

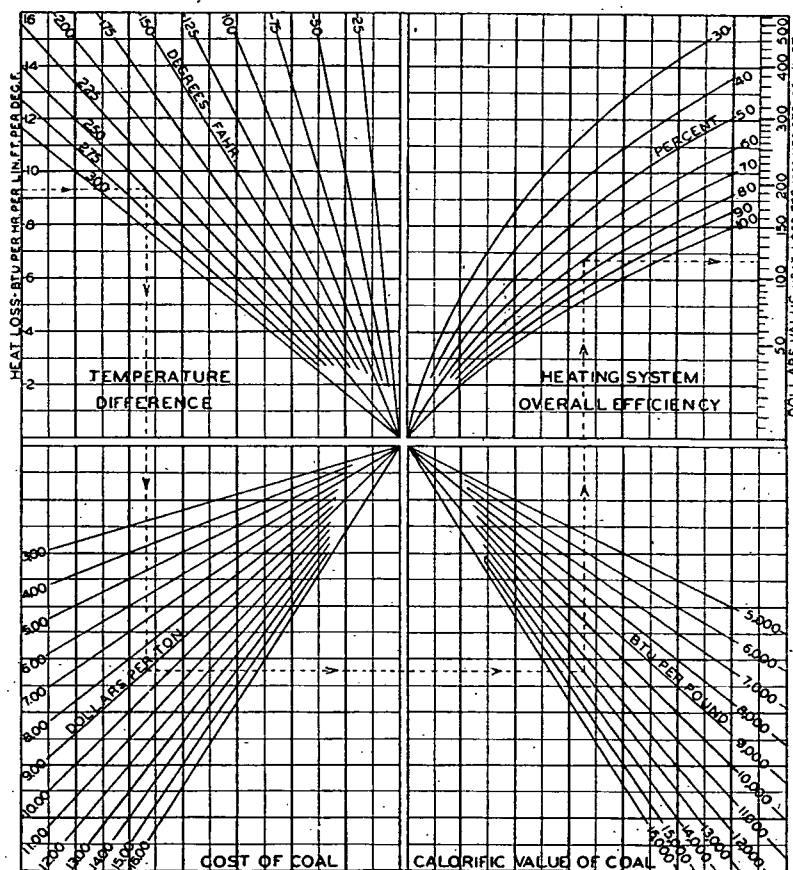


FIG. 1. CHART FOR ESTIMATING DOLLAR VALUE OF HEAT LOSS FROM BARE PIPES. (SEE TABLES 1, 2, 3 AND 4)<sup>a</sup>

<sup>a</sup>This chart is based on 100 linear feet per 1000 hours. For fractions or multiples of these factors, multiply by proper percentage.

lose, at 100 lb steam pressure, an amount of heat equivalent to more than a ton of coal per year shows the necessity for insulating such surfaces.

**Example 1.** Compute the total annual heat loss from 165 ft of 2 in. bare pipe in service 4000 hours per year. The pipe is carrying steam at 10 lb pressure and is exposed to an average air temperature of 70 F.

**Solution.** The pipe temperature is taken as the steam temperature, which is 239.4 F, obtained by interpolation from Table 8, Chapter 1. The temperature difference between the pipe and air =  $239.4 - 70 = 169.4$  F. By interpolation of Table 1 between temperature differences of 157.1 and 227.7 F, the heat loss from a 2 in. pipe at a temperature difference of 169.4 F is found to be 1.624 Btu per hour per linear foot per degree temperature difference. The total annual heat loss from the entire line =  $1.624 \times 169.4 \times 165$  (linear feet)  $\times 4000$  (hours) = 181,600 Mb.

**Example 2.** Coal costing \$11.50 per ton and having a calorific value of 13,000 Btu per pound is being burned in the furnace supplying steam to the pipe line given in the previous example. If the system is operating at an overall efficiency of 55 per cent, determine the monetary value of the annual heat loss from the line.

**Solution.** The cost of heat per 1000 Mb supplied to the system =  $1,000,000 \times 11.5$

TABLE 1. HEAT LOSSES FROM HORIZONTAL BARE STEEL PIPES  
Expressed in Btu per hour per linear foot per degree Fahrenheit difference in temperature between the pipe and surrounding still air at 70 F

| NOMINAL PIPE SIZE (INCHES) | HOT WATER              |       |       |       | STEAM          |                 |                  |
|----------------------------|------------------------|-------|-------|-------|----------------|-----------------|------------------|
|                            | 120 F                  | 150 F | 180 F | 210 F | 227.1 F (5 Lb) | 299.7 F (50 Lb) | 337.9 F (100 Lb) |
|                            | TEMPERATURE DIFFERENCE |       |       |       |                |                 |                  |
|                            | 50 F                   | 80 F  | 110 F | 140 F | 157.1 F        | 227.7 F         | 267.9 F          |
| 1/2                        | 0.455                  | 0.495 | 0.546 | 0.584 | 0.612          | 0.706           | 0.760            |
| 3/4                        | 0.555                  | 0.605 | 0.666 | 0.715 | 0.748          | 0.866           | 0.933            |
| 1                          | 0.684                  | 0.743 | 0.819 | 0.877 | 0.919          | 1.065           | 1.147            |
| 1 1/4                      | 0.847                  | 0.919 | 1.014 | 1.086 | 1.138          | 1.324           | 1.425            |
| 1 1/2                      | 0.958                  | 1.041 | 1.148 | 1.230 | 1.288          | 1.492           | 1.633            |
| 2                          | 1.180                  | 1.281 | 1.412 | 1.512 | 1.578          | 1.840           | 1.987            |
| 2 1/2                      | 1.400                  | 1.532 | 1.683 | 1.796 | 1.883          | 2.190           | 2.363            |
| 3                          | 1.680                  | 1.825 | 2.010 | 2.153 | 2.260          | 2.630           | 2.840            |
| 3 1/2                      | 1.900                  | 2.064 | 2.221 | 2.433 | 2.552          | 2.974           | 3.215            |
| 4                          | 2.118                  | 2.302 | 2.534 | 2.717 | 2.850          | 3.320           | 3.590            |
| 5                          | 2.580                  | 2.804 | 3.084 | 3.303 | 3.470          | 4.050           | 4.385            |
| 6                          | 3.036                  | 3.294 | 3.626 | 3.886 | 4.074          | 4.765           | 5.160            |
| 8                          | 3.880                  | 4.215 | 4.638 | 4.960 | 5.210          | 6.100           | 6.610            |
| 10                         | 4.760                  | 5.180 | 5.680 | 6.090 | 6.410          | 7.490           | 8.115            |
| 12                         | 5.590                  | 6.070 | 6.670 | 7.145 | 7.500          | 8.800           | 9.530            |

TABLE 2. HEAT LOSS FROM HORIZONTAL BARE BRIGHT COPPER PIPE  
Expressed in Btu per hour per linear foot per degree Fahrenheit difference between the pipe and surrounding still air at 70 F

| NOMINAL PIPE SIZE (INCHES) | HOT WATER (Type K Copper Tube) |       |       |       | STEAM (Standard Pipe Size Pipe) |                 |                  |
|----------------------------|--------------------------------|-------|-------|-------|---------------------------------|-----------------|------------------|
|                            | 120 F                          | 150 F | 180 F | 210 F | 227.1 F (5 Lb)                  | 297.7 F (50 Lb) | 337.9 F (100 Lb) |
|                            | TEMPERATURE DIFFERENCE         |       |       |       |                                 |                 |                  |
|                            | 50 F                           | 80 F  | 110 F | 140 F | 157.1 F                         | 227.7 F         | 267.9 F          |
| 1/2                        | 0.180                          | 0.210 | 0.218 | 0.229 | 0.299                           | 0.338           | 0.355            |
| 3/4                        | 0.236                          | 0.275 | 0.291 | 0.307 | 0.357                           | 0.408           | 0.418            |
| 1                          | 0.290                          | 0.338 | 0.354 | 0.373 | 0.440                           | 0.492           | 0.523            |
| 1 1/4                      | 0.340                          | 0.400 | 0.418 | 0.443 | 0.510                           | 0.571           | 0.598            |
| 1 1/2                      | 0.390                          | 0.463 | 0.473 | 0.507 | 0.598                           | 0.671           | 0.710            |
| 2                          | 0.490                          | 0.525 | 0.600 | 0.628 | 0.719                           | 0.813           | 0.851            |
| 2 1/2                      | 0.580                          | 0.675 | 0.709 | 0.750 | 0.840                           | 0.953           | 1.008            |
| 3                          | 0.680                          | 0.788 | 0.848 | 0.871 | 0.987                           | 1.107           | 1.165            |
| 3 1/2                      | 0.760                          | 0.888 | 0.946 | 1.000 | 1.114                           | 1.235           | 1.307            |
| 4                          | 0.940                          | 1.000 | 1.045 | 1.107 | 1.210                           | 1.361           | 1.456            |
| 4 1/2                      | 1.020                          | 1.200 | 1.255 | 1.320 | 1.335                           | 1.495           | 1.488            |
| 5                          | 1.160                          | 1.375 | 1.410 | 1.500 | 1.465                           | 1.670           | 1.755            |
| 6                          | 1.160                          | 1.375 | 1.410 | 1.500 | 1.685                           | 1.890           | 1.942            |
| 8                          | 1.460                          | 1.725 | 1.820 | 1.890 | 2.100                           | 2.373           | 2.510            |