

order to prevent flooding of the lower dehumidifiers. Where spray dehumidifiers are on the same level, equalizing lines between the pans may be required if a storage tank is not provided.

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 all or 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 bellying or vibration under pulsations in air flow but to withstand the abuse of normal usage. Casings should be adequately braced wherever access doors are installed and all large panels should be adequately reinforced by angle iron.

Each apparatus layout is to be made with accessibility in mind. Where cooling coils are used space for removing and repairing or replacing the coils should be provided. Adequate space is to be provided for the servicing and replacement of eliminators. 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. Provisions should be made for the complete removal and replacement of any part of the system that is subject to wear, deterioration or damage, whether it may be filter, fan wheel, motor, rotor, 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 summer only or winter only systems, the unrelated parts are to 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 dew-point 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.

## Chapter 22

# UNIT HEATERS, UNIT VENTILATORS, UNIT HUMIDIFIERS

*Unit Heaters, Ratings, Unit Ventilators, Applications, Window Ventilators, Unit Humidifiers, Types of Units*

IN other chapters, descriptions are given of heating, cooling, ventilating, humidifying, and dehumidifying systems. The success of such systems has led to the production of factory-assembled equipment employing a majority of the principles of these complete systems. As a result, present day practice involves the use of unitary equipment in the majority of installations where capacity and application demands are within the limits of such units. Thus unit heaters, unit ventilators, and unit humidifiers described in this chapter, and cooling units, unit air conditioners, and attic fans described in Chapter 23 have come to occupy a place of their own in the industry.

### Unitary Equipment

Unitary equipment was first applied in units of small capacity but increased experience in this field has led to an ever widening range of capacities and applications. In general a *unit* may be defined as a factory-made encased assembly of the functional elements indicated by its name, such as unit heater, unit ventilator, etc. These units are shipped substantially complete or built and shipped in sections so that the only field work necessary is the assembling together of the sections, without resorting to any field fabrication.

A unit may be complete in itself, employing its own direct means of air distribution and source of heating, in which case it thus represents a complete self-contained unit. Or it may be coupled with separate means of air distribution such as duct work and outlets, in which case it will still be considered as a unit system, as contrasted with the generally accepted term of a field fabricated central station system. The manufacturer of the unit is responsible for the output and performance of the unit under rated conditions, whereas the contractor installing the complete unitary system is normally held responsible for the performance of the complete system.

Unit equipment justifies its existence due to the following features:

1. Lower cost per unit capacity. Standardized design and volume production makes possible low cost factory assembly thereby eliminating individual design and handling of every part for each installation.