

TABLE 9. RETURN PIPE CAPACITIES  
Capacity Expressed in Square Feet of Equivalent Direct Radiation  
(Reference to this table will be by column letter M through ZB)

This table is based on pipe size data developed through the research investigations of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.

| Pipe Size<br>Inches | CAPACITY OF RETURN MAINS AND RISERS  |        |                                      |        |                                     |        |                                      |        |                                     |         |                                   |         |
|---------------------|--------------------------------------|--------|--------------------------------------|--------|-------------------------------------|--------|--------------------------------------|--------|-------------------------------------|---------|-----------------------------------|---------|
|                     | MAINS                                |        |                                      |        |                                     |        | RISERS                               |        |                                     |         |                                   |         |
|                     | 1/32 Lb or 1/4 Os<br>Drop per 100 Ft |        | 1/16 Lb or 1/2 Os<br>Drop per 100 Ft |        | 1/8 Lb or 3/4 Os<br>Drop per 100 Ft |        | 1/16 Lb or 1/2 Os<br>Drop per 100 Ft |        | 1/8 Lb or 3/4 Os<br>Drop per 100 Ft |         | 1/4 Lb or 1 Os<br>Drop per 100 Ft |         |
| M                   | Wet                                  | Dry    | Wet                                  | Dry    | Wet                                 | Dry    | Wet                                  | Dry    | Wet                                 | Dry     | Wet                               | Dry     |
|                     | N                                    | O      | T                                    | U      | V                                   | X      | Y                                    | Z      | AA                                  | BB      | CC                                | DD      |
| 3/4                 | 500                                  | 248    | 326                                  | 320    | 400                                 | 412    | 568                                  | 1,400  | 460                                 | 800     | 1,130                             | 1,977   |
| 1                   | 850                                  | 520    | 570                                  | 670    | 1,200                               | 1,000  | 1,700                                | 2,400  | 962                                 | 2,400   | 3,390                             | 5,370   |
| 1 1/4               | 1,350                                | 822    | 976                                  | 1,058  | 1,900                               | 1,362  | 2,696                                | 3,800  | 1,512                               | 3,800   | 5,370                             | 8,925   |
| 2                   | 2,800                                | 1,880  | 2,140                                | 2,300  | 4,000                               | 2,700  | 5,600                                | 8,000  | 3,300                               | 8,000   | 11,300                            | 18,925  |
| 2 1/2               | 4,700                                | 3,040  | 3,256                                | 3,500  | 6,700                               | 4,600  | 9,400                                | 13,400 | 5,450                               | 13,400  | 18,925                            | 30,230  |
| 3                   | 7,500                                | 5,840  | 6,250                                | 6,700  | 10,000                              | 7,000  | 15,000                               | 21,400 | 9,000                               | 21,400  | 30,230                            | 45,200  |
| 3 1/2               | 11,000                               | 8,800  | 9,710                                | 10,700 | 16,000                              | 11,000 | 22,000                               | 32,000 | 14,300                              | 32,000  | 45,200                            | 62,180  |
| 4                   | 15,500                               | 11,700 | 13,400                               | 15,000 | 22,000                              | 15,000 | 31,000                               | 44,000 | 21,500                              | 44,000  | 62,180                            | 109,300 |
| 5                   | .....                                | .....  | .....                                | .....  | 38,700                              | 22,000 | 54,920                               | 88,000 | .....                               | 88,000  | 109,300                           | 175,100 |
| 6                   | .....                                | .....  | .....                                | .....  | 62,000                              | 38,700 | 88,000                               | .....  | .....                               | 124,000 | 175,100                           | .....   |
| 7                   | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 8                   | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 9                   | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 10                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 11                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 12                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 13                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 14                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 15                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 16                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 17                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 18                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 19                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 20                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 21                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 22                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 23                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 24                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 25                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 26                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 27                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 28                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 29                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 30                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 31                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 32                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 33                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 34                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 35                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 36                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 37                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 38                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 39                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 40                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 41                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 42                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 43                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 44                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 45                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 46                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 47                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 48                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 49                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 50                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 51                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 52                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 53                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 54                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 55                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 56                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 57                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 58                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 59                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 60                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 61                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 62                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 63                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 64                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 65                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 66                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 67                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 68                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 69                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 70                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 71                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 72                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 73                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 74                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 75                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 76                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 77                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 78                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 79                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 80                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 81                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 82                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 83                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 84                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 85                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 86                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 87                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 88                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 89                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 90                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 91                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 92                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 93                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 94                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 95                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 96                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 97                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 98                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 99                  | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |
| 100                 | .....                                | .....  | .....                                | .....  | .....                               | .....  | .....                                | .....  | .....                               | .....   | .....                             | .....   |

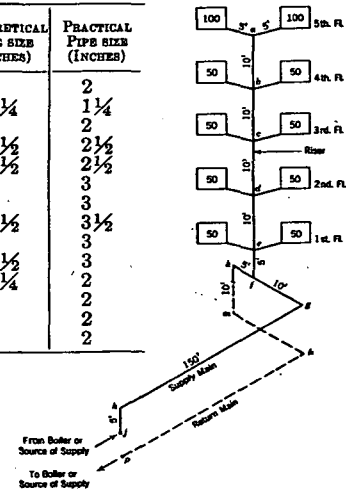
Column C; radiator runouts and undrilled riser runouts from Column L; up-feed risers from Column J; the main riser on a down-feed system from Column C (it will be noted that if Column H is used the drop would exceed the limit of  $\frac{1}{4}$  lb); the dry return from Column R; and the wet return from Column Q.

With a  $\frac{1}{2}$ -lb drop the sizing would be the same as for  $\frac{1}{4}$  lb except that the steam main and dripped runouts would be sized from Column B, the main riser on a down-feed system from Column B, the dry return from Column O, and the wet return from Column N.

TABLE 10. PIPE SIZES FOR ONE-PIPE UP-FEED SYSTEM SHOWN IN FIG. 2

| PART OF SYSTEM             | SECTION OF PIPE | RADIATION SUPPLIED (Sq Ft) | THEORETICAL PIPE SIZE (INCHES) | PRACTICAL PIPE SIZE (INCHES) |
|----------------------------|-----------------|----------------------------|--------------------------------|------------------------------|
| Branches to radiators..    | .....           | 100                        | 2                              | 2                            |
| Branches to radiators..    | .....           | 50                         | 1 1/4                          | 1 1/4                        |
| Riser.....                 | a to b          | 200                        | 2                              | 2                            |
| Riser.....                 | b to c          | 300                        | 2 1/2                          | 2 1/2                        |
| Riser.....                 | c to d          | 400                        | 2 1/2                          | 2 1/2                        |
| Riser.....                 | d to e          | 500                        | 3                              | 3                            |
| Riser.....                 | e to f          | 600                        | 3                              | 3                            |
| Branch to riser.....       | f to g          | 600                        | 3 1/2                          | 3 1/2                        |
| Supply main.....           | g to h          | 600                        | 3                              | 3                            |
| Branch to supply main..... | h to j          | 600                        | 2 1/2                          | 3                            |
| Dry return main.....       | f to k          | 600                        | 1 1/4                          | 2                            |
| Wet return main.....       | k to m          | 600                        | 1                              | 2                            |
| Wet return main.....       | m to n          | 600                        | 1                              | 2                            |
| Wet return main.....       | n to p          | 600                        | 1                              | 2                            |

FIG. 2. RISER, SUPPLY MAIN AND RETURN MAIN OF ONE-PIPE SYSTEM



**Example 3.** Size the one-pipe gravity steam system shown in Fig. 2 assuming that this is all there is to the system or that the riser and run shown involve the longest run on the system.

**Solution.** The total length of run actually shown is 215 ft. If the equivalent length of run is taken at double this, it will amount to 430 ft, and with a total drop of  $\frac{1}{4}$  lb the drop per 100 ft will be slightly less than  $\frac{1}{4}$  lb. It would be well in this case to use  $\frac{1}{4}$  lb, and this would result in the theoretical sizes indicated in Table 10. These theoretical sizes, however, should be modified by not using a wet return less than 2 in. while the main supply, g-h, if from the uptake of a boiler, should be made the full size of the main, or 3 in. Also the portion of the main k-m should be made 2 in. if the wet return is made 2 in.

#### Notes on Gravity One-Pipe Air-Vent Systems

- Pitch of mains should not be less than  $\frac{1}{4}$  in. in 10 ft.
- Pitch of horizontal runouts to risers and radiators should not be less than  $\frac{1}{2}$  in. in 10 ft. Where this pitch cannot be obtained runouts over 8 ft in length should be one size larger than called for in the table.
- In general, it is not desirable to have a main less than 2 in. The diameter of the far end of the supply main should not be less than half its diameter at its largest part.
- Supply mains, branches to risers, or risers, should be dripped where necessary.