

USEFUL TABLES

Conversion Table

“The information contained in these tables are not part of this American National Standard (ANS) and have not been processed in accordance with ANSI’s requirements for an ANS. As such, these tables may contain material that has not been subjected to public review or a consensus process. In addition, they do not contain requirements necessary for conformance to the standard.”

MULTIPLY	BY	TO OBTAIN
Acres	43,560	Square feet
Acre-feet	43,560	Cubic feet
Acre-feet	325,851	Gallons
Atmospheres.....	76.0	Cm of mercury
Atmospheres.....	29.92	Inches of mercury
Atmospheres.....	33.90	Feet of water
Atmospheres.....	14.70	Pounds/square inch
Btu/minute	12.96	Foot-Pounds/second
Btu/minute	0.02356	Horse power
Centimeters	0.3937	Inches
Centimeters of mercury	0.01316	Atmospheres
Centimeters of mercury	0.4461	Feet of water
Centimeters of mercury	27.85	Pounds/square feet
Centimeters of mercury	0.1934	Pounds/square inch
Cubic feet.....	1728	Cubic inches
Cubic feet.....	0.03704	Cubic yards
Cubic feet.....	7.48052	Gallons
Cubic feet.....	29.92	Quarts (liquid)
Cubic feet/minute.....	472.0	Cubic cms/second
Cubic feet/minute.....	0.1247	Gallons/second
Cubic feet/minute.....	62.43	Pounds of water/minute
Cubic feet/second.....	0.0646317	Million gallons/day
Cubic feet/second.....	448.831	Gallons/minute
Cubic yards	27	Cubic feet
Cubic yards	202.0	Gallons
Feet of water	0.02950	Atmospheres
Feet of water	0.8826	Inches of mercury
Feet of water	62.43	Pounds/square feet
Feet of water	0.4335	Pounds/square inch
Feet/minute	0.01667	Feet/second
Feet/minute	0.01136	Miles/hour
Feet/second	0.6818	Miles/hour
Feet/second	0.01136	Miles/minute
Gallons.....	3785	Cubic centimeters
Gallons.....	0.1337	Cubic feet

OREGON PLUMBING SPECIALTY CODE

MULTIPLY	BY	TO OBTAIN
Gallons.....	231.....	Cubic inches
Gallons.....	4.....	Quarts (liquid)
Gallons water.....	8.3453.....	Pounds of water
Gallons/minute.....	0.002228.....	Cubic feet/second
Gallons/minute.....	8.0208.....	Cubic feet/hour
Gallons water/minute.....	6.0086.....	Tons of water/24 hours
Inches.....	2.540.....	Centimeters
Inches of mercury.....	0.03342.....	Atmospheres
Inches of mercury.....	1.133.....	Feet of water
Inches of mercury.....	0.4912.....	Pounds/square inch
Inches of water.....	0.002458.....	Atmospheres
Inches of water.....	0.07355.....	Inches of mercury
Inches of water.....	5.202.....	Pounds/square feet
Inches of water.....	0.03613.....	Pounds/square inch
Liters.....	1000.....	Cubic centimeters
Liters.....	61.02.....	Cubic inches
Liters.....	0.2642.....	Gallons
Miles.....	5280.....	Feet
Miles/hour.....	88.....	Feet/minute
Miles/hour.....	1.467.....	Feet/second
Millimeters.....	0.1.....	Centimeters
Millimeters.....	0.03937.....	Inches
Million gallons/day.....	1.54723.....	Cubic feet/second
Pounds of water.....	0.01602.....	Cubic feet
Pounds of water.....	27.68.....	Cubic inches
Pounds of water.....	0.1198.....	Gallons
Pounds/cubic inch.....	1728.....	Pounds/cubic feet
Pounds/square foot.....	0.01602.....	Feet of water
Pounds/square inch.....	0.06804.....	Atmospheres
Pounds/square inch.....	2.307.....	Feet of water
Pounds/square inch.....	2.036.....	Inches of mercury
Quarts (dry).....	67.20.....	Cubic inches
Quarts (liquid).....	57.75.....	Cubic inches
Square feet.....	144.....	Square inches
Square miles.....	640.....	Acres
Square yards.....	9.....	Square feet
Temperature (°C) + 273.....	1.....	Abs. temperature (°C)
Temperature (°C) + 17.28.....	1.8.....	Temperature (°F)
Temperature (°F) + 460.....	1.....	Abs. temperature (°F)
Temperature (°F) – 32.....	5/9.....	Temperature (°C)
Tons (short).....	2000.....	Pounds
Tons of water/24 hours.....	83.333.....	Pounds water/hour
Tons of water/24 hours.....	0.16643.....	Gallons/minute
Tons of water/24 hours.....	1.3349.....	Cubic feet/hour

USEFUL TABLES

Areas and Circumferences of Circles

Diameter		Circumference		Area	
Inches	mm	Inches	mm	Inches ²	mm ²
1/8	6	0.40	10	0.01227	8.0
1/4	8	0.79	20	0.04909	31.7
3/8	10	1.18	30	0.11045	71.3
1/2	15	1.57	40	0.19635	126.7
3/4	20	2.36	60	0.44179	285.0
1	25	3.14	80	0.7854	506.7
1-1/4	32	3.93	100	1.2272	791.7
1-1/2	40	4.71	120	1.7671	1,140.1
2	50	6.28	160	3.1416	2,026.8
2-1/2	65	7.85	200	4.9087	3,166.9
3	80	9.43	240	7.0686	4,560.4
4	100	12.55	320	12.566	8,107.1
5	125	15.71	400	19.635	12,667.7
6	150	18.85	480	28.274	18,241.3
7	175	21.99	560	38.485	24,828.9
8	200	25.13	640	50.265	32,428.9
9	225	28.27	720	63.617	41,043.1
10	250	31.42	800	78.540	50,670.9

EQUAL PERIPHERIES

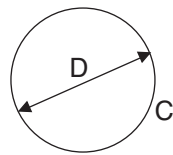
$$S = 0.7854 D$$

$$D = 1.2732 S$$

$$S = 0.8862 D$$

$$D = 1.1284 S$$

$$S = 0.2821 C$$



EQUAL AREAS

Area of square (S') =
1.2732 x area of circle

Area of square (S) =
0.6366 x area of circle

$$C = \pi D = 2\pi R$$

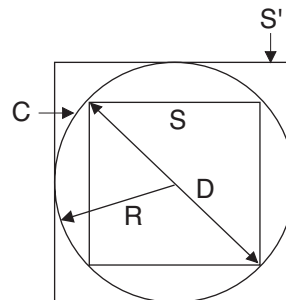
$$C = 3.5446 \sqrt{\text{area}}$$

$$D = 0.3183 C = 2R$$

$$D = 1.1283 \sqrt{\text{area}}$$

$$\text{Area} = \pi R^2 = 0.7854 D^2$$

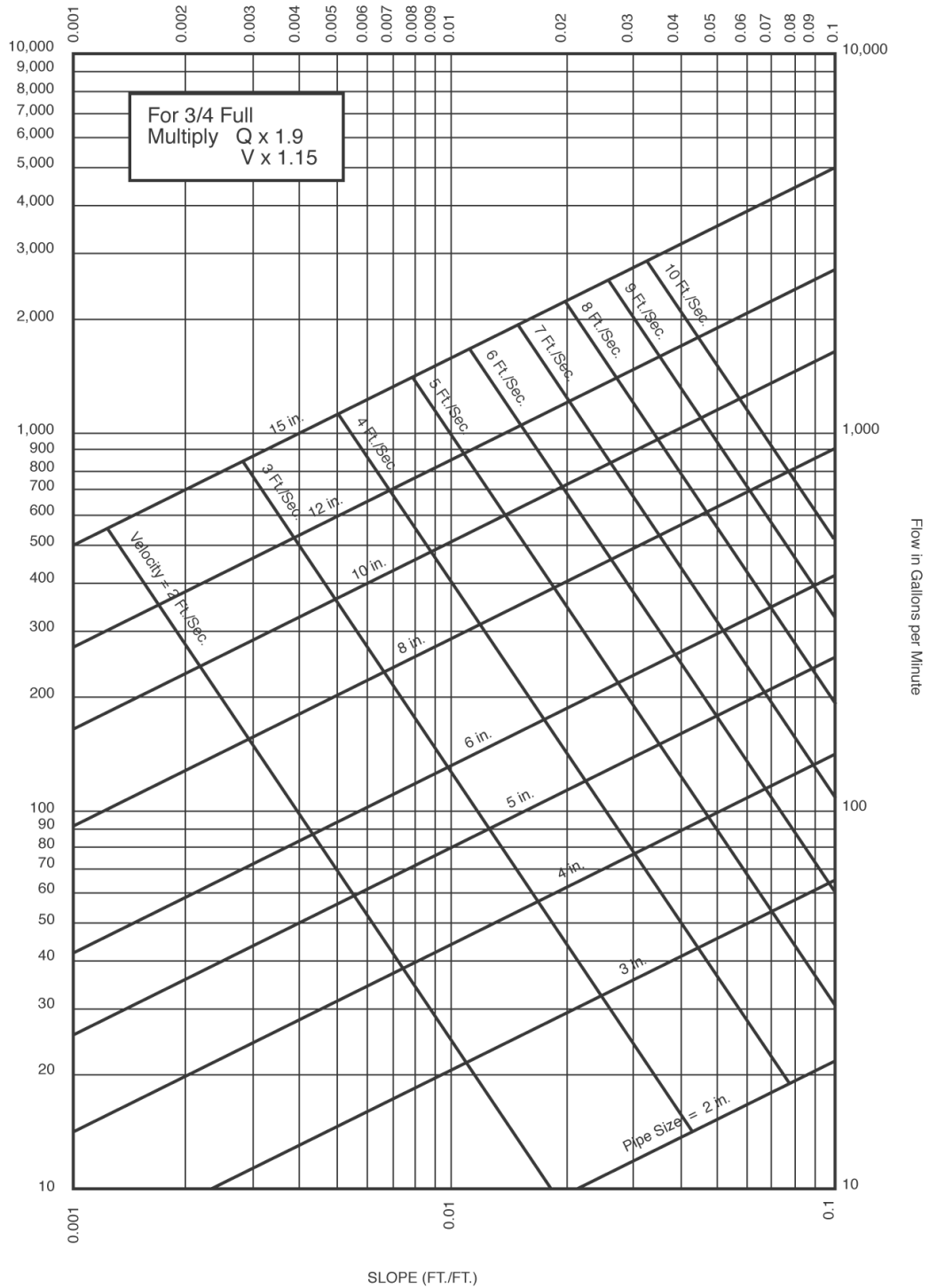
$$\text{Area} = 0.07958 C^2 = \frac{\pi D^2}{4}$$



$$\pi = 3.1416$$

**Flow in Partly Filled (One-Half Full) Pipes
(Based on Manning's Formula with n = .012)**

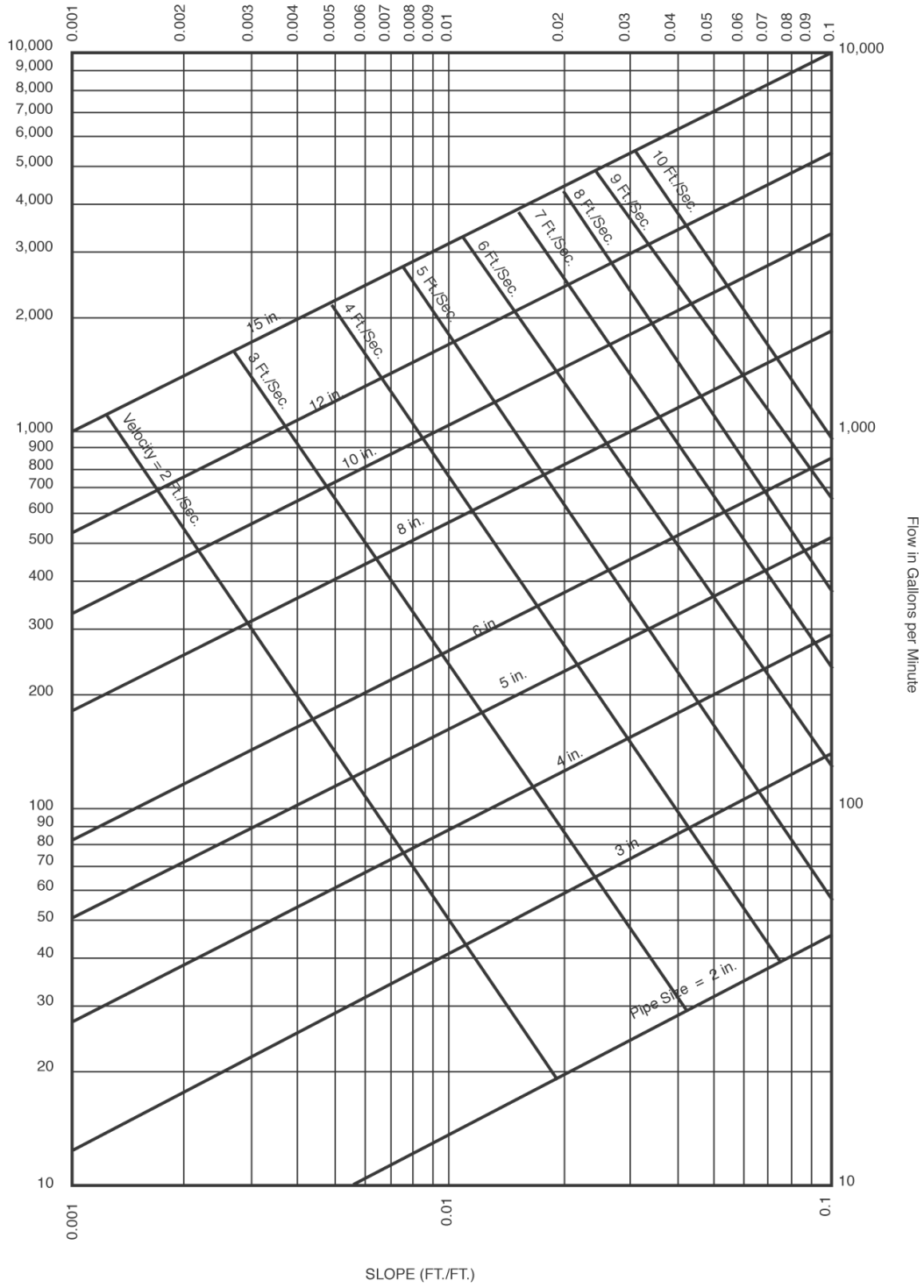
gpm x 6.31 = L/s
ft/sec x .305 = m/s
in. x 25.4 = mm



USEFUL TABLES

**Flow in Partly Filled (Full) Pipes
(Based on Manning's Formula with n = .012)**

gpm x 6.31 = L/s
ft/sec x .305 = m/s
in. x 25.4 = mm



METRIC SYSTEM

(INTERNATIONAL SYSTEM OF UNITS – SI)

For the users of this code, we are including a short explanation and some conversion tables to aid in the conversion of our familiar English units to the forthcoming SI units.

This is written with the code users in mind, and will detail only those measurements used in everyday work and calculations. For the scientific units, we recommend the use of ANSI Z210.1, "Metric Practice Guide."

GENERAL COMMENTS

Our present system of measuring involves the three dimensions of force, length and time. The SI units involve mass, length, and time. The change of force to mass has meaning in scientific and engineering work, but for practical use in ordinary construction, we will show kilogram to pounds conversion values, although an exact conversion would be pounds force divided by the acceleration due to gravity to mass units.

In the same manner, the SI units for temperature expressed in Kelvins and based on absolute zero will be given as degrees Celsius, which is the more familiar and practical Centigrade degrees.

The SI system measures angles in radians where there are 2 pi radians in a circle, but using a 1.5708 bend to change from a vertical stack to a horizontal house drain is not as easy as calling out a 1/4 bend or an ell for water piping.

The foregoing notes are intended to show that in making conversions from one unit system to another, a little common sense must be used and the degree of accuracy needed to do the job at hand.

The following tables are set up using this approach and using the preferred SI units.

USEFUL TABLES

**METRIC SYSTEM
(INTERNATIONAL SYSTEM OF UNITS – SI)**

TO CONVERT	INTO	MULTIPLY BY
Atmospheres	Cm of mercury	76.0
Btu	Joules	1,054.8
Btu/hour	Watts	0.2931
Btu/minute	Kilowatts	0.01757
Btu/minute	Watts	17.57
Centigrade	Fahrenheit	$(^{\circ}\text{C} \times 9/5) + 32^{\circ}$
Circumference	Radians	6.283
Cubic centimeters	Cubic inches	0.06102
Cubic feet	Cubic meters	0.02832
Cubic feet	Liters	28.32
Cubic feet/minute	Cubic cm/second	472.0
Cubic inches	Cubic cm	16.39
Cubic inches	Liters	0.01639
Cubic meters	Gallons (U.S. liquid)	264.2
Feet	Centimeters	30.48
Feet	Meters	0.3048
Feet	Millimeters	304.8
Feet of water	Kg/square cm	0.03048
Foot-Pounds	Joules	1.356
Foot-pounds/minute	Kilowatts	2.260×10^{-5}
Foot-pounds/second	Kilowatts	1.356×10^{-3}
Gallons	Liters	3.785
Horsepower	Watts	745.7
Horsepower-hours	Joules	2.684×10^6
Horsepower-hours	Kilowatt-hours	0.7457
Joules	Btu	9.480×10^{-4}
Joules	Foot-pounds	0.7376
Joules	Watt-hours	2.778×10^{-4}
Kilograms	Pounds	2.205
Kilograms	Tons (short)	1.102×10^{-3}
Kilometers	Miles	0.6214
Kilometers/hour	Miles/hour	0.6214
Kilowatts	Horsepower	1.341
Kilowatt-hours	Btu	3,413
Kilowatt-hours	Foot-pounds	2.655×10^6
Kilowatt-hours	Joules	3.6×10^6
Liters	Cubic feet	0.03531

**METRIC SYSTEM
(INTERNATIONAL SYSTEM OF UNITS – SI)
(Continued)**

TO CONVERT	INTO	MULTIPLY BY
Liters	Gallons (U.S. liquid)	0.2642
Meters	Feet	3.281
Meters	Inches	39.37
Meters	Yards	1.094
Meters/second	Feet/second	3.281
Meters/second	Miles/hr	2.237
Miles (statute)	Kilometers	1.609
Miles/hour	Meters/minute	26.82
Millimeters	Inches	0.03937
Ounces (fluid)	Liters	0.02957
Pints (liquid)	Cubic centimeters	473.2
Pounds	Kilograms	0.4536
PSI	Pascals	6,895
Quarts (liquid)	Liters	0.9463
Radians	Degrees	57.30
Square inches	Square millimeters	645.2
Square meters	Square inches	1,550
Square millimeters	Square inches	1.550×10^{-3}
Watts	Btu/hour	3.4129
Watts	Btu/minute	0.05688
Watts	Foot-pounds/second	0.7378
Watts	Horsepower	1.341×10^{-3}

When the plumbing industry, including plumbers, suppliers, and manufacturers, actually begins the metric conversion program, it will undoubtedly follow the guidelines of committees selected from all phases of the construction industry as set up under the American National Metric Council.

The final preferred units used will be those that apply to our industry and will be of the magnitude to simplify and ease job calculations and avoid confusion and ambiguity.

The conversion looks complex and confusing, but when the metric system was first proposed in France, an attempt was made to include a ten-hour day, a ten-day week, and ten months to the year, but cooler heads prevailed and our time still follows the sun and seasons. Likewise, assigning new units or numbers to the quantities we must work with cannot change the basic hydraulic principles that plumbers have worked with throughout history.

Information on conversion factors is provided by ANSI, the American National Metric Council, and the Division of Designatronics, Inc.