

TABLE 5. STEAM PIPE CAPACITIES FOR LOW PRESSURE SYSTEMS  
(Reference to this table will be by column letter A through L)

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

| CAPACITIES OF STEAM MAINS AND RISERS      |                                                 |                        |                      |                      |                      |                      |                                 |                               |                       | SPECIAL CAPACITIES FOR ONE-PIPE SYSTEMS ONLY |                              |  |
|-------------------------------------------|-------------------------------------------------|------------------------|----------------------|----------------------|----------------------|----------------------|---------------------------------|-------------------------------|-----------------------|----------------------------------------------|------------------------------|--|
| PIPE SIZE IN.                             | DIRECTION OF CONDENSATE FLOW IN PIPE LINE       |                        |                      |                      |                      |                      |                                 |                               | Supply Risers Up-Feed | Radi-ator Valves and Vertical Con-nections   | Radi-ator and Riser Run-outs |  |
|                                           | With the Steam in One-Pipe and Two-Pipe Systems |                        |                      |                      |                      |                      | Against the Steam Two-Pipe Only |                               |                       |                                              |                              |  |
|                                           | 1/2 psi or 1/2 Os Drop                          | 1/2 psi or 1/2 Os Drop | 1/2 psi or 1 Os Drop | 1/2 psi or 2 Os Drop | 1/2 psi or 4 Os Drop | 1/2 psi or 8 Os Drop | Vertical                        | Horizontal                    |                       |                                              |                              |  |
|                                           |                                                 |                        |                      |                      |                      |                      |                                 |                               |                       |                                              |                              |  |
| A                                         | B                                               | C                      | D                    | E                    | F                    | G                    | H <sup>a</sup>                  | I <sup>c</sup>                | J <sup>b</sup>        | K                                            | L <sup>e</sup>               |  |
| Capacity Expressed in Square Feet E D R   |                                                 |                        |                      |                      |                      |                      |                                 |                               |                       |                                              |                              |  |
| 1/4                                       | —                                               | —                      | 30                   | —                    | —                    | —                    | 30                              | —                             | 25                    | —                                            | —                            |  |
| 1                                         | 39                                              | 46                     | 56                   | 79                   | 111                  | 157                  | 56                              | 34                            | 45                    | 28                                           | 28                           |  |
| 1 1/4                                     | 87                                              | 100                    | 122                  | 173                  | 245                  | 346                  | 122                             | 75                            | 98                    | 62                                           | 62                           |  |
| 1 1/2                                     | 134                                             | 155                    | 190                  | 269                  | 380                  | 538                  | 190                             | 108                           | 152                   | 93                                           | 93                           |  |
| 2                                         | 273                                             | 315                    | 386                  | 546                  | 771                  | 1,091                | 386                             | 195                           | 288                   | 169                                          | 169                          |  |
| 2 1/4                                     | 449                                             | 518                    | 635                  | 898                  | 1,270                | 1,800                | 635                             | 395                           | 464                   | —                                            | 260                          |  |
| 3                                         | 822                                             | 948                    | 1,160                | 1,650                | 2,330                | 3,290                | 1,130                           | 700                           | 800                   | —                                            | 475                          |  |
| 3 1/4                                     | 1,230                                           | 1,420                  | 1,740                | 2,460                | 3,470                | 4,910                | 1,550                           | 1,150                         | 1,140                 | —                                            | 745                          |  |
| 4                                         | 1,740                                           | 2,010                  | 2,460                | 3,480                | 4,910                | 6,950                | 2,040                           | 1,700                         | 1,520                 | —                                            | 1,110                        |  |
| 4 1/4                                     | 3,210                                           | 3,710                  | 4,550                | 6,430                | 9,090                | 12,900               | 4,200                           | 3,150                         | —                     | —                                            | 2,180                        |  |
| 5                                         | 5,280                                           | 6,100                  | 7,460                | 10,550               | 14,900               | 21,100               | 7,200                           | 5,600                         | —                     | —                                            | —                            |  |
| 6                                         | 11,000                                          | 12,700                 | 15,500               | 21,970               | 31,070               | 43,900               | 15,000                          | 12,000                        | —                     | —                                            | —                            |  |
| 8                                         | 20,000                                          | 23,100                 | 28,300               | 40,100               | 56,700               | 80,200               | 28,000                          | 23,000                        | —                     | —                                            | —                            |  |
| 10                                        | 32,000                                          | 37,100                 | 45,500               | 64,300               | 91,000               | 129,000              | 46,000                          | 38,000                        | —                     | —                                            | —                            |  |
| 12                                        | 46,000                                          | 53,000                 | 64,300               | 91,000               | 129,000              | 180,000              | 64,000                          | 52,000                        | —                     | —                                            | —                            |  |
| 16                                        | 81,000                                          | 94,000                 | 115,000              | 161,000              | 226,000              | 314,000              | 115,000                         | 94,000                        | —                     | —                                            | —                            |  |
| Capacity Expressed in Pounds per Hour     |                                                 |                        |                      |                      |                      |                      |                                 |                               |                       |                                              |                              |  |
| 1/4                                       | —                                               | —                      | 8                    | —                    | —                    | —                    | 8                               | —                             | 6                     | —                                            | 7                            |  |
| 1                                         | 10                                              | 12                     | 14                   | 20                   | 28                   | 40                   | 14                              | 9                             | 11                    | 7                                            | 16                           |  |
| 1 1/4                                     | 22                                              | 25                     | 31                   | 43                   | 61                   | 87                   | 31                              | 19                            | 20                    | 16                                           | 23                           |  |
| 1 1/2                                     | 34                                              | 39                     | 48                   | 67                   | 95                   | 135                  | 48                              | 27                            | 38                    | 23                                           | 42                           |  |
| 2                                         | 68                                              | 79                     | 97                   | 137                  | 193                  | 273                  | 97                              | 49                            | 72                    | 42                                           | 85                           |  |
| 2 1/4                                     | 112                                             | 130                    | 159                  | 225                  | 318                  | 449                  | 159                             | 99                            | 116                   | —                                            | 119                          |  |
| 3                                         | 206                                             | 237                    | 291                  | 411                  | 581                  | 822                  | 282                             | 175                           | 200                   | —                                            | 186                          |  |
| 3 1/4                                     | 307                                             | 355                    | 434                  | 614                  | 869                  | 1,230                | 387                             | 288                           | 286                   | —                                            | 278                          |  |
| 4                                         | 435                                             | 503                    | 614                  | 869                  | 1,230                | 1,740                | 511                             | 425                           | 380                   | —                                            | 545                          |  |
| 5                                         | 806                                             | 923                    | 1,140                | 1,610                | 2,270                | 3,210                | 1,050                           | 788                           | —                     | —                                            | —                            |  |
| 6                                         | 1,320                                           | 1,520                  | 1,870                | 2,640                | 3,730                | 5,280                | 1,800                           | 1,400                         | —                     | —                                            | —                            |  |
| 8                                         | 2,750                                           | 3,170                  | 3,880                | 5,490                | 7,770                | 11,000               | 3,750                           | 3,000                         | —                     | —                                            | —                            |  |
| 10                                        | 5,010                                           | 5,790                  | 7,090                | 10,000               | 14,200               | 20,000               | 7,000                           | 5,700                         | —                     | —                                            | —                            |  |
| 12                                        | 8,040                                           | 9,290                  | 11,400               | 16,100               | 22,700               | 32,200               | 11,500                          | 9,500                         | —                     | —                                            | —                            |  |
| 16                                        | 15,100                                          | 17,400                 | 21,200               | 30,300               | 42,400               | 60,500               | 22,000                          | 19,000                        | —                     | —                                            | —                            |  |
| All Horizontal Mains and Down-Feed Risers |                                                 |                        |                      |                      |                      |                      | Up-Feed Risers                  | Mains and Un-dripped Run-outs | Up-Feed Risers        | Radi-ator Con-nections                       | Run-outs Not Dripped         |  |

Note.—Steam at an average pressure of 1 psig is used as a basis for calculating capacities. All drops shown are in psi per 100 ft of equivalent run—based on pipe properly reamed.

\* Do not use Column H for drops of 1/24 or 1/32 psi; substitute Column C or Column B as required.

<sup>b</sup> Do not use Column J for drop 1/32 psi except on sizes 3 in. and over; below 3 in. substitute Column B.

<sup>c</sup> Pitch of horizontal runouts to risers and radiators should be not less than 1/2 in. per ft. Where this pitch cannot be obtained, runouts over 8 ft in length should be one pipe size larger than called for in Table 5.

critical velocities of the steam to permit the counter flow of condensate without noise.

Return piping may be sized with the aid of Tables 6 and 7 where pipe capacities for wet, dry, and vacuum return lines are shown for the pressure drops per 100 ft corresponding to the drops in Table 5. It is customary to use the same pressure drop on both the steam and return sides of a system.

**Example 2:** What pressure drop should be used for the steam piping of a system if the measured length of the longest run is 500 ft, and the initial pressure is not to be over 2-psig?

**Solution:** It will be assumed, if the measured length of the longest run is 500 ft., that when the allowance for fittings is added, the equivalent length of run will not exceed 1,000 ft. Then, with the pressure drop not over one-half of the initial pressure, the drop could be 1 psi or less. With a pressure drop of 1 psi and a length of run of 1,000 ft, the drop per 100 ft would be 1/10 psi, while if the total drop were 1/2 psi, the drop per 100 ft would be 1/20 psi. In the first instance the pipe could be sized according to Column D for 1/10 psi per 100 ft, and in the second case, the pipe could be sized according to Column C for 1/20 psi. On completion of the sizing, the drop could be checked by taking the longest line and actually calculating the equivalent length of run from the pipe sizes determined. If the calculated drop is less than that assumed, the pipe size is all right; if it is more, it is probable that there are an unusual number of fittings involved, and either the lines must be straightened or the column for the next lower drop must be used, and the lines resized. Ordinarily, resizing will be unnecessary.

#### TABLES FOR PIPE SIZING FOR HIGH PRESSURE SYSTEMS

Many of the recent installations of heating systems for large industrial type buildings have been designed for the use of high pressure steam, that is, without the use of pressure reducing valves. Such systems usually involve the use of unit heaters or large built-up fan units with blast heating coils. Pressures on these systems vary from 30 to 150 psi. Temperatures are controlled by a modulating or throttling type thermostatic valve controlled by the air temperature in the room, fan inlet or outlet.

Tables 8 to 11 may be used for the sizing of steam and return piping for systems of 30 and 150 psi pressure at various pressure drops. These tables are based on Babcock's formula, and have been used as the basis of design for a number of years.

#### SIZING PIPING FOR ONE-PIPE GRAVITY SYSTEMS

Gravity one-pipe air-vent systems, in which the equivalent length of run does not exceed 200 ft, should be sized by means of Tables 5, 6 and 7 as follows:

1. For the steam main and dripped runouts to risers where the steam and condensate flow in the same direction, use 1/2 psi drop (Column D).
2. Where the riser runouts are not dripped and the steam and condensate flow in opposite directions, and also in the radiator runouts where the same condition occurs use Column L.
3. For up-feed steam risers carrying condensate back from the radiators, use Column J.
4. For down-feed systems, the main risers of which do not carry any radiator condensate, use Column H.
5. For the radiator valve size and the stub connection, use Column K.
6. For the dry-return main, use Column U.
7. For the wet-return main, use Column T.

On systems exceeding an equivalent length of 200 ft, it is suggested that the total drop be not over 1/2 psi. The return piping sizes should correspond with the drop used on the steam side of the system. Thus, where 1/2 psi drop is being used, the steam main and dripped runouts would be