they may be needed for each zone, independent of other zones.

In many existing buildings, the central system will be added to a radiation system of heating. The designer should take full advantage of this radiation for heating the outside walls and windows. At the same time, it must be controlled to prevent overheating the whole system. A few uncontrolled radiators will often change the heat balance and cause excessive overheating of the whole zone, without occupants near the radiators realizing the source of the trouble. All radiation used locally in connection with the control system should be equipped with automatic control to prevent overheating.

The apparatus should be placed for minimum piping and duct work but it must be accessible for maintenance, repair, and cleaning. The air conditioning unit should be designed to provide access for cleaning coils, drip pans, eliminators and for very easy maintenance on filters. This equipment will be in operation for many years, probably for the life of the building, and a little thought spent in the plan will simplify maintenance and assure successful results.

Lastly, an air conditioning system should be designed from the standpoint of safety so that the fire hazard will be kept at a minimum, and the designer should acquaint himself with existing local regulations.

Example 1. With the assumed values as indicated, perform the essential calculations to determine the design loads for heating and cooling and the necessary factors for designing the distribution system.

Solution: Design Conditions.

Outside air dry-bulb, winter.....	0 F
Outside air dry-bulb, summer.....	95 F
Outside air wet-bulb, summer.....	75 F
Inside air dry-bulb, winter.....	72 F
Inside air wet-bulb, winter.....	56 F
Inside air relative humidity, winter.....	35 per cent
Inside air dry-bulb, summer.....	80 F
Inside air wet-bulb, summer.....	66.7 F
Inside air relative humidity, summer.....	50 per cent
200 people—4 kw light load.	

Design Heating Load.

Sensible heat loss through walls, etc..... 200,000 Btu per hour

Outside air— $2000 \text{ cfm} \times 0.075 \times 60 \times 0.24 \times (72 - 0) = 155,500 \text{ Btu per hour}$

Humidification— $\frac{2000 \times 0.075 \times 60 \times (40 - 5) \times 1040}{7000} = 46,900 \text{ Btu per hour}$

Heat loss through ducts..... 33,200 Btu per hour

Heat gain from lights, etc..... Disregard

Total heating load..... 435,600 Btu per hour