

Table 7 . . . Required Size of Extended-Plenum

Cfm Handled by Plenum	Plenum Dimensions Inches	Cfm Handled by Plenum	Plenum Dimensions Inches
Up to 300	8 x 8	701 to 800	20 x 8
301 to 400	10 x 8	801 to 900	22 x 8
401 to 500	12 x 8	901 to 1000	24 x 8
501 to 600	14 x 8	1001 to 1100	26 x 8
601 to 700	16 x 8	1101 to 1200	28 x 8

tures. When either higher bonnet pressures or temperatures, or both, are to be used, care must be taken to ascertain that the furnace employed is capable of meeting the required conditions.

INSIDE WALL DELIVERY SYSTEMS

The concept of warm-air perimeter heating is relatively new. The older methods of introducing warm air into spaces use other outlet locations. One of the most common of these has been the use of register locations on a warm or inside wall. For such systems, the combinations of parts selected as standard by the National Warm Air Heating and Air Conditioning Association are shown in Tables 9 and 10.

A simplified method for selecting the combinations of branches, boots, stacks, and registers, is given in Manual 7 of the National Warm Air Heating and Air Conditioning Association.* In this method, the sizes of the branch ducts are obtained from two tables giving their Btu capacities. The proper combination of parts for each branch can be determined if the following information is available.

1. Location of room, that is, whether on first or second story.

Table 8 . . . Required Size of Return Air Grille and Duct

For Pressure Drop Allowance of 0.05 in. of Water

Actual Ft		Up to 10 Ft						11 to 20 Ft						21 to 30 Ft						31 to 40 Ft					
Grille Free Area	No. of 90 Deg Turns	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
		Duct Free Area																							
16	5,000	14	17	20	23	26	28	15	19	22	25	27	28	17	20	23	25	27	29	18	31	24	27	28	30
32	10,000	27	32	37	42	46	49	29	34	39	43	47	49	31	36	41	45	48	51	33	38	43	47	49	51
47	15,000	37	44	50	55	60	64	40	46	52	57	61	65	43	49	54	58	63	67	45	51	56	61	64	67
63	20,000	46	54	61	66	73	78	49	57	63	69	75	79	53	60	65	71	77	82	55	62	68	74	78	83
79	25,000	54	64	72	79	86	92	58	68	75	82	88	94	62	71	78	84	91	96	66	74	80	87	92	98
95	30,000	62	73	82	89	97	104	67	76	85	93	100	106	71	80	88	95	102	108	75	84	91	99	104	110
111	35,000	69	82	92	101	111	119	74	85	95	106	114	121	79	91	99	108	117	124	84	94	103	113	119	126
126	40,000	77	90	100	110	121	130	82	94	105	116	124	132	87	99	109	118	128	137	92	103	113	123	130	140
158	50,000	89	105	119	132	146	158	95	111	124	138	150	161	102	117	129	142	155	166	108	123	135	148	158	170
190	60,000	100	122	139	154	170	181	111	129	145	161	174	184	119	137	151	165	178	189	126	143	158	172	181	193
221	70,000	117	139	158	174	191	203	127	147	164	182	195	206	135	155	171	186	200	213	144	162	178	193	203	216
252	80,000	128	155	175	191	208	222	140	164	182	198	214	225	151	172	188	203	219	231	160	179	195	211	222	235
284	90,000	141	168	188	206	225	244	153	177	195	213	232	248	164	188	201	218	240	256	173	193	209	229	244	262
316	100,000	154	180	200	221	247	265	166	189	209	233	252	270	176	198	217	239	258	277	185	206	227	250	265	285

* Note: Where a multiple number of return air ducts join together, add the individual duct free areas together to determine the free area of duct to be used from that point to the return air plenum of furnace.

2. Actual horizontal length of duct from bonnet to boot, in feet.

3. Btu loss from room to be heated.

4. Equivalent lengths in feet of all fittings and of the register. Fig. 7 shows the values of equivalent lengths of fittings commonly used for domestic systems.

This simplified method is applicable to structures having heat losses not in excess of approximately 120,000 Btu per hour. The capacities shown in Tables 9 and 10 are based upon the most reliable data pertaining to friction losses and temperature drops in ducts. They are also based upon a 100 deg temperature rise of the air, and a static pressure available for overcoming friction losses in the external duct system alone of 0.20 in. of water. The use of this method requires that the fan in the fan-furnace assembly will be capable not only of overcoming the resistance of the external duct system alone, but also the resistances imposed by the blower inlet, the filter, and the furnace casing.

Tables 9 and 10 are applicable for the selection of both warm air and return air branches. A depth of 8 in. has been adopted as the standard for trunk ducts, and where a branch joins the trunk the required increase shown in the last line of Table 9 or Table 10 refers to an 8-in. trunk duct.

Where two branches form a trunk the longer branch is considered to be the trunk and its equivalent width (for 8-in. depth) is increased as required.

DESIGN PROCEDURE FOR LARGE SYSTEMS¹¹

For buildings having a heat loss in excess of 120,000 Btu per hour, the design procedure given in Manual 9 of the National Warm Air Heating and Air Conditioning Association, may be used. Work sheets 9a, 9b, and 9c are available to simplify calculations.¹² The procedure consists of:

1. Calculation of design heat losses from individual spaces

Table 9 . . . Capacity and Sizing Table—First Story
For Warm Air and Return Air Stack, Branch, and Registers

Equiv. Length of Fittings and Registers	Horizontal Length Furnace to Register		First Story Room Heat Loss—Btu/h								
	Col. b	Col. c	Room Heat Loss—Btu/h								
			Col. d	Col. e	Col. f	Col. g	Col. h	Col. i	Col. j	Col. k	Col. l
Up to 70 Eq Ft	Up to 7	Up to 5	7,200	12,500	16,000	19,100	25,000	32,000	40,000	50,000	60,000
	8-12	6-9	6,700	11,700	15,000	18,000	23,400	29,400	36,400	45,400	54,400
	13-17	10-13	6,100	10,800	14,000	17,000	21,600	27,600	34,600	43,600	52,600
	18-25	14-18	5,600	9,900	13,000	16,000	19,800	25,000	31,000	38,000	46,000
	26-35	19-25	4,800	8,500	11,000	14,200	17,000	21,600	26,600	32,600	39,600
71 to 100 Eq Ft	36-45	26-35	4,100	7,400	9,900	12,500	14,800	18,800	23,800	29,800	35,800
	46-55	36-45	3,500	6,400	8,700	11,000	12,800	16,800	20,800	25,800	31,800
	56-65	46-55	3,000	5,500	7,700	9,600	11,000	14,000	17,000	21,000	25,000
	66-75	56-65	2,500	4,600	6,500	8,300	9,600	11,800	14,800	18,800	22,800
	76-85	66-75	2,000	3,700	5,400	7,000	8,300	10,300	13,300	16,300	20,300
101 to 130 Eq Ft	Up to 7	Up to 5	4,600	8,500	11,300	14,300	17,000	22,000	28,000	34,000	40,000
	8-12	6-9	4,300	7,900	10,600	13,500	16,300	21,300	27,300	33,300	39,300
	13-17	10-13	4,100	7,400	10,000	12,700	15,400	20,400	26,400	32,400	38,400
	18-25	14-18	3,800	6,900	9,400	11,900	14,800	19,800	25,800	31,800	37,800
	26-35	19-25	3,300	6,100	8,400	10,500	12,200	16,800	21,800	27,800	33,800
131 to 165 Eq Ft	36-45	26-35	3,000	5,300	7,400	9,300	10,600	14,800	19,800	25,800	31,800
	46-55	36-45	2,700	4,700	6,500	8,300	9,400	13,000	17,000	22,000	28,000
	56-65	46-55	2,300	4,000	5,500	7,000	8,000	10,800	14,800	19,800	25,800
	66-75	56-65	2,000	3,600	4,900	6,400	7,400	9,800	13,800	18,800	24,800
	76-85	66-75	1,700	3,000	4,100	5,400	6,400	8,800	12,800	17,800	23,800
166 to 200 Eq Ft	Up to 7	Up to 5	3,800	6,500	8,800	11,000	13,000	17,000	22,000	28,000	34,000
	8-12	6-9	3,500	6,100	8,200	10,500	12,200	16,400	21,400	27,400	33,400
	13-17	10-13	3,300	5,700	7,700	9,900	11,400	15,400	20,400	26,400	32,400
	18-25	14-18	3,100	5,400	7,200	9,300	10,800	14,800	19,800	25,800	31,800
	26-35	19-25	2,700	4,800	6,400	8,300	9,600	12,800	17,800	23,800	29,800
201 to 240 Eq Ft	36-45	26-35	2,400	4,300	5,700	7,300	8,600	11,400	15,400	20,400	26,400
	46-55	36-45	2,100	3,800	5,000	6,400	7,600	10,000	14,000	19,000	25,000
	56-65	46-55	1,800	3,300	4,400	5,800	7,000	9,400	13,400	18,400	24,400
	66-75	56-65	1,500	2,800	3,700	5,000	6,200	8,600	12,600	17,600	23,600
	76-85	66-75	1,200	2,300	3,100	4,400	5,600	8,000	12,000	17,000	23,000
Combination Number			41	42	43	44	45	46	47		
Stacks: No. (in parenthesis) and Size			(1) 10x3 1/4	(1) 10x3 1/4	(1) 12x3 1/4	(1) 14x3 1/4	(2) 10x3 1/4	(2) 12x3 1/4	(2) 15x3 1/4		
Rectangular Branch Size			3x8	4x8	5x8	6x8	8x8	10x8	15x8		
Round Branch Size (Diam)			5	6	7	8	9	10	12		
Number of Joist Spaces and Minimum Depth—Return Air			1 at 3	1 at 3	1 at 4	1 at 5	1 at 6 or 2 at 3	1 at 7 or 2 at 4	1 at 9 or 2 at 5		
Registers: Low Wall, High Wall, or Baseboard			10x6	10x6	12x6	14x6	(2)10x6 or (1) 24x6	(2)12x6 or (1) 30x6	—		
Registers: Floor-Warm Air			8x10	8x10	9x12	9x12 or longer	10x12	12x14	—		
Registers: Floor-Return Air			6x10 or 4x14	6x10 or 4x14	6x12 or 6x14	6x14	6x30	6x30	8x30		
Trunk Duct Increase, Inches			1	2	3	4	5	7	12		

* Uninsulated ducts in heated spaces and insulated ducts in unheated spaces.

¹¹ Note: For return air a 14x3 1/4 in. stud space may be used instead of 16x3 1/4 in. stack. Where 12x3 1/4 in. or 14x3 1/4 in. stack is required, a 14x3 1/4 in. stud space may be used only when inside of stud space is smooth and without protruding plaster keys. The number of joist spaces for combination 47 is based on 2x8 in. joists. One space may be used with 2x10 in. joists.

¹² The limiting factor for a duct combination is the stack capacity.