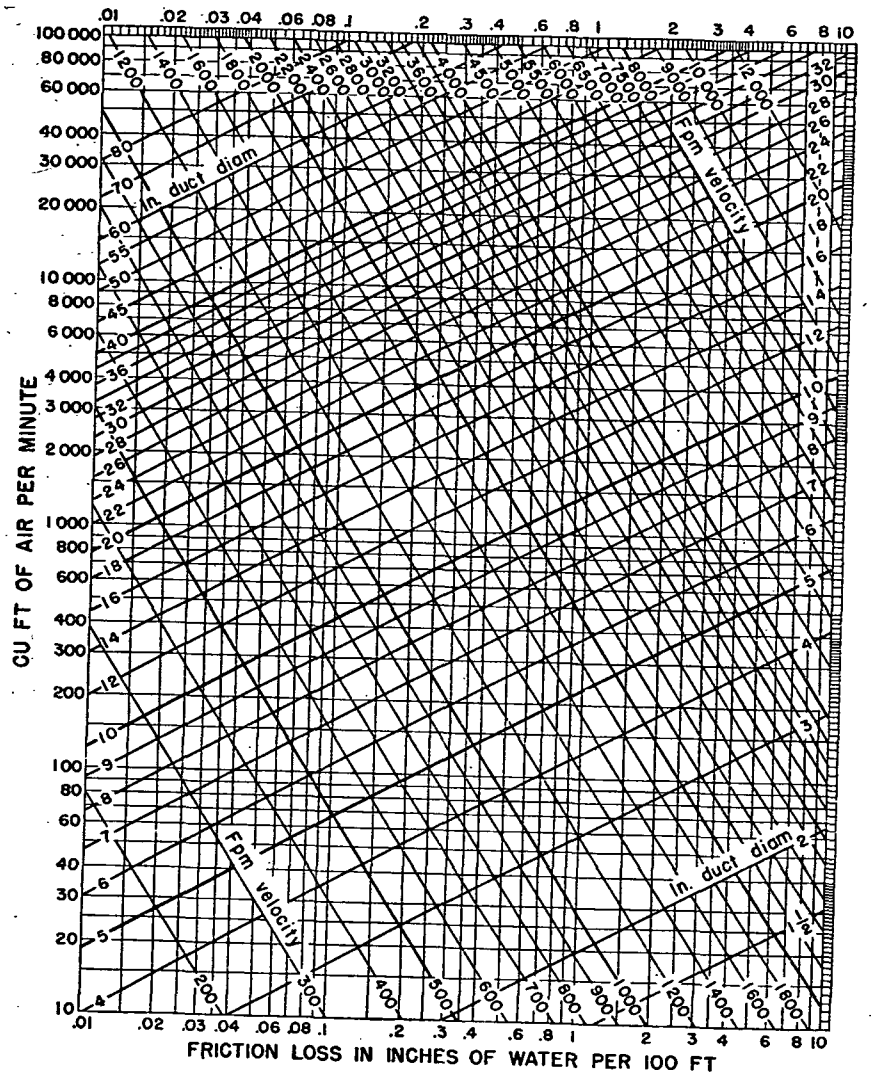

FIG. 2. FRICTION OF AIR IN STRAIGHT DUCTS

(Based on Standard Air at 29.921 In. of Mercury barometric pressure and 69.41 F flowing through average, clean, round, galvanized metal ducts having approximately 40 joints per 100 ft.) Caution: Do not extrapolate below chart.

For ducts of other than standard sheet metal construction, correction factors may be obtained from Fig. 3 [4]. The correction factors shown in Fig. 3 were computed for the values of ϵ, the roughness in feet, shown in Table 1 [4]. The correct friction loss for such ducts may then be determined by multiplying the losses obtained from Fig. 2 by these factors.

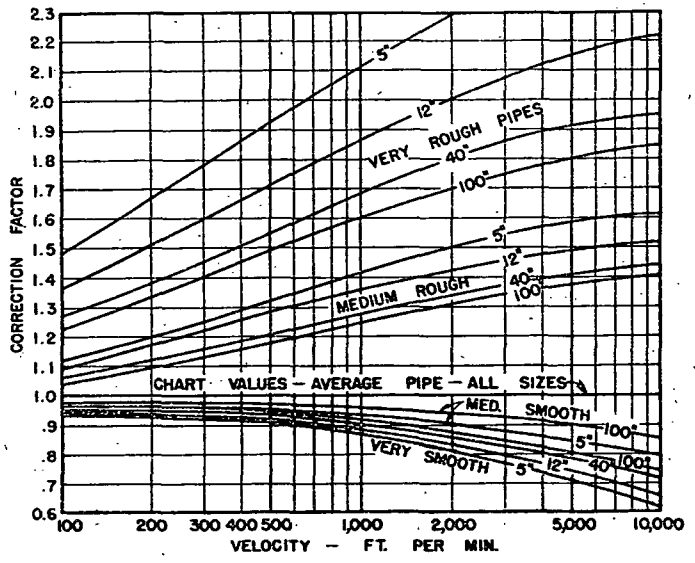

FIG. 3. CORRECTION FACTORS FOR PIPE ROUGHNESS

To correct for pipe roughness multiply friction loss obtained from Fig. 2 by correction factor obtained from Fig. 3.

For ordinary ventilating work, friction may be assumed to vary directly as the density without serious error. If temperatures or viscosities are much different from standard, and if precise results are desired, corrections should be made by use of Equation 3, with the appropriate value of the coefficient of friction, f. However, the following approximate equations [2] are presented and will be found sufficiently accurate for most purposes.

For perfectly smooth ducts: $$h_o = h_s \left(\frac{\rho_o}{\rho_s}\right)^{0.81} \left(\frac{\mu_o}{\mu_s}\right)^{0.19} \quad (4)$$

For average ducts, $$h_o = h_s \left(\frac{\rho_o}{\rho_s}\right)^{0.90} \left(\frac{\mu_o}{\mu_s}\right)^{0.1} \quad (5)$$

For very rough ducts, $$h_o = h_s \left(\frac{\rho_o}{\rho_s}\right) \quad (6)$$

where

h = friction loss.

ρ = density.

μ = absolute viscosity.

h, ρ and μ may be in *any consistent units*.
Subscripts o and s refer to *actual operating* and *standard* conditions respectively.

The absolute viscosity of dry air at various temperatures is given in Fig. 4. The effect of relative humidity on viscosity may be neglected.

Examples 1 and 2 illustrate the use of Fig. 2 to determine friction loss and the use of Fig. 3 to apply a correction for roughness.