

**Two-Pipe System (Steam or Water):** A heating system in which one pipe is used for the supply of the heating medium to the heating unit, and another for the return of the heating medium to the source of heat supply. The essential feature of a two-pipe system is that each heating unit receives a direct supply of the heating medium, which medium cannot have served a preceding heating unit.

**Up-Feed System:** A heating system in which the supply mains are below the level of the heating units which they serve.

**Vacuum Heating System:** A two-pipe steam heating system equipped with the necessary accessory apparatus which will permit operating the system below atmospheric pressure when desired.

**Vane Ratio:** In air distributing devices the ratio of depth of vane to shortest opening width between two adjacent grille bars.

**Vapor:** The gaseous form of substances which are normally in the solid or liquid state, and which can be changed to these states either by increasing the pressure or decreasing the temperature. Vapors diffuse. (ASA definition.)

**Vapor Heating System:** A steam heating system which operates under pressures at or near atmospheric and which returns the condensate to the boiler or receiver by gravity. Vapor systems have thermostatic traps or other means of resistance on the return ends of the heating units for preventing steam from entering the return mains; they also have a pressure-equalizing and air-eliminating device at the end of the dry-return.

**Velocity:** A vector quantity which denotes at once the time rate and the direction of a linear motion.  $V = \frac{ds}{dt}$ . For uniform linear motion  $V = \frac{s}{t}$ . Common units are: feet per second.

**Ventilation:** The process of supplying or removing air, by natural or mechanical means, to or from any space. Such air may or may not have been conditioned. (See *Air Conditioning*.)

**Viscosity:** That property of semi-fluids, fluids and gases by virtue of which they resist an instantaneous change of shape or arrangement of parts. It is the cause of fluid friction whenever adjacent layers of fluid move with relation to each other.

The coefficient of viscosity is the resistance offered by a layer of the fluid of unit area to the motion parallel to this area of another layer of the fluid at unit distance moving with unit velocity relative to the first layer. This coefficient is known as the *absolute viscosity*, and in cgs units is the force in dynes per square centimeter at a velocity of 1 cm per second at a distance of 1 cm. This unit of absolute viscosity is the *poise*. Values of absolute viscosity are frequently listed in centipoises, a centipoise being 1/100 of 1 poise.

In many formulas *absolute viscosity* is expressed in pounds per foot second or pounds per foot hour. Conversion from centipoises may be made as follows: viscosity in centipoises  $\times 0.000672$  = viscosity in pounds per foot second, or viscosity in centipoises  $\times 2.42$  = viscosity in pounds per foot hour.

*Kinematic viscosity* is the ratio of *absolute viscosity* to the density of a fluid. The unit is the stoke which equals one poise per cu cm per gram, or 1 sq cm per sec. For conversion to English units: kinematic viscosity in stokes  $\times 0.001076$  = kinematic viscosity in square feet per second.

**Volume, Specific:** The volume of a substance per unit mass; the reciprocal of density. Units: cubic feet per pound, cubic centimeters per gram, etc.

**Warm Air Heating System:** A warm air heating plant consists of a heating unit (fuel-burning furnace) enclosed in a casing, from which the heated air is distributed to various rooms of the building through ducts.

**Warm Air Heating System, Forced:** A warm air heating system in which circulation of air is effected by a fan. Such a system may include air cleaning devices.

**Warm Air Heating System, Gravity:** A warm air heating system in which the motive head producing flow depends on the difference in weight between the heated air leaving the casing and the cooler air entering the bottom of the casing.

**Warm Air Heating System, Perimeter:** A warm air heating system of the combination panel and convection type. Warm air ducts embedded in the concrete slab of a basementless house, around the perimeter, receive heated air from a furnace and deliver it to the heated space through registers placed in or near the floor. Air is returned to the furnace from registers near the ceiling.

## CHAPTER 2

ABBREVIATIONS, SYMBOLS,  
CONVERSION FACTORS

Standard Abbreviations; Standard Symbols; Greek Alphabet; Conversion Equations; Graphical Symbols for Piping, Ductwork, Heating and Ventilating, Refrigerating; Identification of Piping by Color

THIS chapter contains information regarding abbreviations, symbols, and conversion equations, which are of particular interest to the engineer engaged in heating, ventilating, and air conditioning.

## ABBREVIATIONS

Abbreviations are shortened forms of names and expressions employed in texts and tabulations, and should not generally be used as symbols in equations. Most of the following abbreviations have been compiled from a list of approved standards.<sup>1</sup> In general, the period has been omitted in all abbreviations, except where the omission results in the formation of an English word. Additional abbreviations applying to individual chapters will be found at the end of Chapters 3, 4, and 13.

|                                         |             |
|-----------------------------------------|-------------|
| Absolute.....                           | abs         |
| Air horsepower.....                     | air hp      |
| Alternating-current (as adjective)..... | a-c         |
| Ampere.....                             | amp         |
| Ampere-hour.....                        | amp-hr      |
| Atmosphere.....                         | atm         |
| Average.....                            | avg         |
| Avoirdupois.....                        | avdp        |
| Barometer.....                          | bar.        |
| Boiling point.....                      | bp          |
| Brake horsepower.....                   | bhp         |
| Brake horsepower-hour.....              | bhp-hr      |
| British thermal unit.....               | Btu         |
| British thermal units per hour.....     | Btuh        |
| Calorie.....                            | cal         |
| Centigram.....                          | cg          |
| Centimeter.....                         | cm          |
| Centimeter-gram-second (system).....    | cgs         |
| Cubic.....                              | cu          |
| Cubic centimeter.....                   | cu cm or cc |
| Cubic foot.....                         | cu ft       |
| Cubic feet per minute.....              | cfm         |
| Cubic feet per second.....              | cfs         |
| Decibel.....                            | db          |
| Degree.....                             | deg or °    |
| Degree, Centigrade.....                 | C           |
| Degree, Fahrenheit.....                 | F           |
| Degree, Kelvin.....                     | K           |
| Degree, Rankine.....                    | R           |
| Diameter.....                           | diam        |

<sup>1</sup> Abbreviations for Scientific and Engineering Terms, Z10.1-1941 (American Standards Association).

<sup>2</sup> It is recommended that the abbreviation for the temperature scale, F, C, K, R, be included in expressions for numerical temperatures but, wherever feasible, the abbreviation for degree be omitted e.g., 68 F.