TABLE 10. RADIATING SURFACE PER LINEAR FOOT OF PIPE

| Nominal Pipe Size (Inches) | Surface Area (Sq Ft) | Nominal Pipe Size (Inches) | Surface Area (Sq Ft) | Nominal Pipe Size (Inches) | Surface Area (Sq Ft) |
|---|---|---|---|---|---|
| ½ | 0.22 | 2 | 0.622 | 5 | 1.456 |
| ¾ | 0.275 | 2½ | 0.753 | 6 | 1.734 |
| 1 | 0.344 | 3 | 0.917 | 8 | 2.257 |
| 1¼ | 0.435 | 3½ | 1.047 | 10 | 2.817 |
| 1½ | 0.498 | 4 | 1.178 | 12 | 3.338 |

TABLE 11. RADIATING SURFACE PER LINEAR FOOT OF COPPER TUBING
*Outside diameter ⅛ in. greater than nominal size*

| Tube Size (Inches) | Surface Area (Sq Ft) | Tube Size (Inches) | Surface Area (Sq Ft) | Tube Size (Inches) | Surface Area (Sq Ft) |
|---|---|---|---|---|---|
| ½ | 0.164 | 2 | 0.556 | 5 | 1.342 |
| ¾ | 0.229 | 2½ | 0.687 | 6 | 1.604 |
| 1 | 0.295 | 3 | 0.818 | 8 | 2.128 |
| 1¼ | 0.360 | 3½ | 0.949 | .. | ..... |
| 1½ | 0.426 | 4 | 1.080 | .. | ..... |

For example, the free convection transfer from a 3 in. o.d. horizontal cylinder for a temperature difference of 40 F = 25.0 × 0.73 × 1.52 = 27.7 Btu per square foot per hour.

The increased rate of heat transfer due to forced convection can be calculated from the formula:

$$q_{fc} = 1 + 0.225V \qquad (3)$$

*where*

$q_{fc}$ = heat transfer by forced convection, Btu per square foot per hour per degree Fahrenheit temperature difference.

$V$ = velocity of air, feet per second.

This formula is approximately correct for large surfaces exposed to air currents at temperatures of approximately 70 to 80 F.

## HEAT LOSSES FROM BARE PIPES

Heat losses from horizontal bare steel pipes, based on tests conducted at *Mellon Institute* and calculated from Equations 1 and 2 are given in Table 6. The monetary values of the loss of heat given in Table 6 may be obtained by means of Fig. 1 for various heating system efficiencies, temperature differences, and calorific values, and costs of coal. To solve a problem, select the proper heat loss coefficient from Table 6 and locate this value on the upper left-hand margin of the chart. Then draw lines in the order indicated by the dotted lines, the dollar value of the heat loss per 100 linear feet of pipe per 1000 hours being given on the upper right-hand scale. In using the chart, the cost of coal should also include the labor for handling it, boiler room expense, etc.

Heat losses from horizontal copper tubes and pipes with bright, lacquered and tarnished surfaces are given in Tables 7, 8, and 9[3].

[3]Heat Loss from Copper Piping, by R. H. Heilman (*Heating, Piping and Air Conditioning*, September, 1933, p. 458).





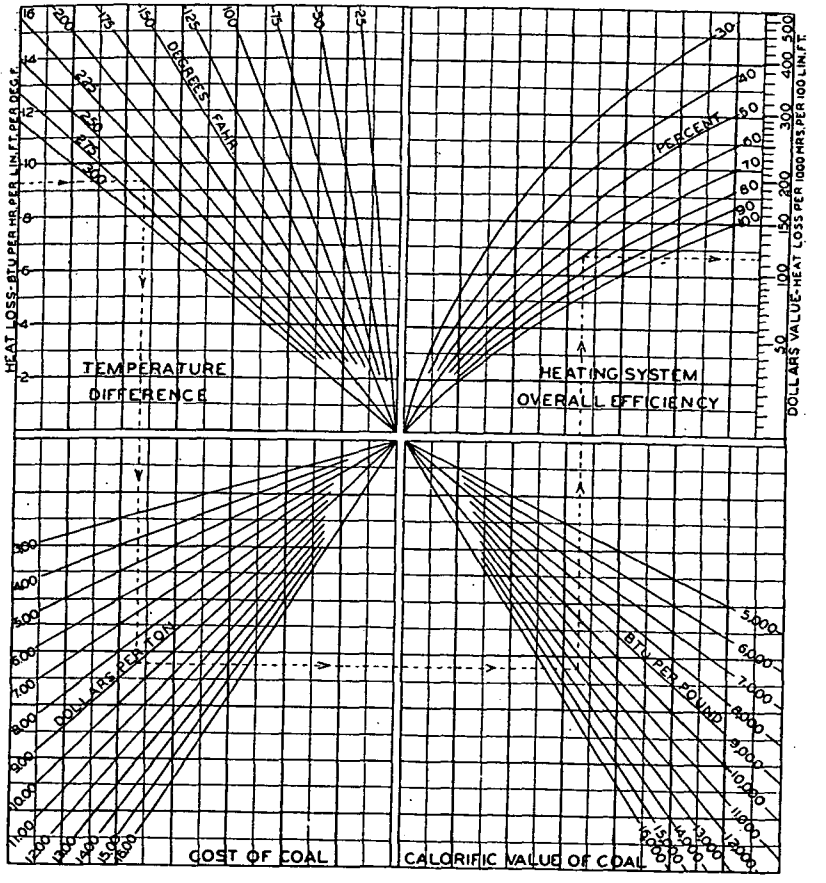


FIG. 1. CHART FOR ESTIMATING DOLLAR VALUE OF HEAT LOSS FROM BARE IRON PIPES. (SEE TABLE 6)[a]

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

The area in square feet per linear foot of pipe is given in Table 10 for various standard pipe sizes, and Table 11 for copper tubing, while Table 12 gives the area in square feet of flanges and fittings for various standard pipe sizes. These tables can be used to advantage in estimating the amount of insulating cement required for various equipment.

Very often, when pipes are insulated, flanges and fittings are left bare so as to allow for easy access to the fittings in case of repairs. The fact that a pair of 8-in. standard flanges having an area of 2.41 sq ft would 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.