Example.—
Temperature rise 122.3 deg. − 0 deg. = 122.3 deg. with all outside air.
or
Assume 50 per cent outside air 0 deg.
50 per cent recirculation 60 deg.
$P_oT_o + P_rT_r = (0.50 \times 0)$
$(0.50 \times 60) = 30$ deg. initial temperature.
Temperature rise through heater = 122.3 deg. − 30 deg. = 92.3 deg.

7. Calculate required free area through heaters.[2]

Select velocity through heaters suitable to problem.

$$\text{Free area} = \frac{\text{Total C.F.M.}}{\text{Vel. in F.P.M.}}$$

Example.—Assume total C.F.M. of all rooms = 21,000.
Assume 900 F.P.M. through heater. (See table.)
$\frac{21{,}000}{900} = 23.3$ sq. ft. free area.

8. Select size and number of heaters.

Take temperature rise from 6.
Take free area from 7.
Assume maximum allowable combustion rate for fuel to be burned and stack available.
Note resistance of heaters for air volume.
Select suitable heaters from ratings.

9. Design duct system.

Ducts may be designed according to standard practice.
See Chapters VIII and X.

10. Calculate total static pressure for entire system.

11. Select blower.

See Chapter XXVI and Fan Manufacturers tables.

12. Select motor (See Chapter XXVII).

13. Select drive.

[2]Some heaters are rated on the basis of the volume of air that may be warmed over any given temperature range for all heater sizes and list the static resistance in each instance. In this case the free area need not be calculated, but the combustion rate should be investigated.

CHAPTER X

UNIT SYSTEMS FOR HEATING AND AIR CONDITIONING

Industrial Types, Direct Fired Units, Air Conditioning Units, Piping Connections.

INDUSTRIAL UNIT HEATERS

THE unit heater for industrial plant application is composed of a radiator or heating element enclosed by a casing in which a power driven fan or fans are mounted. The fans draw or force air over the heating surface where it is heated and discharged in selected directions. Unit heaters are placed directly within the room to be heated and discharge the heated air into the enclosure, where it is distributed uniformly over wide areas under the direct impulse of the fans and by the currents of circulation set up.

The function for which unit heaters are designed are: To circulate the air in the building at a rapid rate; to promote uniformity of temperatures and quick heating-up; to control and direct the heated air for the positive and rapid placing of the heat where it is effective; to distribute heat over wide areas, to reduce the number of units and simplify piping and installation; to increase the capacity of the heating surface by passing the air over it at high velocity; to provide a system by which room temperatures are readily controlled manually or by thermostats.

Different types of unit heaters are built to suit various purposes. Most employ a heating coil to be supplied with steam or hot water. Some are designed primarily for mounting on the floor, others for suspension overhead. Heating surfaces in the form of pipe coils, non-ferrous tubes or shapes with extended surfaces, cast-iron, pressed and built-up sections of the cartridge or automotive type are all used in one or more of makes available. Fans employed are the disc or propeller, housed centrifugal and cone types.

Unit heaters may be arranged to recirculate the air or to supply warmed air from the outside for ventilation or to make up air exhausted. One type combines a means for exhausting air with the above functions. In addition to their prime function of plant heating, they may be adapted to a number of industrial processes, such as drying, curing, etc. Here the use of heated air in more rapid circulation with uniform distribution is of particular advantage. They may be used for moisture absorption, such as fog removal in dye-houses or the prevention of condensation on

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