Fanning Friction Factor for Pipe Flow

Reynolds Number

\[ f = \frac{h}{(4 \cdot \frac{V^2}{2g})} = \frac{\tau_w}{(\frac{V^2}{2g})} \]

Critical Zone

Transition Zone

Complete Turbulence Zone

Sample inflectional roughness curves

Friction Factor

Relative Roughness

Smooth honed steel 0.00065
Drawn tubing: glass, brass, copper, lead, plastic 0.0015
Asphalted cast iron 0.12
Galvanized steel 0.15
Wood stave 0.18–0.91
Cast iron 0.26
Concrete 0.3–3
Heavy brush coat: asphalts, enamels, tars 0.45–0.6
General tuberculation 1–3 mm 0.6–1.9
Riveted steel 0.9–9
Severe tuberculation and incrustation 2.5–6.5

Reynolds Number

\[ Re = \frac{\rho V D}{\mu} = \frac{VD}{\gamma} \]