

such pans; when the radiator is steam hot and the relative humidity in the room is between 25 and 40 per cent. This source of supply of moisture alone is not adequate to maintain a relative humidity above 25 per cent on a zero day.

REFERENCES

- ¹—A.S.H.V.E. Code for Testing Radiators (A.S.H.V.E. TRANSACTIONS, Vol. 33, 1927, p. 18).
- ²—A.S.H.V.E. Standard Code for Testing and Rating Concealed Gravity Type Radiation (Steam), (A.S.H.V.E. TRANSACTIONS, Vol. 37, 1931, p. 367); (Hot Water), (A.S.H.V.E. TRANSACTIONS, Vol. 39, 1933, p. 237). (See also A.S.H.V.E. TRANSACTIONS, Vol. 41, 1935, p. 38, and Vol. 42, 1936, p. 29).
- ³—A.S.H.V.E. RESEARCH REPORT No. 998—Factors Affecting the Heat Output of Convectors, by A. P. Kratz, M. K. Fahnestock, and E. L. Broderick (A.S.H.V.E. TRANSACTIONS, Vol. 40, 1934, p. 443).
- ⁴—Factors Influencing the Heat Output of Radiators, by A. C. Davis, W. M. Sawdon and David Dropkin (A.S.H.V.E. TRANSACTIONS, Vol. 42, 1942, p. 185) and Cornell University, *Engineering Experiment Station Bulletin* No. 29, April, 1942.
- ⁵—Heat Emission from Radiators, by K. F. Rubert (Cornell University, *Engineering Experiment Station Bulletin* No. 24, 1937).
- ⁶—Comparative Tests of Radiator Finishes, by W. H. Severns (A.S.H.V.E. TRANSACTIONS, Vol. 33, 1927, p. 41).
- ⁷—Heat Loss from Direct Radiation, by J. R. Allen (A.S.H.V.E. TRANSACTIONS, Vol. 26, 1920, p. 11).
- ⁸—Heat Output of Concealed Radiators, by E. A. Allcut (University of Toronto, *School of Engineering, Research Bulletin* No. 140, 1933).
- ⁹—The Heating Effect of Radiators, by Charles Brabbée (A.S.H.V.E. TRANSACTIONS, Vol. 33, 1927, p. 33).
- ¹⁰—University of Illinois, *Engineering Experiment Station Bulletins* Nos. 192 and 223, and Investigation of Heating Rooms with Direct Steam Radiators Equipped with Enclosures and Shields, by A. C. Willard, A. P. Kratz, M. K. Fahnestock and S. Konzo (A.S.H.V.E. TRANSACTIONS, Vol. 35, 1929, p. 77).
- ¹¹—A.S.H.V.E. RESEARCH REPORT No. 962—The Application of the Eupatheoscope for Measuring the Performance of Direct Radiators and Convectors in Terms of Equivalent Temperature, by A. C. Willard, A. P. Kratz and M. K. Fahnestock (A.S.H.V.E. TRANSACTIONS, Vol. 39, 1933, p. 303).
- ¹²—The Kata Thermometer—Its Value and Defects, by W. J. McConnell and C. P. Yagloglou. (Reprint No. 953 from U. S. *Public Health Service Report*, pp. 2293-2337, September 5, 1924).
- ¹³—The Thermo-Integrator—A New Instrument for the Observation of Thermal Interchanges, by C. E. A. Winslow and Leonard Greenburg (A.S.H.V.E. TRANSACTIONS, Vol. 41, 1935, p. 149).
- ¹⁴—The Calibration of the Thermo-Integrator, by C. E. A. Winslow, A. P. Gage, Leonard Greenburg, I. M. Moriyama and E. J. Rodee. (*The American Journal of Hygiene*, Vol. 22, No. 1, July, 1935, pp. 137-156).
- ¹⁵—The Globe Thermometer in Studies of Heating and Ventilation, by T. Bedford and C. G. Warner. (*The Journal of Hygiene*, Vol. 34, No. 4).
- ¹⁶—A.S.H.V.E. RESEARCH REPORT No. 1067—The Cooling and Heating Rates of a Room with Different Types of Steam Radiators and Convectors, by A. P. Kratz, M. K. Fahnestock and E. L. Broderick (A.S.H.V.E. TRANSACTIONS, Vol. 43, 1937, p. 389).
- ¹⁷—University of Illinois, *Engineering Experiment Station Bulletin* No. 230, p. 20.

Unit Heaters, Unit Ventilators, Unit Humidifiers

Definitions; Unit Heaters: Classification, Application, Outlet Velocities, Ratings for Various Types, Temperature, Location, Automatic Control, Piping Connections; Boiler Capacity for Steam Unit Heaters; Unit Ventilators: Ratings, Applications, Location, Exhaust Vents; Window Ventilators; Unit Humidifiers

DESCRIPTIONS of heating, cooling, ventilating, humidifying, and dehumidifying systems are given in other chapters. This chapter deals with unit heaters, unit ventilators, and unit humidifiers. Cooling units, unit air conditioners, and attic fans are described in Chapter 36.

Definitions

The generally accepted meaning of the word *unit* in the terms unit heaters, unit ventilators and unit humidifiers is that of a factory made, encased assembly of the functional elements indicated by its name. Such units can be shipped complete or in sections so that the only field work necessary is the assembling of the sections, providing proper supports and connecting the unit to sources of heat (or fuel), power and water supply, and, if necessary, to vent pipes for combustion gases.

The term *unit heater* describes an assembly of elements whose principal function is heating. The essential elements of a unit heater are a fan and motor, a heater, a housing, and outlet vanes or diffusers.

The term *unit ventilator* describes an assembly whose principal function is to ventilate. It may serve to circulate air within the space, or to introduce air from without the space, or may accomplish both purposes. The essential elements of a unit ventilator are a fan and motor, a heater, a set of dampers, a housing and outlet vanes or diffusers.

The term *unit humidifier* describes an assembly of elements whose principal function is to humidify. The essential element of a unit humidifier is an atomizer or evaporator. To this may be added a fan, a heater, outlet vanes or diffusers, and a housing to enclose the various parts.

UNIT HEATERS

Classification

The various types of unit heaters which are at present available can usually be classified according to one of the three following methods:

1. *By type of heater.* Under this classification there are three types of heating elements to be considered: (a) the *steam or hot water type*, (b) the *electric type*, and (c) the *direct fired type* which may be gas, oil, or coal fired.

2. *By type of fan.* Under this classification there are two types of fans to be considered: (a) the *propeller type*, which may be equipped with a horizontal or vertical shaft, and (b) the *centrifugal type* which may be designed for horizontal or vertical blow.

3. *By arrangement of elements.* Under this classification there are two types of heaters to be considered: (a) the *draw-through type*, in which the