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TABLE AND CHARTS

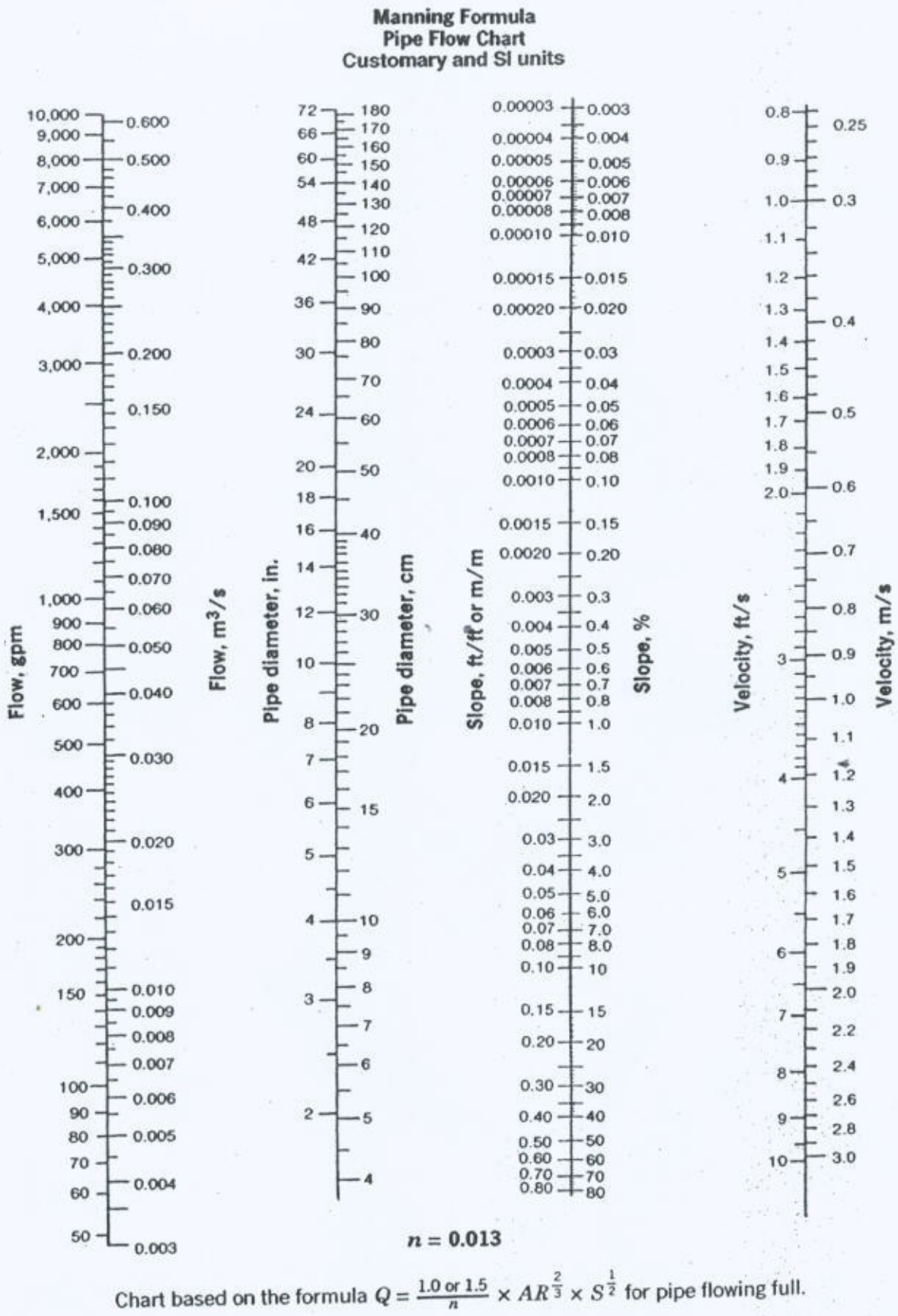


FIGURE 2.21
Manning's nomograph *for circular pipes flowing full, with* n = *0.013. Manning's equation is used for open channel or gravity flow, whereas the Hazen–Williams equation is used for flow under pressure.* (Reprinted with permission from the U.S. Pipe and Foundry Company and Scranton Gillette Communications, Inc.)

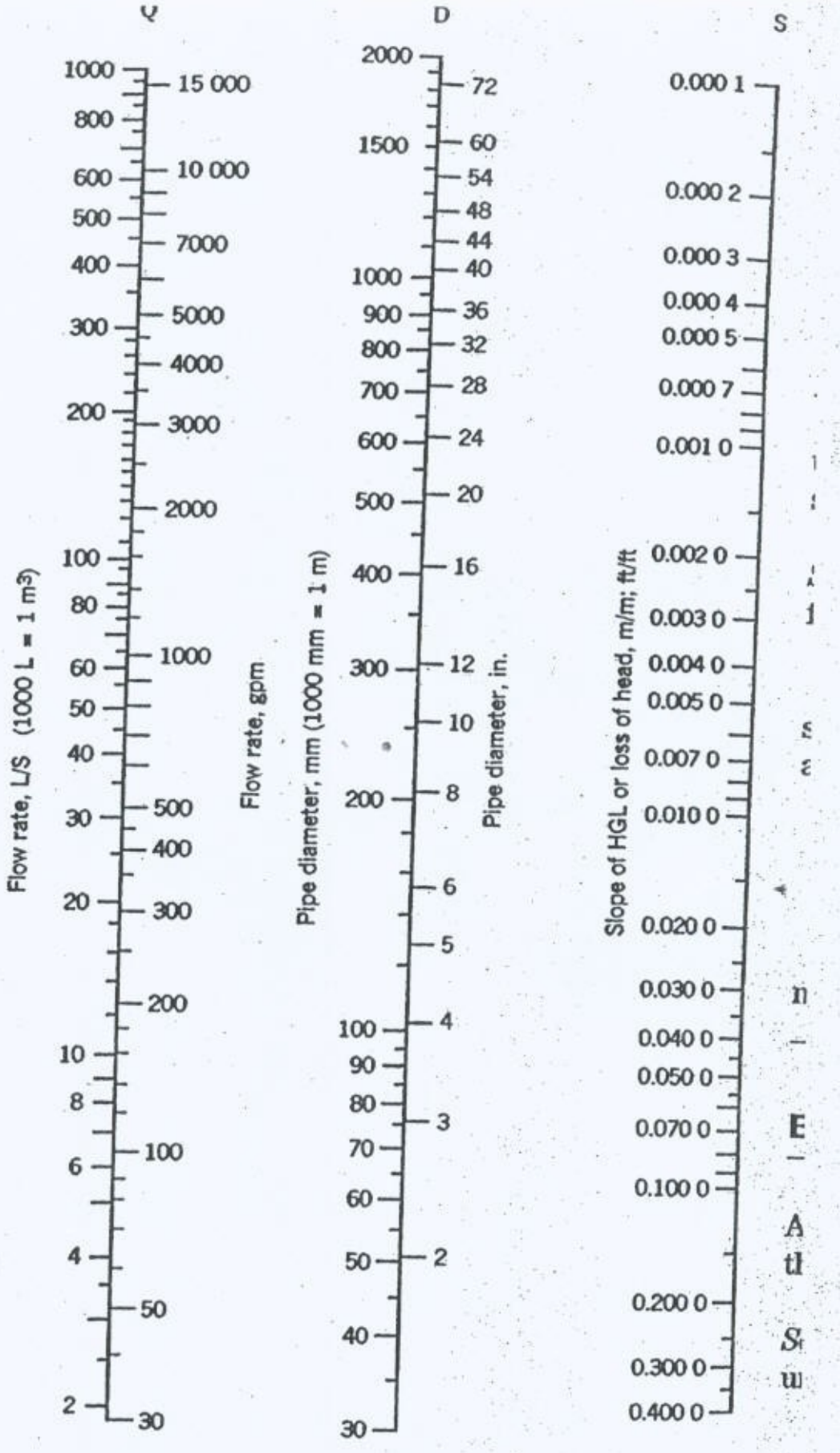


FIGURE 2.15

A nomograph that provides a graphical solution to the Hazen–Williams equation for water flowing in circular pipes under pressure, with C = *100.*

Nomenclature:
d = partial depth
D = full depth or pipe diameter
q = partial discharge
Q = full-flow discharge
v = velocity, partially full
V = velocity, full

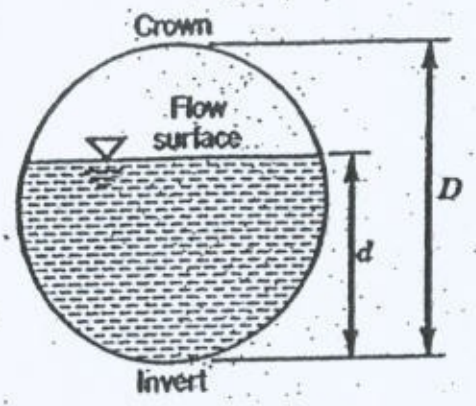
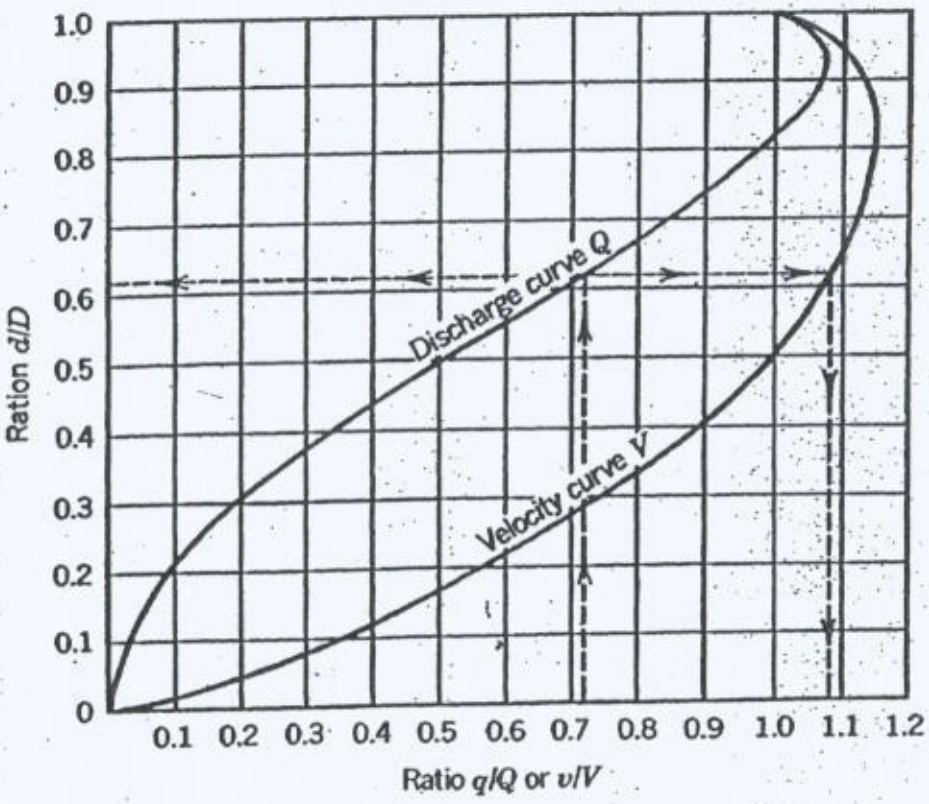


FIGURE 2.22
A partial-flow diagram *for a circular pipe that carries flow with the water surface below the pipe crown.*



Unit conversions and equivalencies

SI metric to U.S. Customary equivalencies

Length
1 mm = 0.03937 in.
1 m = 3.281 ft
1 km = 0.6214 mi

Area
1 m^2 = 10.76 ft^2
1 ha = 10 000 m^2 = 2.471 ac
1 km^2 = 0.3861 mi^2

Volume
1 L = 0.2642 gal = 0.03531 ft^3
1 m^3 = 264.2 gal = 35.31 ft^3

Volume flow rate
1 L/s = 15.85 gpm = 0.02282 mgd = 0.03531 cfs
1 m^3/s = 15,850 gpm = 22.82 mgd = 35.31 cfs
1 ML/d = 1000 m^3/d = 0.264 mgd

Mass and weight (force)
1 kg = 2.205 lb
1 N = 0.2248 lb
1 ton (metric) = 1000 kg = 2205 lb
1 kg/L = 8.345 lb/gal
1 kN/m^3 = 172 lb/yd^3

Pressure
1 kPa = 0.147 psi
1 atm = 100 kPa = 14.7 psi

Chemical concentrations
1 mg/L = 1 ppm = 0.0584 gpg = 8.345 lb/million gal
1 µg/L = 1 ppb
1% = 10 000 ppm

Power
1 kW = 1.341 hp
1 hp = 550 ft · lb/s

Unit abbreviations

ac = acre
atm = atmosphere
cfs = cubic feet per second
ft = feet
ft^2 = square feet
ft^3 = cubic feet
gal = gallon
gpg = grains per gallon
gpm = gallons per minute
ha = hectare
hp = horsepower
in. = inch
kg = kilogram
km = kilometer
km^2 = square kilometer
kN = kilonewton
kPa = kilopascal
kW = kilowatt
L = liter
L/s = liters per second
lb = pound
m = meter
m^2 = square meter
m^3 = cubic meter
m^3/s = cubic meters per second
mg/L = milligrams per liter
mgd = million gallons per day
mi = mile
mi^2 = square mile
ML/d = megaliters per day
mm = millimeter
N = newton
ppb = parts per billion
ppm = parts per million
% = percent
psi = pound per square inch
yd^3 = cubic yard
µg/L = micrograms per liter