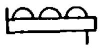
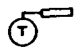
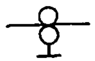
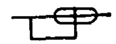
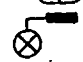
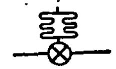
76. Scale Trap	
77. Spray Pond	
78. Thermal Bulb	
79. Thermostat (Remote Bulb)	
80. Valves	
80.1 Automatic Expansion	
80.2 Compressor Suction Pressure Limiting, Throttling Type (Compressor Side)	
80.3 Constant Pressure, Suction	
80.4 Evaporator Pressure Regulating, Snap Action	
80.5 Evaporator Pressure Regulating, Thermostatic Throttling Type	
80.6 Evaporator Pressure Regulating, Throttling Type (Evaporator Side)	
80.7 Hand Expansion	
80.8 Magnetic Stop	
80.9 Snap Action	
80.10 Suction Vapor Regulating	
80.11 Thermo Suction	
80.12 Thermostatic Expansion	
80.13 Water	
81. Vibration Absorber, Line	

IDENTIFICATION OF PIPING SYSTEMS BY COLOR

The color scheme for identification of piping systems, based on material carried, as listed in the following table and shown in Fig. 1, is reprinted from Part V, Fourth Edition, of the Engineering Standards of the *Heating, Piping and Air Conditioning Contractors National Association.*[7]

CLASS	COLOR
F—Fire-protection	Red
D—Dangerous materials	Yellow or Orange
S—Safe Materials	Green (or the achromatic colors, white, black, gray or aluminum)
and, when required	
P—Protective materials	Bright blue
V—Extra valuable materials	Deep purple

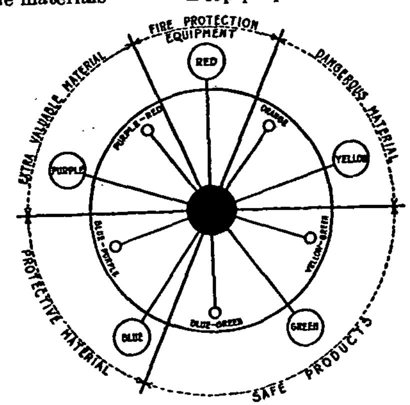


FIG. 1. MAIN CLASSIFICATION BY COLOR

[1] See Scheme for Identification of Piping Systems, A13-1928, *American Standards Association*

CHAPTER 3

THERMODYNAMICS

Mass and Energy Balances; Thermodynamic Properties of Moist Air; Formulas and Tables; Thermodynamic Properties of Water, Formulas and Tables; Degree of Saturation; ASHAE Psychrometric Chart; Solution of Air Conditioning Problems by Use of Tables and Psychrometric Chart; U. S. Standard Atmosphere

THERMODYNAMICS is that branch of natural science which deals with energy and its transformations into various forms. In this chapter the discussion will be limited to thermodynamics as it affects the arts of heating and air conditioning. This will necessarily presume some knowledge of the fundamentals of the science on the part of the reader who may also find it desirable to refer to a standard text on the subject, preferably one published after 1930.

MASS AND ENERGY BALANCES

The First Law of Thermodynamics is a statement of the Principle of Conservation of Energy. It may be stated as follows: *The energy added to a system is equal to the increase or decrease of the energy stored in the system, plus the energy which leaves the system.* For a completely contained, or non-flow system, this may be restated as: The heat added to a non-flow system is equal to the change in the internal energy of the system, plus the work done by the system.

$$ {}_1q_2 = U_2 - U_1 + w \tag{1} $$

For a constant pressure process

$$ {}_1q_2 = H_1 - H_2 \tag{2} $$

where

${}_1q_2$ = energy added between points 1 and 2.
U = internal energy of system.
w = work done by system.
H = enthalpy of system.

Subscripts 1 and 2 refer to sections of the system between which a change takes place.

For engineering problems, a more important application of the First Law is its use in cases in which, in addition to energy, one or more fluids are crossing the boundaries of the system. The most simple of these is the steady flow system, in which the rates of energy and mass flow across the boundaries of the system are constant, and no mass or energy is stored or released by the system.

Consider a system as illustrated in Fig. 1. The fluid crossing the boundaries of the system carries with it potential energy by reason of its elevation above some convenient datum, kinetic energy by reason of its