Table 12 .... Selection of Bonnet Temperature, Register Temperature and Register Delivery (CFM)[a,b]

(For Buildings Having a Heat Loss Greater than 350,000 BTU/Hr.)

Register Delivery Volume in CFM per 1000 BTU per Hr.

Bonnet Temp. °F	Linear Distance from Bonnet to Register, in Feet																						
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240
140	138[a]	136	134	132	130	128	127	126	125	124	123	121	120	119	118	117	116	115	114	113	112	111	110	109
14.0[c]	14.4[b]	14.8	15.1	15.5	15.9	16.4	16.6	16.9	17.2	17.3	17.6	18.1	18.4	18.7	19.0	19.3	19.6	20.0	20.3	20.7	21.1	21.6	22.1	22.5
150	148	146	143	141	139	137	135	133	131	129	128	127	126	124	123	122	120	119	118	117	116	115	114	113
12.6	12.8	13.1	13.5	13.9	14.2	14.6	14.9	15.3	15.7	16.2	16.4	16.6	16.9	17.3	17.6	17.9	18.4	18.7	19.0	19.3	19.6	20.0	20.3	20.7
160	158	155	152	150	147	145	143	140	138	136	134	132	130	128	127	126	125	124	123	121	120	119	118	117
11.4	11.6	12.0	12.3	12.6	12.9	13.2	13.5	14.0	14.4	14.8	15.1	15.5	15.9	16.4	16.6	16.9	17.2	17.3	17.6	18.1	18.4	18.7	19.0	19.3
170	167	164	161	158	155	152	150	147	145	143	140	138	136	134	132	130	128	127	126	125	124	123	121	120
10.5	10.7	11.0	11.3	11.6	12.0	12.3	12.6	12.9	13.2	13.5	14.0	14.4	14.8	15.1	15.5	15.9	16.4	16.6	16.9	17.2	17.3	17.6	18.1	18.4
180	177	173	170	167	164	161	158	155	152	150	147	145	143	140	138	136	134	132	130	128	127	126	125	124
9.7	9.9	10.2	10.5	10.7	11.0	11.3	11.6	12.0	12.3	12.6	12.9	13.2	13.5	14.0	14.4	14.8	15.1	15.5	15.9	16.4	16.6	16.9	17.2	17.3
190	186	182	178	175	172	168	165	162	159	156	153	151	148	146	143	141	139	137	135	133	131	129	128	127
9.1	9.3	9.6	9.8	10.0	10.3	10.7	10.9	11.2	11.5	11.8	12.2	12.4	12.8	13.1	13.5	13.9	14.2	14.6	14.9	15.3	15.7	16.2	16.4	16.6
200	196	191	187	183	179	176	172	169	166	163	160	157	154	151	149	147	144	142	140	138	135	133	131	130
8.6	8.8	9.0	9.2	9.5	9.8	9.9	10.3	10.6	10.8	11.1	11.4	11.7	12.1	12.4	12.7	12.9	13.4	13.7	14.0	14.4	14.9	15.3	15.7	15.9

[a] Register temperature, Fahrenheit. (Use upper value in each group.)
[b] Register delivery volume in cubic feet per minute per 1000 Btu. (Use lower value in each group.)
[c] Register delivery volumes in column 1 are for zero length of duct.

(such as Fig. 2 or Fig. 3, Chapter 12 of the 1961 GUIDE AND DATA BOOK), volume (cfm), and pressure drop per 100 ft of duct.

B. *Return air branches.*
   a. Select a low value of actual duct loss obtained from step b under item A for the suction loss of return duct system.
   b. Proceed in sizing return air branches by the same method described for the warm air branches.

C. *Trunk ducts for warm air and return air sides of system.*
   a. Add air volumes of branches to be handled by each trunk duct.
   b. The friction loss per 100 ft of trunk duct is determined by taking the smaller of the two values for friction loss for the two ducts meeting at the junction.
   c. Determine trunk duct size by using an air friction chart, volume (cfm), and pressure drop per 100 ft of trunk duct.

8. Selection of Blower.

A. Determine total cfm air delivery (the sum of all branch cfm values).

B. Determine static pressure requirement.
   a. For furnace-blower combination units it is the sum of bonnet pressure and suction pressure.
   b. For blowers separately selected from the furnace it is the sum of bonnet pressure, suction pressure, filter loss, casing loss, losses through air washers, coils, and other devices.

9. Selection of Furnace.

A. Determine register delivery (the sum of room Btu losses).

B. Determine bonnet capacity. If the ductwork is all located in spaces that have been included in the calculated heat loss, the required bonnet capacity can be considered equal to the required Btuh register delivery. If the furnace and ductwork are located in spaces not included in the heat loss, the required bonnet capacity of the furnace can be determined from:

Btuh = (cfm) × (temperature rise) × (1.08)

C. Determine allowance for pick-up load. For buildings which are heated intermittently, such as churches and auditoriums, it is customary to add from 10 to 25 percent extra furnace capacity for warming of the structure.

The design procedure outlined above results in a duct system which has been described as a *trunk-and-branch* system. A trunk duct may or may not be reduced in size as each branch duct leaves the trunk. If the trunk duct is *not* reduced as each branch duct leaves the trunk duct, the trunk duct take-off fittings designated as EP1 to EP4 in Fig. 7 are used. The air velocity within a uniformly sized trunk duct decreases as air leaves it through the branch ducts. It is therefore desirable to reduce the trunk duct size frequently enough that the air velocity within it does not drop below about 350 fpm.

The simplified procedures which have been outlined are based upon an assumed air temperature of 70 F surrounding

Table 13 .... Determination of Free Area and Total Pressure Loss of Register for 22 Deg Deflection of Air[a, b, c, d, e]

Register Free Area in Square Inches (Upper value in each group)

Pressure Loss in Inches of Water (Lower value in each group)

Cfm	Residential Use		Cfm	Residential Use		Cfm	Distance from Register to Opposite Wall						
	Reg. Size or Equivalent	Pressure Loss		Reg. Size or Equivalent	Pressure Loss		31–34	35–39	40–49 A′	50–59 B′	60–69	70–79	80–89
Up to 59	10 x 4 10 x 6	.01 .01	100–119	12 x 6 14 x 4	.02 .02	700–739	243 0.02	186 0.03	127 0.06	85 0.11			
60–69	10 x 6 12 x 4	.01 .02	120–129	12 x 6 14 x 6	.02 .02	740–779	271 0.02	208 0.03	141 0.05	94 0.10			
70–99	10 x 6 12 x 6	.02 .02	130–169	14 x 6	.02	780–819		230 0.02	157 0.05	105 0.09			
			170–189	14 x 8	.02	820–859		254 0.02	173 0.04	115 0.08			

Cfm	Distance From Register to Opposite Wall									Cfm	Distance from Register to Opposite Wall								
	Up to 18	19–21	22–24	25–27	28–30 A	31–34	35–39	40–49	50–59		31–34	35–39	40–49 A′	50–59 B′	60–69	70–79	80–89
190–209	68 0.02	49 0.03	38 0.05	29 0.08	24 0.11	19 0.16				860–899		278 0.02	190 0.04	126 0.08			
210–229	82 0.02	60 0.03	45 0.04	35 0.06	29 0.10	23 0.13				900–930		304 0.02	207 0.04	138 0.07			
230–249		71 0.02	54 0.04	42 0.06	34 0.08	28 0.11	22 0.17			940–979		332 0.02	226 0.03	151 0.07	108 0.12		
250–269		84 0.02	63 0.03	49 0.05	40 0.07	32 0.10	25 0.16			980–1019		360 0.02	245 0.03	163 0.06	118 0.11		
270–299		100 0.02	76 0.03	60 0.04	48 0.06	38 0.09	30 0.13			1020–1059		390 0.02	265 0.03	177 0.06	127 0.11		
300–339			96 0.02	73 0.04	60 0.05	48 0.07	37 0.11			1060–1099			285 0.03	190 0.06	137 0.10		
340–379			122 0.02	95 0.03	78 0.04	61 0.06	47 0.09	33 0.18		1100–1139			307 0.03	204 0.05	147 0.09		
380–419				117 0.02	94 0.03	75 0.05	58 0.08	39 0.15		1140–1179			330 0.02	220 0.05	158 0.09		
420–459				142 0.02	113 0.03	91 0.04	70 0.06	47 0.13		1180–1219			353 0.02	235 0.04	169 0.08		
460–499				168 0.02	135 0.03	108 0.04	83 0.06	56 0.11		1220–1259			376 0.02	251 0.04	180 0.08		
500–539					159 0.02	126 0.03	97 0.05	66 0.10		1260–1299			401 0.02	267 0.04	192 0.07	136 0.13	
540–579					185 0.02	147 0.03	113 0.04	77 0.08		1300–1339			426 0.02	284 0.04	204 0.07	144 0.13	
580–619					212 0.02	169 0.03	130 0.04	88 0.08	51 0.18	1340–1379			452 0.02	301 0.04	217 0.06	154 0.12	109 0.22
620–659						192 0.02	147 0.03	100 0.07	59 0.15	1380–1419			479 0.02	319 0.04	230 0.06	163 0.12	116 0.21
660–699						217 0.02	166 0.03	113 0.06	75 0.13	1420–1459			508 0.02	338 0.03	244 0.06	172 0.11	122 0.20
						A	B			1460–1500			536 0.02	356 0.03	256 0.06	182 0.10	129 0.19
													A′	B′			

[a] If register selected based on distance from register to opposite wall is unsatisfactory on account of size or pressure loss, it is permissible to shift one or more spaces left or right in the tables to obtain a more suitable register. If requirements fall in blank space, select two registers in place of one and divide CFM capacity between the two registers.

[b] Total pressure (static plus velocity) loss is based on FLAT FACE ADJUSTABLE BAR TYPE and does NOT include stackhead.

[c] Values on the right of line A and A′ should not be used in applications such as churches, auditoriums, and concert halls.

[d] Values on right of line B and B′ should not be used in applications such as residential work, motion picture theaters, court rooms, and schools.

[e] For floor and baseboard registers where a velocity of approximately 200 FPM is used, the free area = $\frac{CFM \times 144}{200}$ or approximately, $\frac{CFM}{2}$. Assume a pressure loss of 0.01.