expansion valve superheat: the difference between the temperature of the thermal bulb and the temperature corresponding to the pressure at the outlet, or at the equalizer connection, when provided, of a thermostatic expansion valve.

expansion valve superheat change: the change in superheat of a thermostatic expansion valve required to open the valve a predetermined amount.

extended surface: heat transfer surface, one or both sides of which are increased in area by the addition of fins, discs, or other means.

extruded: pushed out through a die. Bars of ice, metal rods, shapes and tubes are made by this method.

factor of safety (in pressure vessels): ratio of ultimate stress to design working stress.

Fahrenheit: a thermometric scale in which 32 deg denotes freezing and 212 deg the boiling point of water under normal pressure at sea level (14.696 psi).

fan: a fan is an air-moving device comprising a wheel or blade, and housing or orifice plate.

fan, centrifugal: a fan rotor or wheel within a scroll type housing and including driving mechanism supports for either belt drive or direct connection.

fan, propeller: a propeller or disc type wheel within a mounting ring or plate and including driving mechanism supports for either belt drive or direct connection.

fan, tubeaxial a propeller or disc type wheel within a cylinder and including driving mechanism supports for either belt drive or direct connection.

fan, vaneaxial: a disc type wheel within a cylinder, a set of air guide vanes located either before or after the wheel and including driving mechanism supports for either belt drive or direct connection.

fan economizer: device which prevents the operation of the fan motor as a cold diffuser during the shut-down period after the coil has been defrosted.

filter: a device to remove solid material from a fluid.

filter press: a device for separating solid and liquid matter under pressure so that the solid residue is compressed into briquettes to facilitate removal.

fin: an extended surface to increase the heat transfer area, as metal sheets attached to tubes.

flammability: a material's ability to burn.

flare fitting: a type of soft-tube connector which involves the flaring of the tube to provide a mechanical seal.

flash chamber: separating tank placed between the expansion valve and evaporator in a refrigeration system to separate and bypass any flash gas formed in the expansion valve.

flash gas: the gas resulting from the instantaneous evaporation of refrigerant in a pressure-reducing device to cool the refrigerant to the evaporation temperature obtaining at the reduced pressure.

flash point: temperature of combustible material, as oil, at which there is a sufficient vaporization to ignite the vapor, but not sufficient vaporization to support combustion of the material.

flotation: a method of treating materials by floating in a liquid. An icemaking method in which ice floats away from the surface on which it has been frozen.

flow, laminar or streamlime: fluid flow in which each fluid particle moves in a smooth path substantially parallel to the paths followed by all other particles.

flow, turbulent: fluid flow in which the fluid moves transversly as well as in the direction of the tube or pipe axis, as opposed to streamline or viscous flow.

fluid: gas, vapor, or liquid.

fluid, primary: the refrigerant, to distinguish from secondary fluid or brine.

fluid, secondary: fluid cooled by the refrigerant in indirect method of refrigeration.

foaming: the formation of a foam or froth of an oil-refrigerant mixture due to rapid boiling out of the refrigerant dissolved in the oil when the pressure is suddenly reduced. This occurs when the compressor starts operating and, if large quantities of refrigerant were dissolved large quantities of oil may boil out and be carried through the refrigerant lines.

fog: suspended liquid droplets generated by condensation from the gaseous to the liquid state, or by breaking up a liquid into a dispersed state, such as by splashing, foaming, and atomizing.

force: the action on a body which tends to change its relative condition as to rest or motion.

free area: the total minimum area of the openings in an air inlet or outlet through which air can pass.

freeze-up: failure of a refrigerating unit to operate normally due to formation of ice at the expansion device. A valve may freeze shut or open, causing improper refrigeration in either case. On a coil, frost formation to the extent that air flow stops or is severely restricted.

freezer: in cold storage, an insulated room kept below 30 F—see (a) *carrying freezer*, (b) *sharp freezer*. Any device for freezing perishables.

freezer, carrying: cold storage freeze room, generally kept between − 20 and 20 F, to receive and hold frozen goods.

freezer, sharp: cold storage freezer room, generally kept at from − 40 to − 10 F, to receive unfrozen goods and freeze them.

freezing method, refrigerated plate: heat transfer through the direct contact of refrigerated plates with the packaged product.

freezing method, tray: a method of freezing food by subjecting it to moving refrigerated air; the food is arranged on shallow trays, which are placed in portable racks and put in an insulated chamber through which the air is blown.

freezing point: temperature at which a given liquid substance will solidify or freeze upon removal of heat. Freezing point for water is 32 F.

freezing time: time for any complete freezing process to take place.

frost back: the flooding of liquid from an evaporator into the suction line accompanied by frost formation on suction line in most cases.

frozen food: any food in which the contained water is in the solid form.

fumes: smoke; aromatic smoke; odor emitted, as of flowers; a smoky or vaporous exhalation, usually odorous, as that from concentrated nitric acid. The word *fumes* is so broad and inclusive that its usefulness as a technical term is very limited. Its principal definitive characteristic is that it implies an odor. The terms vapor, smoke, fog, etc., which can be more strictly defined, should be used whenever possible.

Also defined as solid particles generated by condensation from the gaseous state, generally after volatilization from molten metals, etc., and often accompanied by a chemical reaction such as oxidation. Fumes flocculate and sometimes coalesce.

furnace: that part of a boiler or warm air heating plant in which combustion takes place. Also a complete heating unit for transferring heat from fuel being burned to the air supplied to a heating system.

fusible plug: a device having a predetermined melting temperature member for the relief of pressure.

gage (gauge): instrument for measuring pressure or liquid level. Also arbitrary scale of measurement for sheet metal thickness, wire and drill diameters, etc.

gage glass: device for showing a liquid level.

gas: usually a highly superheated vapor which, within acceptable limits of accuracy, satisfies the perfect gas laws.

gas, inert: a gas that neither experiences nor causes chemical reaction nor undergoes a change of state in a system or process; e.g., nitrogen or helium mixed with a volatile refrigerant.

gas, noncondensable: gas in a refrigerating system which does not condense at the temperature and partial pressure at which it exists in the condenser, and therefore imposes a higher head pressure on the system.

generator: basic part of absorption system; a still provided with means of heating used to drive refrigerant out of solution.

glazing: of foods, freezing a coat of ice on frozen food by dipping in water, the latent heat of the coat being absorbed inwards.

graduated acting: term applied to a control instrument or device which functions to give throttling control; that is, operates between full-on and full-off position.

gravity, specific: density compared to density of standard material; reference usually to water or air.

grille: a louvered or perforated covering for an air passage opening, which can be located in the sidewall, ceiling, or floor.

halide torch: a flame tester generally using alcohol and burning with a blue flame; when the sampling tube draws in halocarbon refrigerant vapor, color of flame changes to bright green.

head, dynamic or total: in flowing fluid, the sum of the static and velocity heads at the point of measurement.

head, static: the static pressure of fluid expressed in terms of the height of a column of the fluid, or of some manometric fluid, which it would support.

head, velocity: in a flowing fluid, the height of the fluid or of some manometric fluid equivalent to its velocity pressure.

heat: the form of energy that is transferred by virtue of a temperature difference.

heat, latent: change of enthalpy during a change of state. With pure substances, latent heat is absorbed or rejected at constant pressure.

heat, sensible: heat which is associated with a change in temperature; specific heat exchange of temperature; in contrast to a heat interchange in which a change of state (latent heat) occurs.

heat, specific: the ratio of the quantitity of heat required to raise the temperature of a given mass of any substance one deg to the quantity required to raise the temperature of an equal mass of a standard substance (usualy water at 59 F) one deg.

heat, vital: heat generated by fruits and vegetables in storage, due to ripening.

heat exchanger: a device specifically designed to transfer heat between two physically separated fluids. Also, see *heat interchanger*.

heat of fusion: latent heat involved in changing between the solid and the liquid states.

heat of reaction: heat per unit mass or per mole of one of the reagents or products of reaction in a chemical reaction; exothermal if given off, endothermal if absorbed.

heat of the liquid: enthalpy of a mass of liquid above an arbitrary zero.

heat of vaporization: latent heat involved in the change between liquid and vapor states.

heat pump: a refrigerating system employed to transfer heat into a space or substance. The condenser provides the heat while the evaporator is arranged to pick up heat from air, water, etc. By shifting the flow of air or other fluid a heat pump system may also be used to cool the space.

heat transmission any time-rate of heat flow; usually refers to conduction, convection and radiation combined.

heat transmission coefficient: any one of a number of coefficients used in the calculation of heat transmission by conduction, convection, and radiation, through various materials and structures. (See *thermal conductance, thermal conductivity, thermal resistance, thermal resistivity, thermal transmittance*, etc.)

heating, regenerative: a heat transfer process for utilizing heat which must be rejected or absorbed in one part of a cycle, to perform a useful function in another part of the cycle.

heating system, high-pressure steam: a steam heating system employing steam at pressures above 15 psig.

heating system, high-temperature water: a heating system in which water having supply temperatures above 350 F is used as a medium to convey heat from a central boiler, through a piping system, to suitable heat distributing means.

heating system, hot water: a heating system in which water having supply temperatures less than 250 F is used as a medium to convey heat from a central boiler, through a piping system, to suitable heat distributing means.

heating system, low-pressure steam: a steam heating system employing steam at pressures between 0 and 15 psig.

heating system, low-temperature water: same as *hot water heating system*.

heating system, medium-temperature water: a heating system in which water having supply temperatures between 250 F and 350 F is used as a medium to convey heat from a central boiler, through a piping system, to suitable heat distributing means.

heating system, panel: a heating system in which heat is transmitted by both radiation and convection from panel surfaces to both air and surrounding surfaces.

heating system, perimeter warm air: 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.

heating system, radiant: a heating system in which only the heat radiated from panels is effective in providing the heating requirements. The term *radiant heating* is frequently used to include both *panel* and *radiant heating*.

heating system, split: a system in which the heating is accomplished by means of radiators or convectors supplemented by mechanical circulation of air (heated or unheated) from a central point. Ventilation may be provided by the same system.

heating system, steam: a heating system in which heat is transferred from the boiler or other source of heat to the heating units by means of steam at, above, or below atmospheric pressure.

heating system, vacuum: a two pipe steam heating system equipped with the necessary accessory apparatus which will permit operating the system below atmospheric pressure when desired.

heating system, vapor: a steam heating system which operates under pressures at or near atmospheric and which returns the condensate to the boiler or receiver by gravity.

heating system, warm air: a warm air heating plant consisting 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.

heating unit, electric: a structure containing one or more heating elements, electrical terminals or leads, electric insulation, and a frame or casing, all assembled together in one unit.

high capacity unit: an air distribution unit consisting of a factory-made assembly of dual duct modulating dampers and integral volume control station together with a temperature mixing station to supply air volumes greater than 2000 cfm from an external source. These units are designed for furred-in application and distribution ducts to provide sound attenuation and air delivery to the occupied room.

high pressure unit: an air distribution unit consisting of a factory-made assembly with either a *dual duct* modulating damper (or a single duct pressure reducing damper), an integral volume controller together with temperature mixing and sound attenuation stations, which supply air volumes up to approximately 2000 cfm and static pressures greater than 0.40 in. water from an external source. Units may be designed for a furred-in application in a plenum or for exposed installation in the space with or without an enclosure.

high side: parts of a refrigerating system subjected to condenser pressure or higher.

horsepower: unit of power in foot-pound-second system, work done at the rate of 550 ft lb per sec, or 33,000 ft lb per min.

hot gas line: a line used to convey discharge gas from the compressor.

humidifier: a device to add moisture to air.

humidifier, central: a device which humidifies air to be circulated through ducts in an air-conditioning system.

humidifier, room-spray type: an air humidifier which sprays water directly into the room.

humidify: to add water vapor to the atmosphere; to add water vapor or moisture to any material.

humidifying effect: the latent heat of vaporization of water at the average evaporating temperature times the weight of water evaporated per unit of time.

humidistat: a regulatory device, actuated by changes in humidity, used for the automatic control of relative humidity.

humidity: water vapor within a given space.

humidity, absolute: the weight of water vapor per unit volume.

humidity, percentage: the ratio of the weight of water vapor associated with a pound of dry air to the weight of water vapor associated with a pound of dry air saturated at the same temperature.

humidity ratio: see *humidity, specific*.

humidity, relative: the ratio of the mol fraction of water vapor present in the air, to the mol fraction of water vapor present in saturated air at the same temperature and barometric pressure; approximately, it equals the ratio of the partial pressure or density of the water vapor in the air, to the saturation pressure or density, respectively, of water vapor at the same temperature.

humidity, specific: weight of water vapor (steam) associated with one lb weight of dry air, also called *humidity ratio*.

hydrolysis: the splitting up of compounds by reaction with water; e.g., reaction of dichlorodifluoromethane or methyl chloride with water, in which cases acid materials are formed.

hydrometer: an instrument which, by the extent of its submergence, indicates the specific gravity of the liquid in which it floats.

hydronics: the science of heating and cooling with liquids.

hygrometer: instrument responsive to humidity conditions (usually relative humidity) of the atmosphere.