

uniform velocities accompanied by decreased turbulence, lower resistance and a minimum of noise.

Heavy canvas connections (asbestos cloth if there is a fire hazard) are recommended on both the inlet and outlet to all fans. Self-vulcanizing adhesive tapes are available for this purpose and for sealing joints in duct work. The fan discharge connections shown in Fig. 15 are marked *good*, *fair*, and *poor* in the order of the amount of turbulence produced. An

TABLE 8. RECOMMENDED SHEET METAL GAGES FOR RECTANGULAR DUCT CONSTRUCTION^a

ALU- MINUM B.&S. GAGE	STEEL U. S. STD. GAGE	MAXIMUM SIDE, INCHES	TYPE OF TRANSVERSE JOINT CONNECTIONS ^b	BRACING
24	26	Up to 12	S, Drive, Pocket or Bar Slips, on 7 ft 10 in. centers	None
		13 to 24	S, Drive, Pocket or Bar Slips, on 7 ft 10 in. centers	None
22	24	25 to 30	S, Drive, 1 in. Pocket or 1 in. Bar Slips, on 7 ft 10 in. centers ^c	1 x 1 x 1/4 in. angles 4 ft from joint
		31 to 40	Drive, 1 in. Pocket or 1 in. Bar Slips, on 7 ft 10 in. centers ^c	1 x 1 x 1/4 in. angles 4 ft from joint
20	22	41 to 60	1 1/2 in. Angle Connections, or 1 1/2 in. Pocket or 1 1/2 in. Bar Slips with 1 1/2 in. x 1/4 in. bar reinforcing on 7 ft 10 in. centers ^c	1 1/2 x 1 1/2 x 1/4 in. angles 4 ft from joint
18	20	61 to 90	1 1/2 in. Angle Connections, or 1 1/2 in. Pocket or 1 1/2 in. Bar Slips 3 ft 9 in. maximum centers with 1 1/2 x 1/4 in. bar reinforcing	1 1/2 x 1 1/2 x 1/4 in. diagonal angles, or 1 1/2 x 1 1/2 x 1/4 in. angles 2 ft from joint
16	18	91 and up	2 in. Angle Connections or 1 1/2 in. Pocket or 1 1/2 in. Bar Slips 3 ft 9 in. maximum centers with 1 1/2 x 1/4 in. bar reinforcing ^d	1 1/2 x 1 1/2 x 1/4 in. diagonal angles, or 1 1/2 x 1 1/2 x 1/4 in. angles 2 ft from joint

^a For normal pressures and velocities (see Table 4) utilized in typical ventilating and air conditioning systems. Where special rigidity or stiffness is required, ducts should be constructed of metal two gages heavier. All uninsulated ducts 18 in. and larger should be cross-braken. Cross-braking may be omitted on uninsulated ducts if two gages of heavier metal are used.

^b Other joint connections of equivalent mechanical strength and air tightness may be used.

^c Duct sections of 3 ft 9 in. may be used with bracing angles omitted, instead of 7 ft 10 in. lengths with joints indicated.

^d Ducts 91 in. and larger require special field study for hanging and supporting methods.

inspection of the heater connections shown in Fig. 15 will readily show that uniform velocity through the heater cannot be expected in the diagram noted *poor*. When obstructions cannot be avoided, the duct area should never be decreased more than 10 percent, and then a *streamlined* collar should be used. Larger obstructions require an increase in the duct size in order to maintain as nearly uniform velocity as possible. Branch take-offs should always be arranged to cut or slice into the air stream in order to reduce as far as possible the losses in velocity head.

Wherever ducts pass through fire walls or connect two fire areas of a building, automatic fire dampers should be provided. For design of such

TABLE 9. WEIGHTS OF BLACK AND GALVANIZED SHEETS

U. S. STD. GAGE	BLACK SHEETS				GALVANIZED SHEETS ^a			
	Approximate Thickness, In.		Weight Per Square Foot		Approximate Thickness, In.		Weight Per Square Foot	
	Steel	Iron	Ounces	Pounds	Steel	Iron	Ounces	Pounds
30	0.0123	0.0125	8	0.500	0.0163	0.0165	10.5	0.656
28	0.0153	0.0156	10	0.625	0.0193	0.0196	12.5	0.781
26	0.0184	0.0188	12	0.750	0.0224	0.0228	14.5	0.906
24	0.0245	0.0250	16	1.000	0.0285	0.0290	18.5	1.156
22	0.0306	0.0313	20	1.250	0.0346	0.0353	22.5	1.406
20	0.0368	0.0375	24	1.500	0.0408	0.0415	26.5	1.656
18	0.0490	0.0500	32	2.000	0.0530	0.0540	34.5	2.156
16	0.0613	0.0625	40	2.500	0.0653	0.0665	42.5	2.656
14	0.0766	0.0781	50	3.125	0.0806	0.0821	52.5	3.281
12	0.1072	0.1094	70	4.375	0.1112	0.1134	72.5	4.531
11	0.1225	0.1250	80	5.000	0.1265	0.1290	82.5	5.156
10	0.1379	0.1406	90	5.625	0.1419	0.1446	92.5	5.781

^a Galvanized sheets are gaged before galvanizing and are therefore approximately 0.004 in. thicker.

dampers and other fire protective details, see Pamphlet No. 90 of the *National Board of Fire Underwriters*.²³

The recommended gages for steel (or iron) and aluminum sheet metal rectangular ducts are given in Table 8. Steel or iron sheets are specified according to the manufacturers or U. S. Standard Gage System. Aluminum sheets are specified according to the American or Brown & Sharpe Gage System. Weights of black and galvanized steel and iron sheets per square foot of surface for various gages are given in Table 9. Similar data for 2S aluminum sheets will be found in Table 10. Weights of standard copper sheets are given in Table 11. In calculating the total weight of a given length of duct work from these tables, it is customary to add 20 percent for the weight of joints and bracings.

Aluminum sheets of the 2S and 3S type alloy and 3/4 hard temper are readily workable, and can be used for practically all duct work. The 2S type (commercially pure aluminum) is suitable for all, except very large ducts. For large ducts, where more strength is desired, the 3S alloy with 3/4 or 1/2 hard temper is frequently used. The higher tempers, particularly full hard, do not have the formability of the lower tempers. For very large ducts, where considerable strength is required, aluminum sheets should be 2 gages heavier than indicated in Table 8, and should be amply

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	0.169
26	0.016	1/64	3.6	0.226
24	0.020	1/64	4.5	0.282
22	0.025	1/32	5.4	0.353
20	0.032	1/32	7.2	0.452
18	0.040	3/64	9.0	0.563
16	0.051	3/64	11.5	0.720
14	0.064	1/16	14.4	0.903