

Measuring Pipes and Pipe Fittings



by Larry Johnston

When you repair or modify home plumbing, knowing the kind and size of pipe you need can save you time and trouble — not to mention trips to the hardware store.

Identify the Kind of Pipe

You can usually identify the kind of pipe just by looking at it: copper pipe is copper-colored metal, galvanized steel water pipe is gray, and plastic pipe for supply lines is usually tan (CPVC, suitable for hot or cold water) or white (PVC, suitable only for cold water). Some supply lines might be PEX flexible plastic tubing in red, white or blue.

Drain, waste and vent (DWV) piping can be copper, galvanized steel, cast iron (black) or plastic (white, tan, black, or blue). If a magnet sticks to a pipe, it's steel or cast iron.

Ungalvanized steel pipe — called black pipe — is usually a gas line that should be left to a pro.

Determine the Pipe Size

Steel and plastic pipe sizes

Nominal size in inches	Outside diameter in inches
1/4	0.54
3/8	0.67
1/2	0.84
3/4	1.05
1	1.315
1-1/4	1.66
1-1/2	1.9
2	2.37
2-1/2	2.87
3	3.5
3-1/2	4.0
4	4.5
5	5.56
6	6.62

Pipe goes by nominal sizes rather than actual measurements, so identifying pipe size can be tricky. Copper 3/4-inch pipe, for instance, doesn't measure 3/4-inch anywhere — its outside diameter (OD) is 0.875 inch and inner diameter (ID) is 0.811 inch for Type M pipe (a designation relating to wall thickness). But steel 3/4-inch pipe is 1.050 inch OD and 0.824 inch ID for standard Schedule 40 pipe (also a wall thickness designation). Plastic pipe measures the same as steel pipe.

To make things a little more confusing, sizes for tubing, such as the small-diameter plastic or copper tubing used to hook up icemakers, are the actual outside diameter and hose sizes indicate actual inside diameter.

Look for manufacturer's markings printed on plastic, copper and cast iron pipe to easily identify type and size. Here's how to determine pipe size by simply measuring the OD.

Copper. The nominal size of copper pipe, whether supply lines or DWV, is always 1/8 inch less than the OD measurement. For example, copper pipe that measures 5/8 inch OD, is called 1/2-inch pipe. The ID varies because wall thickness varies. Type K has the thickest wall, followed by Type L, Type M and DWV.

Cast iron. Cast-iron soil pipe in residential DWV systems is usually 3-inch or 4-inch nominal size. Pipe OD measures about 3/8 inch larger than the nominal size.

Plastic and steel. Plastic and steel pipe with the same nominal size have the same OD. Convert OD measurements to nominal size with the following table.

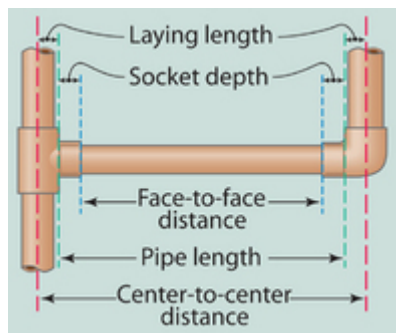
Fit the Fittings

Fittings join pipes together. How a fitting connects pipes depends on the type of pipe:

- Fittings for copper and plastic pipe slip over the end of the pipe and are soldered or glued in place.
- Fittings for steel pipe screw onto tapered external threads on the end of the pipe. The taper jams the threads together to prevent leaks.
- Cast-iron pipe may have straight ends that take clamp-on fittings — called hubless pipe — or one straight end and a belled end to fit over another pipe's straight end — called hub and spigot pipe.

Fittings don't interchange from one type or size of pipe to another, but you can buy fittings to join different types or sizes of pipe. To buy fittings, specify the type of fitting you need and the kind and size of pipe: "I need a 90-degree sweat-solder elbow for $\frac{3}{4}$ inch copper," for example. And always buy a few more than you need.

Figure the Pipe Length



To determine the length of pipe needed to connect two fittings, take two dimensions into account: The fitting socket depth and the laying length. The illustration below shows how the dimensions relate to pipe length.

Socket depth, also called makeup length, is the distance from the face of the fitting to the bottom of the socket. That's how much pipe goes into the fitting.

Laying length, also called fitting gain, is the distance from the bottom of the socket to the centerline of the intersecting pipe. That's how much length the fitting adds to the pipe.

Measure the laying length on the fittings you're using (it varies amount fitting styles and manufacturers). You can then easily figure the pipe length using one of these methods:

Socket depth for threaded steel pipe

Nominal size in inches	Thread length on pipe end	Socket depth when tightened
1/4	0.595	0.367
3/8	0.601	0.407
1/2	0.782	0.534
3/4	0.794	0.553
	0.985	0.661
1-1/4	1.009	0.681
1-1/2	1.025	0.681
2	1.058	0.697
2-1/2	1.571	0.932
3	1.634	1.016
3-1/2	1.684	1.071
4	1.734	1.094

- Measure the face-to-face distance between the fittings and add twice the socket depth.
- Measure the center-to-center distance between the two pipes and subtract the total of the laying lengths of the fittings at both ends.

The table below shows the socket depth for threaded steel pipe.

Writer Larry Johnston's 1908 house in Des Moines is a veritable testing lab for home repair skills and techniques.

© Copyright 2011, Sears Brands, LLC. All Rights Reserved.

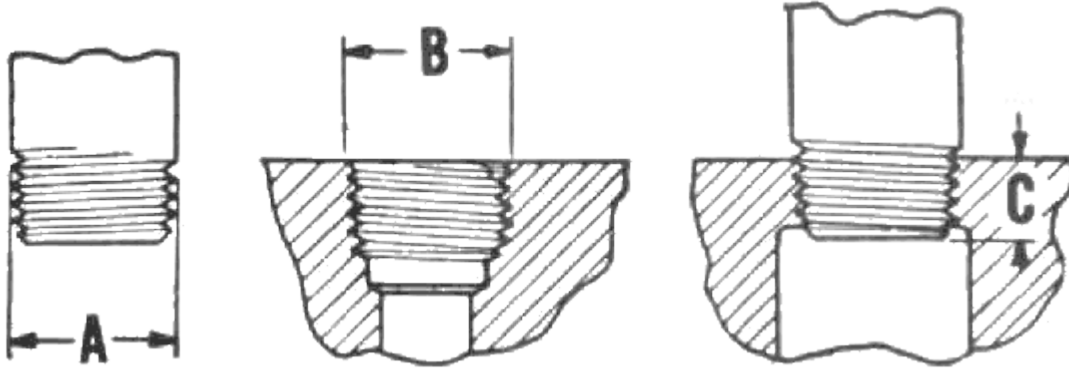
Have a question? [Ask now](#)

PIPE / PIPE THREAD DIMENSIONS

Nominal Pipe sizes do not *match* any of its actual physical dimensions

The OD of pipe / fitting must be measured & compared to the table for

identification For example, a 3/4" NPT pipe thread has an outside diameter of 1.050 inches and 14 threads per inch. Each thread size has a defined number of threads per inch (TPI), but several sizes have the same TPI; because of this, both the TPI and OD of the thread are required for positive identification of thread size.



Male threads:

Measure the outside diameter of the large portion of the thread at "A"; Find figure nearest this dimension in column 1 or 2 of chart. The dimension in column 3 will be your nominal pipe thread size.

Female Threads:

Measure top diameter of thread at "B"; Find figure nearest this dimension in column 1 or 2 of chart. The dimension in column 3 will be your nominal pipe thread size.

Column 1	Column 2	Column 3	Column 4	Column 5
OD Fraction Inch (only for quick reference)	Actual Decimal Inch	Pipe Size Nominal	TPI Threads per Inch	Normal Engagement for a tight joint (dimension "C")
5/16"	0.3125"	1/16"	27	0.2611
13/32"	0.405"	1/8"	27	0.2639
35/64"	0.540"	1/4"	18	0.4018
43/64"	0.675"	3/8"	18	0.4078
27/32"	0.840"	1/2"	14	0.5337
1-3/64"	1.050"	3/4"	14	0.5457
1-5/16"	1.315"	1"	11-1/2	0.6828

1-21/32"	1.660"	1-1/4"	11-1/2	0.7068
1-29/32"	1.900"	1-1/2"	11-1/2	0.7235
2-3/8"	2.375"	2"	11-1/2	0.7565
2-7/8"	2.875"	2-1/2"	8	1.1375
3-1/2"	3.500"	3"	8	1.2000
4"	4.000"	3-1/2"	8	1.2500
4-1/2	4.500"	4"	8	1.3000

Two common pipe thread sizes exist, the tapered **National Pipe Thread (NPT)** and the straight **National Standard Free-Fitting Straight Mechanical Pipe Thread (NPSM)**.

The tapered threads are for joining and sealing, the straight threads are only for joining.

Dry-seal thread (NPTF) allows for joining without sealants.

Female NPT threads may be designated as "FPT"

Male NPT threads may be designated as "MPT."

The pipe size is often written such as this 1/8"-27, with a hyphen between size & thread per inch, and pronounced as "one eighth twenty-seven"

*Three less common threads exist, the **Garden Hose Thread (GHT)**, **Fire Hose Coupling (NST)** and **British Standard Taper Pipe Thread (BSPT)**.*

The NPT and NPTF threads are interchangeable with sealants such as PTFE tape.

None of the other thread standards are interchangeable.

Definition of pipe thread acronyms

NPT National Pipe Thread

FPT Female (National) Pipe Thread

MPT Male (National) Pipe Thread

PTF SAE short tape pipe thread

NPTF American National taper pipe thread for Dryseal pressure-tight joints

NPSM American National straight pipe thread for mechanical joints

NPSI American National straight intermediate pipe thread