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 7: Determine the entering air temperature and heat loss for a duct 24 × 36 in. cross-section and 70 ft in length, insulated with ½ in. of a material having a

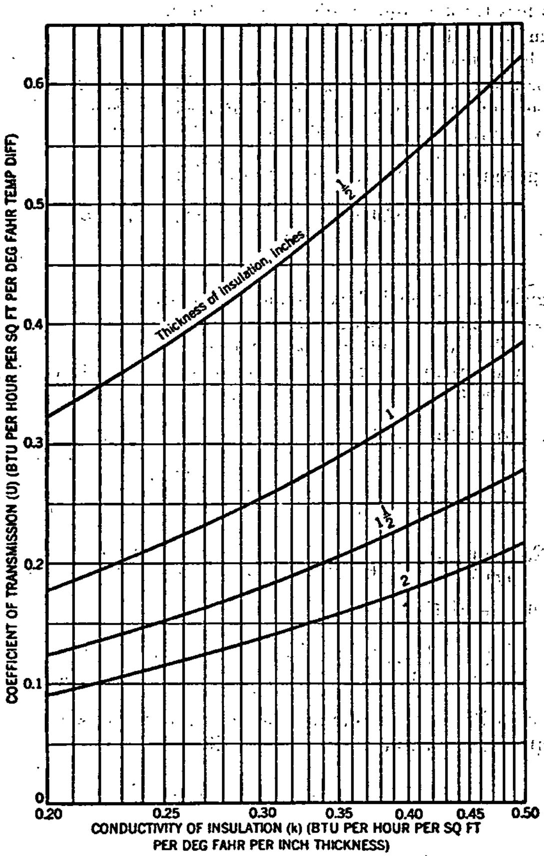

Fig. 16. Heat Loss Coefficients for Insulated Ducts[a]

[a] For round ducts less than 30 in. diameter, increase heat transmission values by the percentages shown below.

Thickness of Insulation (Inches)	½	1	1½	2
12 to 21 in. Duct Diameter	3%	5%	7%	9%
21 to 30 in. Duct Diameter	1%	2%	3%	4%

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. 16, the overall 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 1/13.348 = 0.0749 lb per cu ft. Substituting these and the other given values in Equation 25, y and t_1 will be as follows:

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

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

Substituting in Equation 23:

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

For special considerations which apply to insulation of ducts in marine installations see Chapter 48.

MAINTENANCE

Ducts should be designed in such a manner as to enable easy maintenance.[23] They should have enough access doors, not only to enable inspection, but also to facilitate cleaning of the ducts.[24] The periodic cleaning of the ducts should be part of the regular maintenance schedule. It should be done efficiently and competently to avoid difficulties or hazards in the operation of the system.[25,26]

LETTER SYMBOLS USED IN CHAPTER 32

α = coefficient of contraction.
ϵ = absolute roughness, feet.
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 at which V_m is measured, pounds per cubic foot.
A = cross-section area of duct, square feet.
A_1 = area of inlet duct, square feet.
A_2 = area of outlet duct, square feet.
A'_2 = area of vena contracta, square feet.
a = length of one side of rectangular duct, inches. (Other side is b.)
b = length of one side of rectangular duct, inches. (Other side is a.)
C and C_1 = dynamic loss coefficients, dimensionless.
c_1 = regain constant, dimensionless.
D = inside diameter of duct, feet.
d_e = circular equivalent of a rectangular duct for equal friction and capacity, inches.
e = Naperian 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 = duct dimension perpendicular to plane of bend, feet.
H/W = aspect ratio, dimensionless.
H_c = pressure loss due to sudden contraction, based on standard air, inches of water.
H_e = pressure loss due to sudden enlargement, based on standard air, inches of water.
H_{ge} = pressure loss due to gradual enlargement, based on standard air, inches of water.
H_v = dynamic loss for standard air, inches of water.
H_1 and H_2 = static pressure head at given points (1) and (2), inches of water.
H_r = regain static pressure for standard air, inches of water.
ΔH = total pressure loss, inches of water.