

TABLE 9. STEAM PIPE CAPACITIES FOR 30 PSI STEAM SYSTEMS

Capacity Expressed in Pounds per Hour

(Steam and Condensate Flowing in Same Direction)

| PIPE SIZE<br>INCHES | DROP IN PRESSURE—POUNDS PER 100 FT IN LENGTH |        |        |        |        |         |
|---------------------|----------------------------------------------|--------|--------|--------|--------|---------|
|                     | 1/8                                          | 1/4    | 3/8    | 1/2    | 1      | 2       |
| 3/4                 | 15                                           | 22     | 31     | 38     | 45     | 63      |
| 1                   | 31                                           | 46     | 63     | 77     | 89     | 125     |
| 1 1/4               | 69                                           | 100    | 141    | 172    | 199    | 281     |
| 1 1/2               | 107                                          | 154    | 219    | 267    | 309    | 437     |
| 2                   | 217                                          | 313    | 444    | 543    | 627    | 886     |
| 2 1/2               | 358                                          | 516    | 730    | 924    | 1,033  | 1,460   |
| 3                   | 651                                          | 940    | 1,330  | 1,628  | 1,880  | 2,660   |
| 3 1/2               | 979                                          | 1,414  | 2,000  | 2,447  | 2,825  | 4,000   |
| 4                   | 1,386                                        | 2,000  | 2,830  | 3,464  | 4,000  | 5,660   |
| 5                   | 2,560                                        | 3,642  | 5,225  | 6,402  | 7,390  | 10,460  |
| 6                   | 4,210                                        | 6,030  | 8,590  | 10,420 | 12,140 | 17,180  |
| 8                   | 8,750                                        | 12,640 | 17,860 | 21,865 | 25,250 | 35,100  |
| 10                  | 16,250                                       | 23,450 | 33,200 | 40,625 | 46,900 | 66,350  |
| 12                  | 25,640                                       | 36,930 | 52,320 | 64,050 | 74,000 | 104,500 |

mined pressure by varying the vacuum in the return lines, or by varying the pressure in the supply lines and the vacuum in the returns. The valves are frequently manually set from a remote location, guided by temperature indicating stations in the building; or thermostatically controlled from a thermostat on the roof, which automatically measures the differential of outside and inside temperatures. Since the range through which the pressures may be varied is usually from 0 to 4 psi gage, the control should be capable of maintaining close regulation to maintain the desired space temperatures, particularly in mild weather.

A recommended orifice schedule is shown in Table 8. Some systems use orifices not only in radiator inlets but also at different points in the steam supply piping for the purpose of balancing the system to a greater extent. In this manner the difference between the initial and terminal

TABLE 10. STEAM PIPE CAPACITIES FOR 150 PSI STEAM SYSTEMS

Capacity Expressed in Pounds per Hour

(Steam and Condensate Flowing in Same Direction)

| PIPE SIZE<br>INCHES | DROP IN PRESSURE—PSI PER 100 FT IN LENGTH |        |        |         |         |         |         |
|---------------------|-------------------------------------------|--------|--------|---------|---------|---------|---------|
|                     | 1/8                                       | 1/4    | 3/8    | 1/2     | 1       | 2       | 5       |
| 3/4                 | 29                                        | 41     | 58     | 71      | 82      | 116     | 184     |
| 1                   | 58                                        | 82     | 117    | 143     | 165     | 233     | 369     |
| 1 1/4               | 130                                       | 185    | 262    | 320     | 370     | 523     | 827     |
| 1 1/2               | 203                                       | 287    | 407    | 497     | 575     | 813     | 1,290   |
| 2                   | 412                                       | 583    | 825    | 1,010   | 1,167   | 1,650   | 2,600   |
| 2 1/2               | 683                                       | 959    | 1,359  | 1,650   | 1,920   | 2,710   | 4,290   |
| 3                   | 1,237                                     | 1,750  | 2,476  | 3,020   | 3,500   | 4,940   | 7,820   |
| 3 1/2               | 1,855                                     | 2,626  | 3,715  | 4,550   | 5,250   | 7,420   | 11,740  |
| 4                   | 2,625                                     | 3,718  | 5,260  | 6,430   | 7,430   | 10,500  | 16,620  |
| 5                   | 4,858                                     | 6,875  | 9,725  | 11,900  | 13,750  | 19,450  | 30,750  |
| 6                   | 7,960                                     | 11,275 | 15,950 | 19,500  | 22,550  | 31,850  | 50,400  |
| 8                   | 16,590                                    | 23,475 | 33,200 | 40,600  | 46,950  | 66,400  | 105,000 |
| 10                  | 30,820                                    | 43,430 | 61,700 | 75,600  | 87,250  | 123,400 | 195,000 |
| 12                  | 48,600                                    | 68,750 | 97,250 | 119,000 | 137,600 | 194,400 | 307,400 |

TABLE 11. RETURN PIPE CAPACITIES FOR 30 PSI STEAM SYSTEMS

Capacity Expressed in Pounds per Hour

| PIPE SIZE<br>INCHES | DROP IN PRESSURE—POUNDS PER 100 FT IN LENGTH |        |        |        |        |
|---------------------|----------------------------------------------|--------|--------|--------|--------|
|                     | 1/8                                          | 1/4    | 3/8    | 1/2    | 1      |
| 3/4                 | 115                                          | 170    | 245    | 308    | 365    |
| 1                   | 230                                          | 340    | 490    | 615    | 730    |
| 1 1/4               | 485                                          | 710    | 1,025  | 1,285  | 1,530  |
| 1 1/2               | 790                                          | 1,155  | 1,670  | 2,100  | 2,500  |
| 2                   | 1,575                                        | 2,355  | 3,400  | 4,300  | 5,050  |
| 2 1/2               | 2,650                                        | 3,900  | 5,600  | 7,100  | 8,400  |
| 3                   | 4,850                                        | 7,100  | 10,250 | 12,850 | 15,300 |
| 3 1/2               | 7,200                                        | 10,550 | 15,250 | 19,150 | 22,750 |
| 4                   | 10,200                                       | 15,000 | 21,600 | 27,000 | 32,250 |
| 5                   | 19,000                                       | 27,750 | 40,250 | 55,500 | 60,000 |
| 6                   | 31,000                                       | 45,500 | 65,500 | 83,000 | 98,000 |

pressure in the steam main may be compensated to a great extent. For example, if the initial pressure was 3 psi gage and the pressure at the end of the main was 2 psi, an orifice could be used in each branch for the purpose of obtaining a more uniform pressure throughout the system. Such a provision may be particularly useful in this system for branches close to the boiler where the drop in the main has not yet been produced. Some orifice systems are proprietary.

### HIGH PRESSURE STEAM 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 fan outlet.

Tables 9 to 12 may be used for the sizing of steam and return piping for systems of 30 and 150 psi pressure at various pressure drops. These

TABLE 12. RETURN PIPE CAPACITIES FOR 150 PSI STEAM SYSTEMS

Capacity Expressed in Pounds per Hour

| PIPE SIZE<br>INCHES | DROP IN PRESSURE—PSI PER 100 FT IN LENGTH |        |        |         |         |         |
|---------------------|-------------------------------------------|--------|--------|---------|---------|---------|
|                     | 1/8                                       | 1/4    | 3/8    | 1/2     | 1       | 2       |
| 3/4                 | 156                                       | 232    | 360    | 465     | 560     | 890     |
| 1                   | 313                                       | 462    | 690    | 910     | 1,120   | 1,780   |
| 1 1/4               | 650                                       | 960    | 1,500  | 1,950   | 2,330   | 3,700   |
| 1 1/2               | 1,070                                     | 1,580  | 2,460  | 3,160   | 3,800   | 6,100   |
| 2                   | 2,160                                     | 3,300  | 4,950  | 6,400   | 7,700   | 12,300  |
| 2 1/2               | 3,600                                     | 5,350  | 8,200  | 10,700  | 12,800  | 20,400  |
| 3                   | 6,500                                     | 9,600  | 15,000 | 19,500  | 23,300  | 37,200  |
| 3 1/2               | 9,600                                     | 14,400 | 22,300 | 28,700  | 34,500  | 55,000  |
| 4                   | 13,700                                    | 20,500 | 31,600 | 40,500  | 49,200  | 78,500  |
| 5                   | 25,600                                    | 38,100 | 58,500 | 76,000  | 91,500  | 146,000 |
| 6                   | 42,000                                    | 62,500 | 96,000 | 125,000 | 150,000 | 238,000 |