

overhead cooling systems, since water condensed out of the air generally will be present and may damage the interior finish of the rooms below the apparatus.

All of the various pieces of equipment from the outdoor air intake through the fan usually are connected together by sheet metal casings. Frequently, the building structure or specially constructed walls or partitions may be used to form a portion of the casing. In any case the casing or connection must be sufficiently sturdy for the required duty. Sheet metal work must be well braced not only to prevent vibration under pulsations in air flow, but also to withstand the abuse of normal usage. Casings should be braced wherever access doors are installed, and all large panels should be adequately reinforced by structural steel.

Accessibility for Service

Each apparatus layout should be made with accessibility in mind. Where cooling convectors are used, space for removing and repairing or replacing them should be provided. Adequate space should be provided for the servicing and replacement of eliminators. Whether these accompany sprays or wetted coils, filters must be so located that the proper cleaning, replacement or routine servicing can be accomplished without difficulty. Free access to the bearings of all moving machinery is a necessity. Provision should be made for the complete removal and replacement of any parts of the apparatus that are subject to wear, deterioration or damage, whether they be filtered, fanwheel, motor, pump impeller, or heat transfer surface.

DESIGN PROCEDURE

The customary design procedure is outlined herewith. For simplification the procedure is set up on the basis of a year-round system. For systems designed only for winter or for summer, the unrelated parts may be omitted.

1. Selection of design conditions (inside and outside): (a) summer, (b) winter.
2. Determination of outside air requirements.
3. Determination of cooling load: (a) room sensible heat gain, (b) room latent heat gain, (c) room total heat gain (d) grand total heat gain.
4. Determination of heating load: (a) room sensible heat loss, (b) room moisture loss, (c) humidification requirement, (d) total heating requirement.
5. Determination of apparatus dewpoint and dehumidified or humidified air quantity: (a) summer (full load and part load), (b) winter.
6. Supply air temperature difference and quantity: (a) summer, (b) winter.
7. Equipment selection.
8. Equipment layout.

The foregoing steps are merely typical. Many applications will require at least a preliminary investigation of some of the latter steps before proceeding with the earlier steps. A permanent record of all design assumptions and computations should be made and preserved for comparison with the performance of the installation.

CHAPTER 31

AIR DISTRIBUTION

Definitions, Standards for Satisfactory Conditions, Principles of Air Distribution, Ventilating Jets in Air Distribution, Outlet Performance, Outlet Types, Outlet Location and Selection, Direction and Volume Control, Return and Exhaust Intakes, Specific Applications.

CORRECT air distribution is essential in warm air heating, ventilating, and air conditioning systems. Even though a system delivers the required quantity of conditioned air to a room, unsatisfactory conditions result if the air is poorly distributed.

This chapter deals with room air distribution only; the transmission of air through ducts is treated in Chapter 32, Air Duct Design. The objectives of this chapter are to:

1. Describe the present state of air distribution problems by discussing ventilating jets in room air distribution.
2. Present general information on practical air distribution problems by discussing outlet performance, outlet types, and also location, selection, and control of outlets.
3. Illustrate the use of the basic concepts and of the practical experience gained in air distribution by discussing specific applications.

Further pertinent information on air distribution will be found in Chapter 6, Physiological Principles; Chapter 12, Heating Load; Chapter 13, Cooling Load; Chapter 19, Gravity Warm Air Systems; Chapter 20, Forced Warm Air Systems; Chapter 25, Unit Heaters and Unit Ventilators; Chapter 26, Unit Air Conditioners and Unit Air Coolers; Chapter 30, Central Systems for Air Conditioning; Chapter 41, Sound Control; Chapter 48, Transportation Air Conditioning; Chapter 51, Instruments and Measurements.

DEFINITIONS

The following definitions referring to air distribution equipment have gained general acceptance.

1. **Supply Opening or Outlet:** Any opening through which air is delivered into a space which is being heated, or cooled, or humidified, or dehumidified, or ventilated.
2. **Exhaust Opening or Return:** Any opening through which air is removed from a space which is being heated, or cooled, or humidified, or dehumidified, or ventilated.
3. **Outside Air Opening:** Any opening used as an entry for air from outdoors.
4. **Damper:** A device used to vary the volume of air passing through a confined cross-section by varying the cross-sectional area.
5. **Grille:** A covering for any opening and through which air passes.
6. **Register:** A grille equipped with a damper or control valve.
7. **Free Area:** The total minimum area of the openings in the air outlet or inlet through which air can pass.
8. **Core Area:** The total plane area of that portion of a grille, included within lines tangent to the outer edges of the outer openings through which air can pass.
9. **Free Area Ratio:** The ratio of the free area to the core area.
10. **Coefficient of Discharge:** Ratio of area at vena contracta to area of opening.
11. **Aspect Ratio:** The ratio of length to width of an opening or core of a grille.