

TABLE 10. LINEAR EXPANSION OF SOLIDS AT ORDINARY TEMPERATURES^a

(Tabular values represent increase per foot per 100 deg increase in temperature, Fahrenheit).

SUBSTANCE	TEMP. CONDITIONS ^b DEG. FAHR.	COEFFICIENT PER 100 DEG. FAHR.	SUBSTANCE	TEMP. CONDITIONS ^b DEG. FAHR.	COEFFICIENT PER 100 DEG. FAHR.
Brass (cast)	32 to 212	0.001042	Lead	32 to 212	0.001505
Brass (wire)	32 to 212	0.001072	Mercury	32 to 212	0.009984
Copper	32 to 212	0.000926	Limestone	32 to 212	0.000139
Glass (English flint)	32 to 212	0.000451	Steel (Bessemer rolled, hard)	0 to 212	0.00056
Granite (average)	32 to 212	0.000482	Steel (Bessemer rolled, soft)	0 to 212	0.00063
Iron (cast)	104	0.000589	Steel (cast, French)	104	0.000734
Iron (soft forged)	0 to 212	0.000634	Steel (cast annealed, English)	104	0.000608
Iron (wire)	32 to 212	0.000800			

^aFrom *Mechanical Equipment of Buildings*, Vol. 1, by Harding and Willard, revised edition, 1929.^bWhere range of temperature is given, coefficient is mean over range.^cCoefficient of cubical expansion.

gas, then $\frac{V_1}{V_2} = \frac{P_2}{P_1}$, or $P_1 V_1 = P_2 V_2$, but since $P_1 V_1$ for any given case is a definite constant quantity, it follows that the product of the absolute pressure and volume of a gas is a constant, or $PV = C$, when T is kept constant. Any change in the pressure and volume of a gas at constant temperature is called an *isothermal change*.

Charles' Law refers to the relation between pressure, volume and temperature of a gas and may be stated as follows: *The volume of a given weight of gas varies directly as the absolute temperature at constant pressure, and the pressure varies directly as the absolute temperature at constant volume.* Hence, when heat is added at constant volume, V_c , the resulting equation is $\frac{P_2}{P_1} = \frac{T_2}{T_1}$, or, for the same temperature range at constant pressure, P_c , the relation is $\frac{V_2}{V_1} = \frac{T_2}{T_1}$.

In general, for any weight of gas, W , since volume is proportional to weight, the relation between P , V and T is

$$PV = WRT \quad (2)$$

where

P = the absolute pressure of the gas in pounds per square foot.

V = the volume of the weight W in cubic feet.

W = the weight of the gas in pounds.

R = a constant depending on the nature of the gas.

T = the absolute temperature in degrees Fahrenheit.

This is the characteristic equation for a perfect gas, and while no gases are perfect in this sense, they conform so nearly that Equation 5 will apply to most engineering computations.

Chapter 40

GENERAL INFORMATION

Codes and Standards; Greenhouse Heating; Specifications; Humidification for Residences; Panel Heating System; Sound Level; Trouble Shooting.

CODES AND STANDARDS

THE following codes and standards relating to the design, installation, testing, rating and maintenance of materials and equipment used for the heating and ventilation of buildings, have been adopted by the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS:

SUBJECT	TITLE	WHEN ADOPTED	REFERENCE
Air purity	Synthetic Air Chart	June, 1917	A.S.H.V.E. TRANSACTIONS, Vol. 23, p. 607, and THE GUIDE, 1931
Boilers (testing)	Standard and Short-Form Heat Balance Codes for Testing Low Pressure Steam Heating Solid Fuel Boilers (Codes 1 and 2)	June, 1929	A.S.H.V.E. TRANSACTIONS, Vol. 35, 1929. Reprints available
Boilers (testing)	Performance Test Code for Steam Heating Solid Fuel Boilers (Code 3) ^a	June, 1929	A.S.H.V.E. TRANSACTIONS, Vol. 35, 1929. Reprints available
Boilers—Oil Fuel (testing)	Code for Testing Steam Heating Boilers Burning Oil Fuel	January, 1931	<i>Heating, Piping and Air Conditioning</i> , March, 1931
Boilers (rating)	Code for Rating Steam Heating Solid Fuel Hand Fired Boilers	April, 1930	A.S.H.V.E. TRANSACTIONS, Vol. 36, 1930
Ethics	Code of Ethics for Engineers	January, 1922	A.S.H.V.E. TRANSACTIONS, Vol. 28, 1922, p. 6 (See also p. xiv GUIDE, 1932)
Fans	Standard Test Code for Disc and Propeller Fans, Centrifugal Fans and Blowers.	May, 1923. Revised June, 1931	A.S.H.V.E. TRANSACTIONS, Vol. 29, 1923, p. 407 ^b

^aOriginally adopted by the National Boiler and Radiator Manufacturers Association.^bAlso, see *Heating, Piping and Air Conditioning*, August, 1931, p. 743.