state, liquid: one of three states or phases of matter characterized by limited freedom of molecules and by substantial incompressibility.

state, solid: one of the three states or phases of matter, characterized by stability of dimensions, relative incompressibility, and molecular motion held to limited oscillation.

steam: water in the vapor phase.

steam, dry saturated: steam at the saturation temperature corresponding to the pressure, and containing no water in suspension.

steam, superheated: steam at a temperature higher than the saturation temperature corresponding to the pressure.

steam, wet saturated: steam at the saturation temperature corresponding to the pressure, and containing water particles in suspension.

steam trap: a device for allowing the passage of condensate, or air and condensate, and preventing the passage of steam.

strainer: a device for witholding foreign matter from a flowing liquid or gas.

stroke: of a piston, length of travel (twice its crank radius).

stuffing box: a packing gland surrounding a shaft, stem or rod to prevent leakage.

subcooling: process of cooling refrigerant below condensing temperature, for a given pressure. Also cooling a liquid below its freezing point, where it can exist only in a state of unstable equilibrium.

sublimation: change of state directly from solid to gas without appearance of liquid.

suction inlet: port through which gas enters compressor.

suction line: the tube or pipe which carries the refrigerant vapor from the evaporator to the compressor inlet.

sun effect: solar energy transmitted into space through windows and building materials.

superheater: a heat exchanger used on flooded evaporators, wherein hot liquid on its way to enter the evaporator is cooled by supplying heat to dry and superheat the wet vapor leaving the evaporator.

supply mains: the pipes through which the heating or cooling medium of a system flows from the source of heat or refrigeration to the runouts and risers leading to the heating or cooling units.

surface, heating: the exterior surface of a heating unit. *Extended heating surface (or extended surface)*: Heating surface consisting of fins, pins, or ribs which receive heat by conduction from the prime surface. *Prime surface*: Heating surface having the heating medium on one side and air (or extended surface) on the other. (See also *boiler heating surface.*)

surface cooling: a method of cooling air or other gas by passing over cold surfaces.

surge drum: see *accumulator.*

sweating: condensation of moisture from air on a surface which is below the dew point temperature.

system: a heating or refrigerating scheme or machine, usually confined to those parts in contact with heating or refrigerating medium.

system, closed: a heating or refrigerating piping system in which the circulating water or brine is completely enclosed, under pressure above atmospheric, and shut off from the atmosphere except for a vented expansion tank at the high point of the system.

system, direct: a heating, air-conditioning, or refrigerating system in which electric heating elements or products of combustion, or the refrigerant, exchange heat, directly with the material or space heated or cooled, or with the air in a passageway communicating with such space.

system, direct return: a piping arrangement for a heating, air-conditioning, or refrigerating system, in which the heating or cooling fluid, after it has passed through a heat-exchange unit, is returned to the boiler or evaporator by the shortest direct path, resulting in considerable differences in the lengths of the several circuits composing the system.

system, down-feed: a piping arrangement for a heating, air-conditioning, or refrigerating system, in which the heating or cooling fluid is circulated through supply mains which are above the levels of the heating or cooling units which they serve.

system, duct: a series of ducts, elbows and connectors to convey air from one location to another.

system, forced-circulation: a heating, air-conditioning, or refrigerating system in which the heating or cooling fluid circulation is effected by a fan or pump.

system, gravity circulation: a heating or refrigerating system in which the heating or cooling fluid circulation is effected by the motive head due to difference in densities of cooler and warmer fluids in the two sides of the system.

system, indirect: a heating, air-conditioning, or refrigerating system in which a fluid, such as air, water or brine, heated or cooled by electric heating elements or products of combustion or by a refrigerant, is circulated to the material or space to be heated or cooled, or is used to heat or cool air so circulated.

system, one-pipe: a piping system in which the fluid withdrawn from the supply main passes through a heating or cooling unit and returns to the same supply main.

system, open: a heating or refrigerating piping system in which the circulating water or brine return main is connected to an open-vented elevated tank which serves as a reservoir to accommodate the expansion and contraction of the fluid, and as an inspection point for the condition of the fluid.

system, overhead: a heating, air-conditioning or refrigerating piping system in which the supply main is above the heating or cooling units supplied.

system, reversed-return: a piping system in which the heating or cooling medium from several heat transfer units is returned along paths arranged so that all circuits composing the system or composing a major sub-division of it are of practically equal length.

system, two-pipe: a piping system in which the fluid withdrawn from the supply main passes through a heating or cooling unit to a separate return main.

system, up-feed: a piping arrangement for a heating, air-conditioning or refrigerating system, in which the cooling fluid is circulated through supply mains which are below the levels of the heating or cooling units which they serve.

system, welded: a piping system for conveying fluids, in which all joints are welded or brazed.

temperature: the thermal state of matter with reference to its tendency to communicate heat to matter in contact with it. If no heat flows upon contact, there is no difference in temperature.

temperature, absolute: temperature expressed in degrees above absolute zero.

temperature, critical: the saturation temperature corresponding to the critical state of the substance at which the properties of the liquid and vapor are identical.

temperature, dew-point: the temperature at which the condensation of water vapor in a space begins for a given state of humidity and pressure as the temperature of the vapor is reduced. The temperature corresponding to saturation (100 percent relative humidity) for a given absolute humidity at constant pressure.

temperature, dry-bulb: the temperature of a gas or mixture of gases indicated by an accurate thermometer after correction for radiation.

temperature, effective: an arbitrary index which combines into a single value the effect of temperature, humidity, and air movement on the sensation of warmth or cold felt by the human body. The numerical value is that of the temperature of still, saturated air which would induce an identical sensation.

temperature, mean radiant (MRT): the temperature of a uniform black enclosure in which a solid body or occupant would exchange the same amount of radiant heat as in the existing nonuniform environment.

temperature, room: temperature of any room, as for example (1) a room in which a refrigerator is being operated or tested; (2) a room being conditioned for the comfort of occupants. Used colloquially to mean ordinary temperature one is accustomed to find in dwellings.

temperature, saturation: for a fluid, the boiling point corresponding to a given pressure; evaporation temperature; condensation temperature.

temperature, wet-bulb: thermodynamic wet-bulb temperature is the temperature at which liquid or solid water, by evaporating into air, can bring the air to saturation adiabatically at the same temperature. Wet-bulb temperature (without qualification) is the temperature indicated by a wet-bulb psychrometer constructed and used according to specifications.

temperature difference, mean: mean of differences between temperatures of a fluid receiving and a fluid yielding heat.

thawing: changing free water, or contained water as in foods, from solid phase to liquid phase by the addition of heat.

therm: a quantity of heat equivalent to 100,000 Btu.

thermocouple: devise for measuring temperature utilizing the

fact that an electromotive force is generated whenever two junctions of two dissimilar metals in an electric circuit are at different temperature levels.

thermodynamics: the science of heat energy and its transformations to and from other forms of energy.

thermodynamics, laws of: two laws upon which rest the classical theory of thermodynamics. These laws have been stated in many different, but equivalent ways. *The First Law:* (1) When work is expended in generating heat, the quantity of heat produced is proportional to the work expended; and conversely, when heat is employed in the performance of work, the quantity of heat which disappears is proportional to the work done (Joule); (2) If a system is caused to change from an initial state to a final state by adiabatic means only, the work done is the same for all adiabatic paths connecting the two states (Zemansky); (3) In any power cycle or refrigeration cycle the net heat absorbed by the working substance is exactly equal to the net work done *The Second Law:* (1) It is impossible for a self-acting machine, unaided by any external agency, to convey heat from a body of lower temperature to one of higher temperature (Clausius); (2) It is impossible to derive mechanical work from heat taken from a body unless there is available a body of lower temperature into which the residue not so used may be discharged (Kelvin); (3) It is impossible to construct an engine that, operating in a cycle, will produce no effect other than the extraction of heat from a reservoir and the performance of an equivalent amount of work (Zemansky).

thermometer: an instrument for measuring temperature.

thermostat: an instrument which responds to changes in temperature, and which directly or indirectly controls temperature.

thermostat, direct-acting: an instrument for activating a control circuit upon sensing a predetermined low temperature.

thermostat, reverse-acting: an instrument for activating a control circuit upon sensing a predetermined high temperature.

thermostat, room: a thermostat properly located in a room so as to respond to representative room temperature and thereby control heating or cooling devices.

throttling: of a fluid, an irreversible adiabatic process which consists of lowering pressure by an expansion without work.

throw: the horizontal or vertical axial distance an air stream travels after leaving an air outlet before the maximum stream velocity is reduced to a specified terminal level, e.g., 200, 150, 100, or 50 fpm.

ton of refrigeration: a useful refrigerating effect equal to 12,000 Btu per hr; 200 Btu per min.

ton-day of refrigeration: the heat removed by a ton of refrigeration operating for a day, 288,000 Btu. Approximately equal to the latent heat of fusion or melting of 1 ton (2000 lb) of ice, from and at 32 F.

transmission: in thermodynamics, a general term for heat travel; properly, heat transferred per unit of time.

transmission, heat, coefficient of: any one of a number of coefficients used in the calculation of heat transmission by conduction, convection, and radiation, through various materials and structures.

transmittance, thermal (U factor): the time rate of heat flow from the fluid on the warm side of a barrier to the fluid on the cold side, per unit temperature difference.

triple point: state point at which three phases of given substance (i.e., solid, liquid and gas) exist in equilibrium.

tube, condenser (heat exchanger): tube manufactured to special requirements as to tolerances, finish and temper.

tube, copper water: seamless copper tube of certain standard sizes, in straight lengths and coils, used with flared or soldered joints, for the conveyance of gases, vapors, and liquids.

tube, finned: heat transfer tube or pipe with extended surface in the form of fins, discs or ribs.

tube, seamless: tube produced with an initially continuous periphery.

tube, soft copper: deoxidized, and dehydrated, seamless, soft copper tube, thoroughly annealed to assure quality for bending and flaring.

tube, welded: tube made from plate, sheet or strip with welded longitudinal or helical joint.

unit: a factory-made, encased assembly of the functional elements indicated by its name, such as air-conditioning unit, room-cooling unit, humidifying unit, etc.

unit cooler: a direct-cooling factory-made, encased assembly including a cooling element, fan and motor (usually) and directional outlet.

unit heater: a direct-heating, factory-made, encased assembly including a heating element, fan and motor, and directional outlet.

unloader: a device on or in a compressor for equalising the high and low side pressures for a brief period during starting, in order to decrease the starting load on the motor; also a device for controlling compressor capacity by rendering one or more cylinders ineffective.

valve, back-pressure: see *pressure regulator, evaporator.*

valve, charging: a valve used to charge or add refrigerant to the system, or add oil to the compressor crankcase.

valve, check: a valve allowing (fluid) flow in one direction only.

valve, constant pressure expansion: a controlling device for regulating the flow of volatile refrigerant into a cooling unit, actuated by changes in pressure of the low side.

valve, diaphragm: a form of packless valve, manually or mechanically actuated. Also a valve actuated by pressure of a motivating fluid on one side of the diaphragm which seals the motivating fluid from the flowing fluid controlled by the valve. Flowing and motivating fluids may, but need not, be the same.

valve, direct-acting diaphragm: one which closes with the admission of fluid pressure to a diaphragm and opens when pressure is released.

valve, discharge: on a compressor, the valve which allows compressed refrigerant to flow from the cylinder to the discharge main.

valve, drain: see *valve, purge.*

valve, emergency relief: a manually-operated valve for the discharge of refrigerant in case of fire or other emergency.

valve, expansion: valve for controlling the flow of refrigerant to the cooling element.

valve, expansion, automatic: a device which regulates the flow of refrigerant from the liquid line into the evaporator to maintain a constant evaporator pressure.

valve, expansion, hand: a manually operated needle-type valve for controlling the flow of liquid refrigerant to an evaporator.

valve, expansion, thermostatic: a controlling device for regulating the flow of volatile refrigerant into a cooling unit, actuated by changes in evaporator pressure and superheat of the refrigerant leaving the cooling unit. The basic response is to superheat.

valve, float: regulating valve controlled by liquid level. Valve actuated by float in a liquid container.

valve, king: stop valve between receiver and liquid main.

valve, low-side float: a float valve operating by changes in level of low-pressure liquid, opens at low level and closes at high.

valve, packless: a valve which does not use packing to prevent leaks around the valve stem. Flexible material is generally used to seal against leaks and still permit valve movement.

valve, pressure reducing: an air distribution device consisting of a factory-made assembly with either manual or automatic volume control operating at static pressures above 0.40 in. water.

valve, pressure relief: a valve held closed by a spring or other means and designed to relieve automatically pressure in excess of its setting. Also called *safety valve.*

valve, purge: device to allow fluid to flow out of system, particularly non-condensable gases. Also called a *drain valve.*

valve, reducing: a valve which maintains a uniform pressure on its outlet side, irrespective of how the pressure on its inlet side may vary above the pressure to be maintained.

valve, reverse-acting diaphragm: one which opens with the admission of fluid pressure to a diaphragm and closes when pressure is released.

valve, safety: see *valve, pressure relief.*

valve, service: a valve intended to help isolate an apparatus from the rest of the system; may be a *stop valve.*

valve, solenoid: a valve which is closed by gravity, pressure, or spring action and opened by the movement of a plunger due to the magnetic action of an electrically energised coil, or vice-versa.

valve, stop: a shut-off valve other than a valve for controlling the flow of refrigerant.

valve, suction: in a compressor, the valve which allows refrigerant to enter the cylinder from the suction line and prevents return flow.

valve, suction pressure regulating: an automatic valve located between the evaporator outlet and compressor inlet that is responsive to its own outlet pressure and functions to throttle the vapor flow so as to prevent the suction pressure at the compressor