Velocity (*continued*)
return grilles, 289
unit heater, 229
Vena contracta, 45
Venetian blinds, 135

Ventilation, 6, 63, 149, 178, 186, 206, 683, 686
animal shelters, 157, 158
attic, 131, 146
crawl spaces, 146
dairy stables, 157
garages, 158
living space, 146, 186
natural, 153
general rules, 156
outdoor air, 63, 186, 206, 682, 683
passenger bus in summer, 683
railway passenger car, 681
rules, 156
ship, 686
symbols for drawings, 9
tanks, 727
walls, 147
wind forces, 149

Ventilator, ventilators, 155
control, 156
roof, 155
unit, 223
control, 225
Vertical blow unit heater, 228

Vertical openings, 153, 155
sealing of, 153
Vibration, machine, 363
Viscous filters, 324
impingement, 334
Vitiation of air, 63
Volume
control, 288
furnace, 499, 502
specific, 6

W

Wall, walls
heat flow through, 112–119, 183, 205
heat transfer coefficients, 49, 112–119
infiltration through, 149
time lag of solar radiation, 201

Warm air
gravity heating system, 6, 268
mechanical (forced) systems, 247
air distribution, 247
automatic control, 267, 643
ceiling panel system, 257
cooling methods, 669
continuous circulation, 267
dampers, 249

Warm air (*continued*)
design procedure, 250, 260
ducts, 249
fans, 524
filters, 524
furnace, 524
heavy duty, 524
selection, 264
humidification, 526
large systems, 260
perimeter system, 250–260
panel heating, 267
registers and grilles, 247

Washer, washers, 610
air, 1, 610–612
cooling, 612
dehumidification, 612
humidification, 612

Water
analysis, 752
atmospheric cooling equipment, 597–599
characteristics, 751
classification, 751
coils, 324, 782
content of radiators, 416
control of temperature service, 753
cooled condenser, 574
cooling tower, 599
corrosion treatment, 753–761
demand, 766, 772–777
faucets, 765
fittings, loss, 770, 771
fixtures, 766
fixture units, 766
formed deposits, 751
heater
coal-fired, 777
electric, 779
indirect, 780
solar, 784
heating, 773, 777
in building material, 138
load, 765
make-up, 606, 756
maximum main temperature, 613
meters, 770
mineralized, 752
properties of, 22, 752
services, 765
storage capacity, 773
supply piping, 782
arrangement, 782
temperature control, 783
thermodynamic properties of, 22
treating chemicals, 751, 762
well temperatures, 614

Water vapor, 13, 18–21, 137
condensation in buildings, 137
saturation pressure, 13, 22

Water vapor (*continued*)
specific enthalpy, 2
specific volume, 6, 22
surface condensation, 142

Weather conditions
design outdoor, 161, 178

Welding, 455

Wet-bulb temperature. (see *Temperature*), 5, 15, 605
Wet cup, 140
Wet return, 5, 387

Wind, winds
forces, 149, 153
due to stack effect, 149
natural draft equipment, 531
selection of, velocity, 162, 180

Window, windows
coefficients of transmission, 133
leakage, 150
solar radiation through, 194
Winter
air conditioning system, 269, 669
comfort chart, 69, 72
freezing equipment, 607
Wound rotor motor, 659
Wrought-iron pipe, 447
Wrought-steel pipe, 447

Y

Year-around air-conditioning system, 269, 669
air flow in, 271, 672
control methods, 270, 637–641, 643
design procedure, 269, 275, 669
equipment arrangement, 276
installation, 269, 669
location of apparatus, 276, 671
residential, 669
selection, 275, 669

Z

Zero, absolute, 1

Zone, zones
control, 270, 636, 641, 642
evaporative regulation, 65
metabolic regulation, 65
thermal neutrality, 69
vaso-motor regulation, 65

Zoning, 270, 636, 641
control, 270, 636, 641
hot water system, 641
reheat, 270
volume control, 270

ST. LOUIS PUBLIC LIBRARY SEP 1 1960

CHAPTER 1

TERMINOLOGY

Glossary of Physical and Heating, Ventilating, Refrigerating and Air Conditioning Terms Used in the Text

Absolute Zero: The zero from which absolute temperature is reckoned. Approximately −273.15 C or −459.67 F. These values were established by the Tenth General Conference on Weights and Measures (1954).

Absorbent: A sorbent which changes physically or chemically, or both, during the sorption process.

Absorption: The action of a material in extracting one or more substances present in an atmosphere or mixture of gases or liquids; accompanied by physical change, chemical change, or both, of the sorbent.

Acceleration: The time rate of change of velocity, i.e., the derivative of velocity with respect to time. In the cgs system the unit of acceleration is the centimeter per (second) (second); in the fps system the unit is the foot per (second) (second), $a = \frac{dv}{dt}$.

Acceleration Due to Gravity: The rate of gain in velocity of a freely falling body the value of which varies with latitude and elevation. The international gravity standard has the value of 980.665 cm per (sec) (sec) or 32.174 ft per (sec) (sec) which is the actual value of this acceleration at sea level and about 45 deg latitude.

Adiabatic: An adjective descriptive of a process such that no heat is added to, or taken from, a substance or system undergoing the process.

Adsorbent: A sorbent which does not change physically or chemically during the sorption process.

Adsorption: The action, associated with surface adherence, of a material in extracting one or more substances present in an atmosphere or mixture of gases and liquids, unaccompanied by physical or chemical change. Commercial adsorbent materials have enormous internal surfaces.

Aerosol: An assemblage of small particles, solid or liquid, suspended in air. The diameters of the particles may vary from 100 microns down to 0.01 micron or less, e.g., dust, fog, smoke.

Air Cleaner: A device designed for the purpose of removing airborne impurities such as dusts, gases, vapors, fumes, and smokes. (Air cleaners include air washers, air filters, electrostatic precipitators, and charcoal filters.)

Air Conditioning: The process of treating air so as to control simultaneously its temperature, humidity, cleanliness, and distribution to meet the requirements of the conditioned space.

Air, Dry: In psychrometry, air unmixed with, or containing no, water vapor.

Air, Saturated: A mixture of dry air and saturated water vapor, all at the same dry-bulb temperature.

Air, Standard: Air with a density of 0.075 lb per cu ft and an absolute viscosity of 0.0379×10^{-4} lb mass per (ft) (sec). This is substantially equivalent to dry air at 70 F and 29.92 in. Hg barometric pressure.

Air Washer: An enclosure in which air is drawn or forced through a spray of water in order to cleanse, humidify, or dehumidify the air.

Anemometer: An instrument for measuring the velocity of a fluid.

Aspect Ratio: In air distribution outlets, the ratio of the length of the core of a grille, face, or register to the width.
In rectangular ducts, the ratio of the width to the depth.

Atmospheric Pressure: The pressure of the atmosphere to be measured by means of the barometer. *Standard Atmospheric Pressure* or *Standard Atmosphere* is exactly 1,013,250 dynes per sq cm by recent action of the Tenth General Conference on Weights and Measures (1954). It is approximately the pressure exerted by a column of mercury 76 cm high at standard gravitational acceleration, 980.665 cm per (sec) (sec), the mercury having a density of 13.5951 g per cu cm. It is equivalent to 14.696 psi or 29.921 in. Hg at 32 F.

Baffle: A surface used for deflecting fluids, usually in the form of a plate or wall.

Blast Heater: A set of heat transfer coils or sections used to heat air which is drawn or forced through it by a fan.

Blow (throw): In air distribution, the distance an air stream travels from an outlet to a position at which air motion along the axis reduces to a velocity of 50 fpm.
For unit heaters, the distance an air stream travels from a heater without a perceptible rise due to temperature difference and loss of velocity.

Boiler Heating Surface: All of the surface of the heat-transfer apparatus in contact on one side with the water or wet steam being heated and on the other side with the gas or refractory being cooled, in which the fluid being heated forms part of the circulating system, this surface to be measured on the side receiving heat. (Stationary Steam-Generating Units, *ASME Power Test Codes*, PTC 4-1946.)
Direct Heating Surface is generally understood to be the *boiler heating surface* subject to direct radiation from the surface of the grate, or from the surfaces of oil or gas burners.
Indirect Heating Surface is the *boiler heating surface* within the flues.

Boiler Horsepower: The equivalent evaporation of 34.5 lb of water per hr from and at 212 F. This is equal to a heat output of $970.3 \times 34.5 = 33{,}475$ Btuh.

British Thermal Unit (Btu): The Btu is defined as 778.177 foot-pounds if it is related to the IT calorie in such a way that 1 IT calorie per (kg) (C deg) = 1 Btu per (lb) (F deg), with 1 lb = 453.5924 g. The Ninth General Conference on Weights and Measures (1948) recommended the absolute joule as the fundamental unit of energy thereby, in effect, liquidating the old international electrical units. This calls for a redefinition of the International Tables calorie (IT cal) according to the following conversion factor: 4.18684 joule per IT calorie.

Calorie (Gram Calorie): The IT gram calorie is equivalent to 0.003968 Btu. (See definition of Btu.)

Central Fan System: A mechanical indirect system of heating, ventilating, or air conditioning, in which the air is treated or handled by equipment located outside the rooms served, usually at a central location, and is conveyed to and from the rooms by means of a fan and a system of distributing ducts. (See Chapter 19.)

Chimney Effect: The tendency of air or gas in a duct or other vertical passage to rise when heated due to its lower density compared with that of the surrounding air or gas. In buildings, the tendency toward displacement (caused by the difference in temperature) of internal heated air by unheated outside air due to the difference in density of outside and inside air.

Coefficient of Performance (Heating): The ratio of the total *instantaneous* useful heating effect produced by a heat pump system at stated conditions, to the heat equivalent of the total energy input rate required to drive or operate the system.

Coefficient of Performance (Cooling): The ratio of the *instantaneous* refrigeration effect produced by a heat pump