

Table 5.... Btuh Capacities and Cfm of Individual Ducts in Perimeter Systems
Used in Crawl-Space or Basement Construction (Concluded)

Section C. For 6-Inch Individual Round Pipe and for Baseboard Diffusers Only

Bonnet Pressure 0.15 in. Static Bonnet Temperature 170 F

No. of Elbows		Actual Length of Pipe from Bonnet to Diffuser—feet															
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
0	Btuh Cfm						8570 109.0	8000 107.2	7450 105.5	6910 103.7	6420 102.0	5960 100.4	5560 98.8	5150 97.5	4800 96.1	4450 94.8	4160 93.5
1	Btuh Cfm					8700 105.5	8100 104.0	7550 102.3	7000 100.7	6520 99.2	6060 97.6	5630 96.2	5250 95.0	4880 93.8	4530 92.3	4220 91.1	3930 90.0
2	Btuh Cfm				8890 102.8	8270 101.3	7700 99.8	7160 98.2	6660 96.7	6200 95.3	5750 94.0	5350 92.7	4980 91.5	4620 90.2	4300 89.0	4000 87.8	3700 86.5
3	Btuh Cfm			8440 95.8	7870 94.4	7320 93.0	6820 91.6	6350 90.3	5880 89.0	5460 87.8	5070 86.7	4700 85.7	4350 84.6	4020 83.7	3710 82.6	3440 81.6	3200 80.5
4	Btuh Cfm		8690 93.4	8080 92.2	7500 91.0	6980 89.8	6500 88.5	6030 87.3	5580 86.2	5180 85.1	4800 84.1	4450 83.1	4120 82.0	3820 81.0	3520 79.9	3250 78.9	3100 78.0
5	Btuh Cfm	8940 93.4	8320 92.2	7740 91.0	7200 89.8	6680 88.5	6190 87.3	5720 86.2	5320 85.1	4920 84.1	4550 83.1	4220 82.0	3890 81.0	3600 79.9	3350 78.9	3100 78.0	
6	Btuh Cfm	8580 90.0	7960 89.8	7380 88.5	6850 87.3	6350 86.2	5880 85.1	5440 84.2	5040 83.1	4660 82.0	4320 81.0	4000 79.9	3670 78.9	3400 77.8	3150 76.7	2930 76.0	

The Equivalent Length Values used and included in calculating this table are: Diffuser and Boot = 100 ft; Plenum Take-off = 20 ft; Each Elbow = 14 ft. For each additional 14 ft equivalent length of boot and diffuser count one additional elbow.
All cfm values are based on standard air.

This is a preliminary estimate of the number of diffusers needed.

4. Measure the length and count the number of elbows in each feeder duct. Determine Btuh capacity of each feeder duct from Table 4. Use Table 4 (Section A) for side-wall and floor diffusers and Table 4 (Section B) for baseboard diffusers.

5. If the total Btuh capacity of all feeders to each room or area equals or exceeds the heat loss of that room or area, the number of feeders initially chosen is satisfactory. If the heat loss exceeds the Btuh capacity of the feeders, use and locate additional diffusers and feeder ducts.

6. The cfm values in Table 4 are used for designing the return-duct system.

Perimeter-Radial System in Crawl Space or Basement Construction

The perimeter concept of warm air heating has been applied to crawl-space and basement homes by locating the diffusers in the perimeter location and by warming the area underneath the floor of such structures. Although the construction of the crawl space and the foundation wall is the responsibility of the architect and the general contractor, it is important that the engineer check the construction to make certain that it will not adversely affect the performance of the heating system. Details on crawl-space construction are shown in Manual 4 of the National Warm Air Heating and Air Conditioning Association. The crawl space or basement should be heated to provide warm floors.

A simplified design procedure for an individual duct system is summarized as follows:

1. Calculate the heat loss of each room or area using the method explained in Chapter 25 of the 1961 GUIDE AND DATA BOOK. Consider the basement or crawl space as a part of the structure and calculate its heat loss. Information in Manual 4 supplements that contained in Chapter 25, particularly with respect to crawl-space heat losses.
2. Determine the required furnace-bonnet capacity from the heat loss of the building.
3. Locate the diffusers on the plan. Allow at least one dif-

fuser for each exposed wall in each room or area of building, and locate them preferably beneath window areas. For residential installations limit each diffuser to a maximum of 7,000 Btuh.

4. Determine the required Btuh delivery of each diffuser. Where more than one diffuser is used per room, proportion the heat loss equally among all diffusers.

5. Measure length and count number of elbows in each duct. From Table 5, determine the duct size (5 or 6-in. diameter) needed. Section A is for 5-in. duct, Section B is for 6-in. duct using side-wall or floor diffusers, and Section C is for 6-in. duct using baseboard diffusers.

Perimeter Extended-Plenum Systems in Crawl-Space or Basement Construction

The considerations involved in the design of extended-plenum systems are essentially the same as those of the individual pipe system. A simplified design procedure is summarized as follows:

1. Calculate the heat loss of each room or area using the method explained in Chapter 25 of the 1961 GUIDE AND DATA BOOK. Consider the basement or crawl space as a part of the structure and calculate its heat loss. Information in Manual 4 supplements that contained in Chapter 25, particularly with respect to crawl-space heat losses.
2. Determine the required furnace-bonnet capacity from the heat loss of the building.
3. Locate the diffusers on the plan. Allow at least one diffuser for each exposed wall in each room or area of building, and preferably beneath window areas. For residential installations limit each diffuser to a maximum of 7,000 Btuh.
4. Determine the required Btuh delivery of each diffuser. Where more than one diffuser is used per room, proportion the heat loss equally among all diffusers.
5. Measure the length of each duct and count number of elbows from the extended plenum to the diffuser. Note whether top or side plenum take-offs are to be used. From Table 6, determine the duct size needed. (Note: Use that section of Table 6, Sections A to E, which applies both to the type of plenum take-off and diffuser to be used.)

6. The cfm values in Table 6 are used with Table 7 for

Table 6.... Heating Capacities and Cfm of Branch Ducts in Extended-Plenum Perimeter Systems

Section A. Side Take-off to 5-Inch Round Pipe for Side-wall, Floor, and Baseboard Diffusers

Extended-Plenum Pressure 0.15 in. Static at 160 F Furnace-Plenum Pressure 0.15 in. Static at 170 F

No. of Elbows		Actual Length from Extended-Plenum to Diffuser—feet															
		5	10	15	20	25	30	35	40	45	50	55	60				
0	Btuh Cfm	8960 97.2	8100 89.4	7310 86.0	6560 83.0	5900 81.2	4800 77.7	4300 75.5	3900 73.1	3510 71.1	3170 69.3	2850 67.8					
1	Btuh Cfm	8070 88.4	7290 85.2	6580 82.2	5950 79.3	5400 76.9	4880 74.6	4400 72.5	3980 70.7	3550 68.9	3200 67.1	2900 65.7	2620 64.2				
2	Btuh Cfm	7340 81.1	6650 78.6	6020 76.0	5460 73.9	4950 71.9	4500 70.0	4070 68.2	3680 66.6	3300 64.1	2980 62.3	2680 61.0					
3	Btuh Cfm	6810 75.0	6180 73.0	5600 71.0	5070 69.2	4610 67.3	4200 65.8	3800 64.4	3420 63.1	3080 61.7	2770 60.2	2480 59.0	2230 58.2				
4	Btuh Cfm	6350 70.4	5750 68.8	5210 67.0	4740 65.4	4300 64.0	3900 62.5	3530 61.1	3180 60.0	2870 58.8	2570 57.7	2300 56.7	2070 55.9				
5	Btuh Cfm	5970 65.2	5400 64.8	4900 63.2	4440 62.0	4040 60.7	3670 59.4	3330 58.3	2990 57.4	2770 56.2	2410 55.3	2160 54.4	1930 53.7				
6	Btuh Cfm	5660 63.0	5120 61.5	4630 60.2	4190 59.1	3800 58.0	3430 56.9	3100 55.9	2800 55.1	2520 54.0	2270 53.0	2040 52.2	1800 51.8				

Note: Where any of the first three runs from the extended-plenum exceeds 20 ft and 3 elbows, count 3 extra elbows for that run.
The Equivalent Length Values used and included in calculating this table are: Diffuser and Boot = 25 ft; Each Elbow = 12 ft; Side Take-off = 20 ft.
Tapered Extended-Plenum Starting Collar.

Section B. Top Take-off to 5-Inch Round Pipe for Side-wall, Floor, and Baseboard Diffusers

Extended-Plenum Pressure 0.15 in. Static at 160 F Furnace-Plenum Pressure 0.15 in. Static at 170 F

No. of Elbows		Actual Length from Extended-Plenum to Diffuser—feet															
		5	10	15	20	25	30	35	40	45	50	55	60				
0	Btuh Cfm	7070 77.8	6400 75.6	5800 73.4	5260 71.4	4800 69.5	4350 68.0	3940 66.4	3550 64.8	3190 63.4	2870 62.0	2580 60.6	2310 59.5				
1	Btuh Cfm	6570 72.6	5970 70.8	5400 68.9	4890 67.2	4430 65.6	4010 64.2	3640 62.8	3290 61.5	2950 60.3	2650 59.0	2380 58.0	2140 57.0				
2	Btuh Cfm	6180 68.4	5610 66.8	5080 65.2	4590 63.7	4160 62.3	3770 61.1	3410 60.0	3080 58.7	2770 57.6	2480 56.4	2210 55.3	2000 54.4				
3	Btuh Cfm	5800 64.4	5250 63.1	4750 61.8	4310 60.5	3900 59.3	3540 58.3	3200 57.1	2890 56.3	2600 55.5	2340 54.7	2100 53.9	1870 53.2				
4	Btuh Cfm	5490 61.2	4960 60.0	4500 58.8	4080 57.8	3700 56.7	3340 55.8	3020 54.9	2720 54.1	2440 53.3	2200 52.6	1970 51.9	1750 51.1				
5	Btuh Cfm	5200 58.5	4710 57.5	4280 56.5	3870 55.5	3510 54.5	3180 53.7	2880 52.9	2580 52.1	2310 51.4	2060 50.7	1830 50.0	1640 49.5				
6	Btuh Cfm	5000 56.0	4520 55.0	4100 54.0	3700 53.4	3350 52.4	3010 51.7	2700 51.0	2440 50.5	2160 50.7	1910 49.1	1700 48.6	1551 48.1				

Note: Where any of the first three runs from the extended-plenum exceeds 20 ft and 3 elbows, count 3 extra elbows for that run.
The Equivalent Length Values used and included in calculating this table are: Diffuser and Boot = 25 ft; Each Elbow = 12 ft; Top Take-off = 50 ft.
Tapered Extended-Plenum Starting Collar.

using the extended-plenum system. No one extended plenum should exceed 35 ft in length.

Design of Return Duct System for Perimeter Installations

With perimeter systems designed in accordance with the foregoing simplified procedures, there is a circulating head

of only 0.05 in. water available on the return side of the system. It is therefore necessary that the return ducts be adequately sized and be as short and straight as practicable. The return grilles may be centrally located, and the ducts may be located in the attic or other unheated spaces provided they are adequately insulated. Return air may be