TABLE 8. DETERMINATION OF FREE AREA AND PRESSURE LOSS OF REGISTER FOR NO DEFLECTION OF AIR[a, b, c, d, e]

Register Free Air in Square Inches (Upper value in each group)
Pressure Loss in Inches of Water Column (Lower value in each group)

CFM	Distance from Register to Opposite Wall									CFM	Distance from Register to Opposite Wall						
	19–21	22–24	25–27	28–30	31–34	35–39	40–49	50–59	60–69		35 39	40–49	50–59	60–69	70–79	80–89
					A	B						A′	B′			
190[f]–209	62 0.02	47 0.03	37 0.04	30 0.06	24 0.09	18 0.15				660–699	210 0.02	143 0.03	95 0.07	69 0.12	49 0.22	
210–229	76 0.02	58 0.02	45 0.04	36 0.05	29 0.08	22 0.12				700–739	236 0.02	160 0.03	107 0.06	77 0.11	54 0.21	
230–249		69 0.02	53 0.03	43 0.04	34 0.07	26 0.11				740–779	262 0.02	179 0.03	119 0.06	86 0.10	61 0.18	
250–269		81 0.02	63 0.03	50 0.04	40 0.06	31 0.09	21 0.18			780–819	291 0.02	198 0.03	132 0.05	95 0.09	67 0.17	
270–299		93 0.02	73 0.02	59 0.03	47 0.05	36 0.08	24 0.16			820–859	320 0.02	218 0.03	145 0.05	105 0.08	74 0.15	
300–339			95 0.02	77 0.03	61 0.04	46 0.06	32 0.12			860–899	352 0.02	240 0.02	160 0.04	115 0.08	81 0.14	
340–379			120 0.02	97 0.02	77 0.03	59 0.05	40 0.10			900–939	385 0.01	262 0.02	175 0.04	126 0.07	89 0.13	
380–419				119 0.02	95 0.03	73 0.04	50 0.08			940–979	419 0.01	285 0.02	190 0.04	137 0.07	97 0.12	
420–459				149 0.02	114 0.03	88 0.04	60 0.07			980–1019	455 0.01	309 0.02	206 0.04	148 0.06	105 0.11	
460–499				171 0.02	136 0.02	105 0.03	71 0.06			1020–1059	493 0.01	335 0.02	223 0.03	161 0.06	113 0.11	
500–539					160 0.02	123 0.03	84 0.05			1060–1099	530 0.01	361 0.02	241 0.03	173 0.06	123 0.10	
540–579					186 0.02	143 0.02	97 0.05	65 0.09	47 0.17	1100–1139	571 0.01	388 0.02	258 0.03	186 0.05	132 0.09	93 0.17
580–619					213 0.02	164 0.02	111 0.04	74 0.08	54 0.15	1140–1179		416 0.02	277 0.03	199 0.05	141 0.08	100 0.16
620–659						180 0.02	127 0.04	85 0.07	61 0.14	1180–1219		446 0.02	297 0.03	214 0.04	151 0.08	107 0.15
							A	B		1220–1259		476 0.02	317 0.03	228 0.04	161 0.07	116 0.14
										1260–1299		507 0.01	338 0.02	243 0.04	172 0.07	122 0.13
										1300–1339		539 0.01	359 0.02	258 0.04	183 0.07	130 0.12
										1340–1379			382 0.02	274 0.04	195 0.07	138 0.12
										1380–1419			403 0.02	290 0.03	206 0.06	146 0.12
										1420–1459				308 0.03	218 0.06	155 0.10
										1460–1500				324 0.03	230 0.06	163 0.10
														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] Pressure 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 300 FPM is used, the free area = $\frac{\text{CFM} \times 144}{300}$ or approximately, $\frac{\text{CFM}}{2}$. Assume a pressure loss of .01.

[f] For any volume under 190 CFM use Table 7.

TABLE 9. SUGGESTED BONNET PRESSURE

Inches of water

Total CFM Through Any One Duct	Suggested Bonnet Pressure In. Water	Total CFM Through Any One Duct	Suggested Bonnet Pressure In. Water
800–1000	0.10	3500 to 5000	0.15
1000–1200	0.10	5000 to 7500	0.25
1200–1800	0.10	7500 to 10,000	0.375
1800–2400	0.13	10,000 to 12,000	0.500
2400 to 3500	0.14	12,000 to 14,000	0.750

the sun or from a fireplace, or by direct heat from any warm air duct, register or chimney.

2. A *fan switch* control located in the bonnet to start blower operations at temperatures between 110 and 130 F, and to stop the blower at about 25 to 30 deg below the cut-in point. The lower settings are used for high sidewall register installations, and the higher settings for baseboard register installations. For most satisfactory results these settings should be as low as is feasible.

3. A protective *high limit switch* located in the bonnet to stop the system independently of the thermostat if the bonnet temperature exceeds 175 F.

4. On oil and gas burner installations, a protective control should be included to cut off the fuel supply if the fire is extinguished, or if there is a failure of the ignition system.

5. On automatic stoker installations, a control is usually included to operate the stoker regardless of thermostat settings whenever the bonnet temperature indicates that the fire is dying, or a time interval contactor is used to cause the stoker to run a few minutes out of each hour.

6. A *humidistat* to regulate the moisture supplied to the rooms, located either in one of the rooms or in the main return duct near the furnace.

ADJUSTMENT OF SYSTEM FOR CONTINUOUS AIR CIRCULATION

This procedure applies to the adjustment of an automatically-fired forced warm air heating system to provide continuous air circulation, when the control arrangement is of the type where the room thermostat controls the fire and the blower control (fan switch) in the furnace bonnet or warm air plenum controls the blower operation. This procedure as outlined in detail in Manual 6 of the *National Warm Air Heating and Air Conditioning Association*, is as follows:[7]

1. Adjust the fuel input in proper relation to the heat loss of the structure.
2. Determine the temperature rise through the furnace.
3. Adjust the air volume to produce a temperature rise through the furnace of about 100 deg.
4. Adjust the fan switch differential to a minimum of about 15 deg.
5. Adjust the fan switch cut-out point as low as practicable.
6. Adjust the room thermostat temperature differential to a minimum which will cause the burner to cycle frequently.
7. Balance the system by adjusting dampers to produce even temperature distribution between rooms.
8. Set the room thermostat at the desired room temperature.

WARM AIR CEILING PANEL SYSTEMS

Warm air ceiling panel heating systems utilize a false ceiling suspended $3\frac{1}{4}$ in. from the ceiling joists which have previously been covered on the bottom with sheets of plasterboard. Special hangers are used to suspend the false ceiling or heating panel from the joists. Steel supporting rods