

not only if the duct passes through unconditioned space, but also on long duct runs within conditioned space. Proper insulation will remedy this situation considerably, but sometimes a redistribution of the supply air to the various supply outlets is necessary in order to compensate for the heating effect of the duct surface.

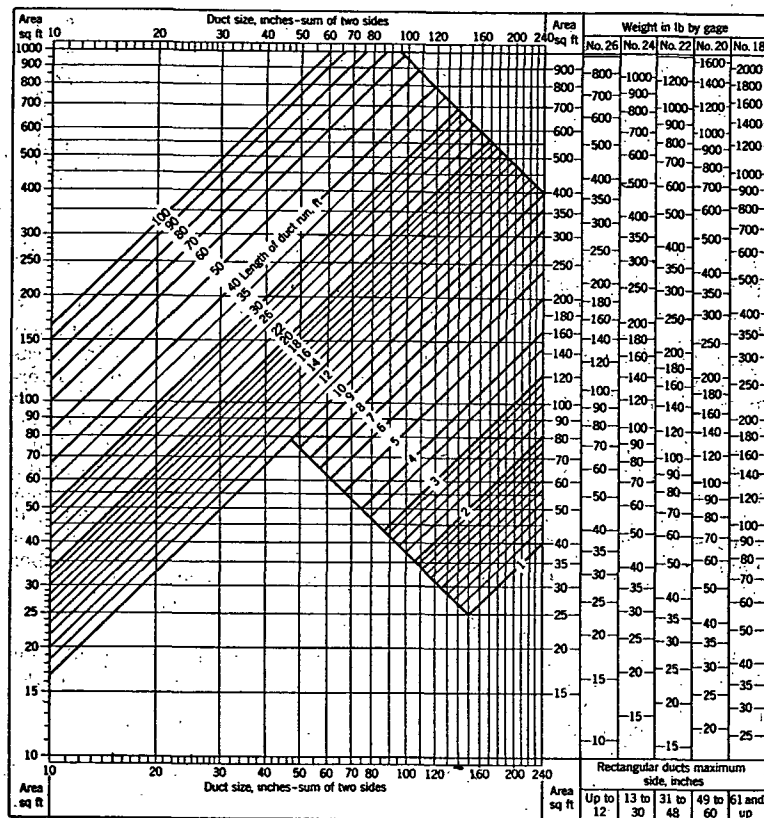


FIG. 10. AREA AND WEIGHT OF RECTANGULAR SHEET METAL DUCTS

The thermal transmittance U for ducts can be found as follows:

$$\text{For uninsulated metal duct, } U = \frac{1}{\frac{1}{f_i} + \frac{1}{f_o}} \quad (19)$$

$$\text{For uninsulated non-metallic ducts, } U = \frac{1}{\frac{1}{f_i} + \frac{x}{k} + \frac{1}{f_o}} \quad (20)$$

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where

U = overall coefficient of heat transfer, Btu per (hour) (square foot) (degree Fahrenheit).

f_i = surface conductance (inside) Btu per (hour) (square foot) (degree Fahrenheit).

f_o = surface conductance (outside) Btu per (hour) (square foot) (degree Fahrenheit).

x = thickness, inches

k = unit conductivity of material, Btu per (hour) (square foot) (degree Fahrenheit per inch thickness).

TABLE 10. WEIGHTS AND THICKNESSES OF 2S ALUMINUM (DENSITY 0.098 LB/CU IN.)

B. & S. GAGE	THICKNESS, INCHES		WEIGHT PER SQUARE FOOT	
	Decimal	Nearest Fraction	Ounces	Pounds
28	0.012	1/64	2.7	.169
26	0.016	1/64	3.6	.226
24	0.020	1/64	4.5	.282
22	0.025	1/32	5.4	.333
20	0.032	1/32	7.2	.452
18	0.040	3/64	9.0	.563
16	0.051	3/64	11.5	.720
14	0.064	1/16	14.4	.903

Where x is small and k is large, however, this factor $\frac{x}{k}$ is of little importance and may be neglected.

Film conductance f_i for air flowing in ducts apparently depends only on the velocity of the air and the diameter of the duct. A fairly reliable inside coefficient can be calculated from Schultz's modified equation:

$$f_i = \frac{0.32V_a^{0.8}}{D^{0.35}} \quad (21)$$

where

V_a = velocity of air in duct, feet per second.

D = inside diameter of duct, feet.

Film conductance f_o depends on a number of variables including temperature, diameter, and emissivity of the outer surface and can be calculated from data in Chapter 5. From this explanation, it is seen that it is unwise to recommend a given value of U for all uninsulated metal ducts.

The heat loss from a given length of duct can be expressed by:

$$Q_w = UPl \left[\left(\frac{t_1 + t_2}{2} \right) - t_a \right] \quad (22)$$

where

Q_w = heat loss through duct walls, Btu per hour.

P = perimeter of duct, feet.