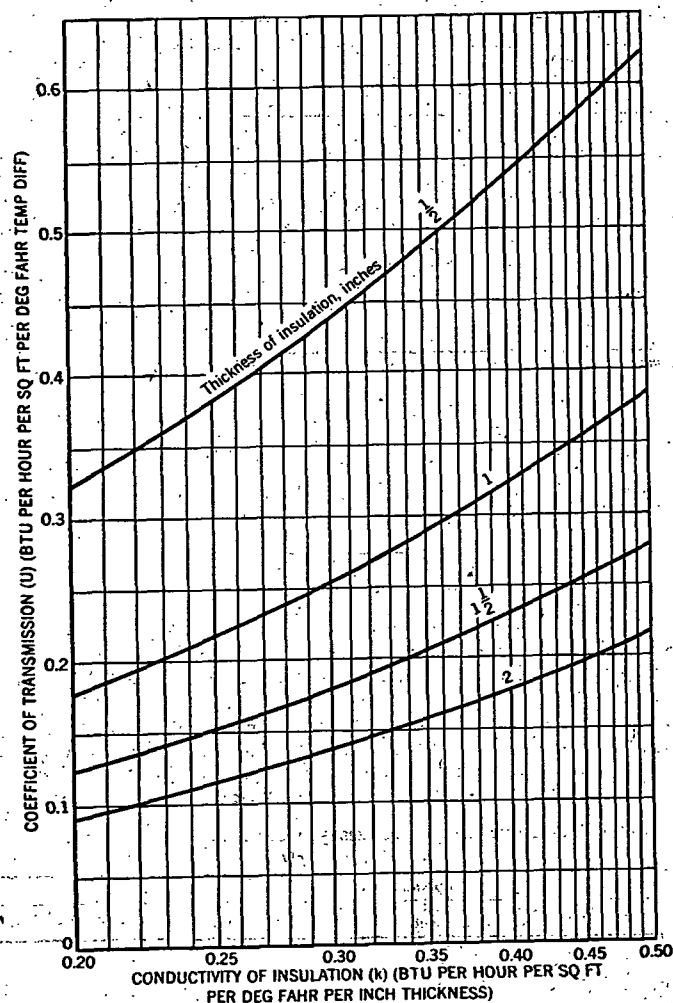


FIG. 9. HEAT LOSS COEFFICIENTS FOR INSULATED DUCTS^a

^aFor round ducts less than 30 in. diameter, increase heat transmission values by the percentages shown.

THICKNESS OF INSULATION (Inches)	1/4	1	1 1/2	2
21 to 30 in. Duct Diameter	1%	2%	3%	4%
12 to 21 in. Duct Diameter	3%	5%	7%	9%

is other than that at which the test was conducted, a correction should be made. However, in most cases the effect of this factor will be small and may be neglected.

Example 4. Determine the entering air temperature and heat loss for a duct 24 × 36 in. cross-section and 70 ft in length, insulated with 1/2 in. of a material having a conductivity of 0.35 Btu at 86 F mean temperature, carrying air at a velocity of 1200 fpm, measured at 70 F, to deliver air at 120 F with air surrounding the duct at 40 F.

Solution. Referring to Fig. 9, the over-all heat transmission coefficient is found to be 0.49 Btu. From Table 1, Chapter 3 the density of air at 70 F and 29.921 in. Hg is found to be 0.0749 lb per cubic foot. Substituting these and the other given values in Equation 13:

$$y = \frac{28.8 \times 6 \times 1200 \times 0.0749}{0.49 \times 10 \times 70} = 45.3$$

$$t_1 = \frac{120 (45.3 + 1) - 80}{45.3 - 1} = 123.7$$

Substituting in Equation 11:

$$Q = 0.49 \times 10 \times 70 \left[\left(\frac{123.7 + 120}{2} \right) - 40 \right] = 28,100 \text{ Btu per hour.}$$

For special considerations which apply to insulation of ducts in marine installations see Chapter 49.

LETTER SYMBOLS USED IN CHAPTER 41

- μ_o = absolute viscosity of air under actual (operating) conditions, any consistent units.
- μ_s = absolute viscosity of air under standard conditions, any consistent units.
- ρ_a = density of air, pounds per cubic foot.
- ρ_o = density of air under actual (operating) conditions, any consistent units.
- ρ_s = density of air under standard conditions, any consistent units.
- ρ_v = density of air at specified temperature at which velocity, V_m , is measured, pounds per cubic foot.
- A = cross-section area of duct, square feet.
- a = length of one side of rectangular duct, feet or inches. (Other side is b .)
- b = length of one side of rectangular duct, feet or inches. (Other side is a .)
- D = inside diameter of conduit, feet.
- d = equivalent diameter, feet or inches.
- e = Napierian base of logarithms = 2.718.
- f = non-dimensional friction coefficient.
- f_i = surface conductance (inside) Btu per (hour) (square foot) (Fahrenheit degree).
- f_o = surface conductance (outside) Btu per (hour) (square foot) (Fahrenheit degree).
- g = acceleration due to gravity, 32.17, feet per (second) (second).
- h_o = friction loss under actual (operating) conditions, any consistent units.
- h_t = friction loss, feet of fluid flowing.
- h_s = friction loss under standard conditions, any consistent units.
- h_w = velocity head or pressure, inches of water.
- l = length of conduit, feet.
- P = perimeter of duct, feet.
- Q = heat loss through duct walls, Btu per hour.
- t_1 = temperature of air entering duct, Fahrenheit degrees.
- t_2 = temperature of air leaving duct, Fahrenheit degrees.
- t_3 = temperature of air surrounding duct, Fahrenheit degrees.
- U = thermal transmittance coefficient, Btu per (hour) (square foot) (Fahrenheit degree).
- V = fluid velocity, feet per second.
- V_a = velocity of air in duct, feet per second.
- V_m = velocity of fluid, feet per minute.
- W = weight of air through duct, pounds per hour.
- x = thickness, inches.