in a rectangular duct should be at least one-half the duct dimension in the plane of the turn. Warm air ducts passing through cold spaces or located in exposed walls, should have 1 to 2 in. of insulation.

Special attention should be given to the problem of noise elimination. The metal duct connection to and from the furnace casing and fan housing should be broken by strips of fire resistant fabric. Motors and mountings must be carefully selected for quiet operation. Electrical conduit and water piping must not be fastened to, nor make contact with the fan housing. Installation of a fan directly under a return air grille is usually avoided.

STANDARD COMBINATIONS OF PARTS

The combinations of parts selected as standard by the *National Warm Air Heating and Air Conditioning Association* are shown in Tables 1 and

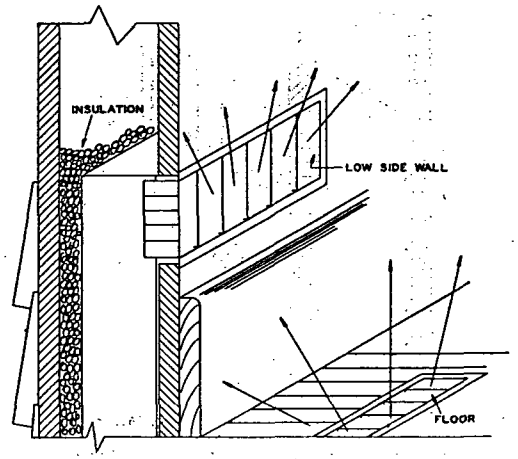

FIG. 3. RECOMMENDED TYPE OF FLOOR OR LOW SIDEWALL INSTALLATION ON OUTSIDE WALL[a]

[a] Registers set to direct air upward along the wall at as wide an angle as possible.

2. A method for selecting these combinations is indicated in the following section Simplified Method of Design.

SIMPLIFIED METHOD OF DESIGN

A simplified method for selecting the combinations of branches, boots, stacks, and registers, is given[3] 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.

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

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

c. Btu loss from room to be heated.

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

TABLE 1. 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—Btuh						
	Ducts[a]	Insulated Attic Ducts							
Col. a	Col. b	Col. c	Col. d	Col. e	Col. f	Col. g	Col. h	Col. i	Col. j
Up to 70 Eq. Ft.	Up to 7	Up to 5	7,200	12,500	16,000	19,100	25,000	32,000	80,000
	8–12	6–9	6,700	11,700	15,000	18,000	23,400	30,000	75,000
	13–17	10–13	6,100	10,800	14,000	17,000	21,600	28,000	70,000
	18–25	14–18	5,600	9,900	13,000	16,000	19,800	26,000	65,000
	26–35	19–25	4,800	8,500	11,000	14,200	17,000	22,600	56,500
	36–45	26–35	4,100	7,400	9,900	12,500	14,800	19,800	49,500
	46–55	36–45	3,500	6,400	8,700	11,000	12,800	17,400	43,500
	.....	46–55	3,000	5,500	7,700	9,600	11,000	15,400	38,500
71 to 100 Eq. Ft.	Up to 7	Up to 5	5,500	9,900	13,100	16,300	19,800	26,200	65,500
	8–12	6–9	5,100	9,200	12,300	15,400	18,400	24,600	61,500
	13–17	10–13	4,800	8,600	11,600	14,500	17,200	23,200	58,000
	18–25	14–18	4,500	8,100	10,900	13,700	16,200	21,800	54,500
	26–35	19–25	3,900	7,100	9,700	12,200	14,200	19,400	48,500
	36–45	26–35	3,400	6,200	8,500	10,800	12,400	17,000	42,500
	46–55	36–45	3,000	5,400	7,500	9,500	10,800	15,000	37,500
	.....	46–55	2,600	4,600	6,500	8,300	9,200	13,000	33,500
101 to 130 Eq. Ft.	Up to 7	Up to 5	4,600	8,500	11,300	14,300	17,000	22,600	56,200
	8–12	6–9	4,300	7,900	10,600	13,500	15,800	21,200	52,600
	13–17	10–13	4,100	7,400	10,000	12,700	14,800	20,000	50,200
	18–25	14–18	3,800	6,900	9,400	11,900	13,800	18,800	47,300
	26–35	19–25	3,300	6,100	8,400	10,500	12,200	16,800	42,000
	36–45	26–35	3,000	5,300	7,400	9,300	10,600	14,800	37,000
	46–55	36–45	2,700	4,700	6,500	8,300	9,400	13,000	32,400
	.....	46–55	2,300	4,000	5,400	7,000	8,000	10,800	27,000
131 to 165 Eq. Ft.	Up to 7	Up to 5	4,100	7,300	9,800	12,300	14,600	19,600	49,200
	8–12	6–9	3,800	6,900	9,100	11,700	13,800	18,200	45,800
	13–17	10–13	3,600	6,400	8,600	11,000	12,800	17,200	41,900
	18–25	14–18	3,400	6,000	8,100	10,300	12,000	16,200	40,300
	26–35	19–25	2,900	5,300	7,200	9,100	10,600	14,400	36,000
	36–45	26–35	2,600	4,700	6,400	8,100	9,600	12,800	31,800
	46–55	36–45	2,300	4,200	5,600	7,100	8,400	11,200	28,100
	.....	46–55	2,000	3,600	4,700	6,000	7,200	9,400	23,500
166 to 200 Eq. Ft.	Up to 7	Up to 5	3,800	6,500	8,800	11,000	13,000	17,600	44,100
	8–12	6–9	3,500	6,100	8,200	10,500	12,200	16,400	51,500
	13–17	10–13	3,300	5,700	7,700	9,900	11,400	15,400	38,800
	18–25	14–18	3,100	5,400	7,200	9,300	10,800	14,400	36,000
	26–35	19–25	2,700	4,800	6,400	8,300	9,600	12,800	32,000
	36–45	26–35	2,400	4,300	5,700	7,300	8,600	11,400	28,200
	46–55	36–45	2,100	3,800	5,000	6,400	7,600	10,000	24,700
	.....	46–55	1,700	3,000	3,900	5,100	6,000	7,800	19,500
Combination Number			41	42	43	44	45	46	47
Stacks[b] No.			1	1	1	1	2	2	—
Size			10x3¼	10x3¼	12x3¼	14x3¼	10x3¼	12x3¼	
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

[a] Uninsulated ducts in heated spaces and insulated ducts in unheated spaces.

[b] Note: For return air a 14x3⅝ in. stud space may be used instead of 10x3¼ in. stack. Where 12x3¼ in. or 14x3¼ in. stack is required, a 14x3⅝ 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.

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