

Pipe Wrenches

The jaws and spring of a pipe wrench should be checked often and replaced if necessary. Smooth jaws are a frequent cause of accidents.

Do not slip a piece of pipe over a wrench handle for a "snipe," it is dangerous both to the wrench and the man.

Care must be taken not to make up pipe or fittings too tight, especially the smaller sizes. Brass valves and malleable iron fittings will be forced out of shape and leak. Cast iron fittings can be broken quite easily by screwing pipe into them too tightly.

The maximum sized pipe that can easily be made up by one man is three pipe sizes smaller than the maximum rated capacity of the tool he is using.

In making up fittings or valves apply the wrench to the head or hex at the pipe end. If the wrench is placed away from the pipe the valve or fitting may be distorted.

Select the proper size wrench for the job. Do not use a 24" on a 1 1/2" pipe or a 10" on a 2" pipe.

Approximate Force Required To Make Up A Tight Joint

Pipe Size	Pounds Applied 2" From End Of Wrench								
	Wrench Size	6"	8"	10"	14"	18"	24"	36"	48"
1/8		35	25	18					
1/4		69	50	35	25	19			
3/8		111	80	57	41	31	22		
1/2		148	108	77	56	41	30		
3/4			152	110	80	59	43	28	
1				157	114	86	62	40	29
1-1/4					154	115	83	55	40
1-1/2					210	158	114	75	55
2						224	163	107	79
3								186	137
4								278	206

In applying the wrench to a pipe the jaw should be opened up so that the pressure is on the middle teeth of the jaw, not on the extreme front end. The wrench should be placed on the pipe horizontally and pressure applied downward. Having the wrench in a vertical position and pulling on it is not a safe practice.

Pipe wrenches are not made to withstand a great deal of side pull. The frame can be quite easily bent with such a pull.

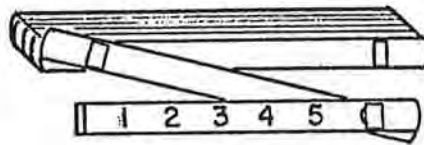
It is not good practice to straighten the handle of a wrench that has been bent. The strains set up in bending and subsequent straightening may cause a break at any time.

MEASUREMENTS

How to measure with the ruler

1. Introductory information

The ruler is a device for measuring linear inches and feet. The common one used by the pipe fitter is called the Zig-Zag ruler. It is 72 inches, or six feet, long. It is divided into twelve six-inch lengths which are graduated in one-inch spaces, and again divided by intermediate markings of $1/2$ -inch, $1/8$ -inch, and $1/16$ -inch graduations, as shown in cut below:



It is well to purchase a rule of this type and of the above dimensions because it is a standard for most pipe fitters. When purchasing a rule the following important points should be observed: first, that it be graduated on all edges in inches and one-sixteenths; second, that it have stainless joints as a precaution against rust; and third, that it have a heavy coat of lacquer to make it more durable. Other features of a good rule are as follows: selected hardwood sticks sealed against moisture, concealed joints having strike platen on each stick, strong spring joints holding rule rigid and preventing "jack knifing," and direction arrows that tell from which end of rule to start measuring.

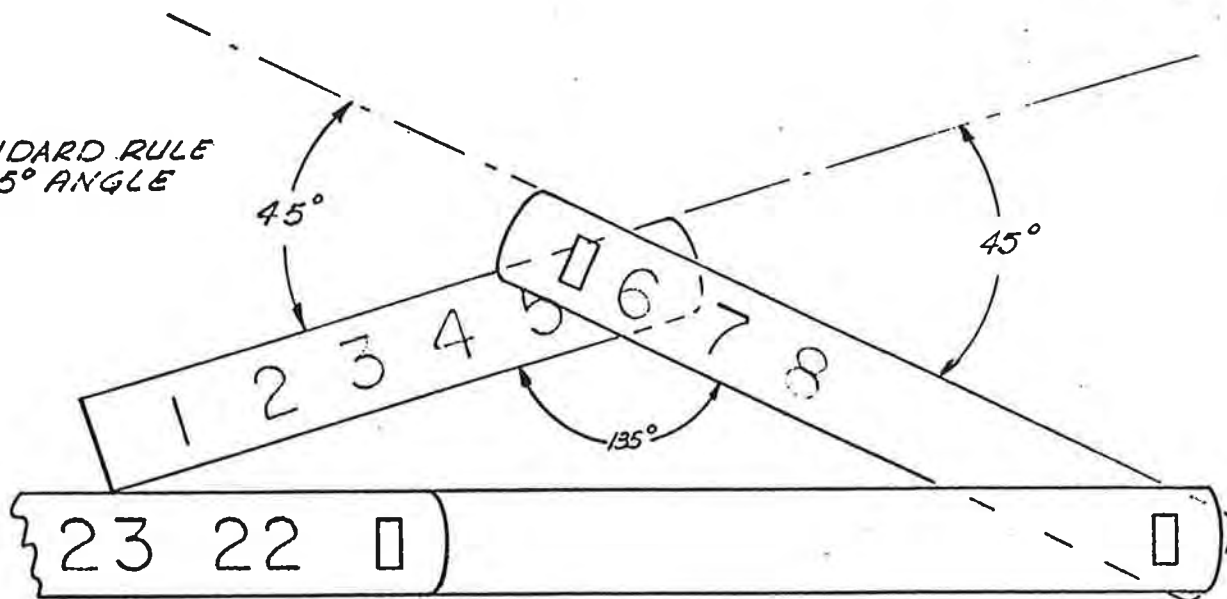
Note: Many cheap rules are made of soft wood, have an ordinary coat of paint, and come loose in a few days. Badly-hinged joints tend to make a rule inaccurate.

2. Procedure

a. MEASURING 90° BEND AND OFFSETS

- (1) Place a 90° bend on the floor or bench.
- (2) Place the straight edge along center of straight part of the pipe.

STANDARD RULE
AT 45° ANGLE

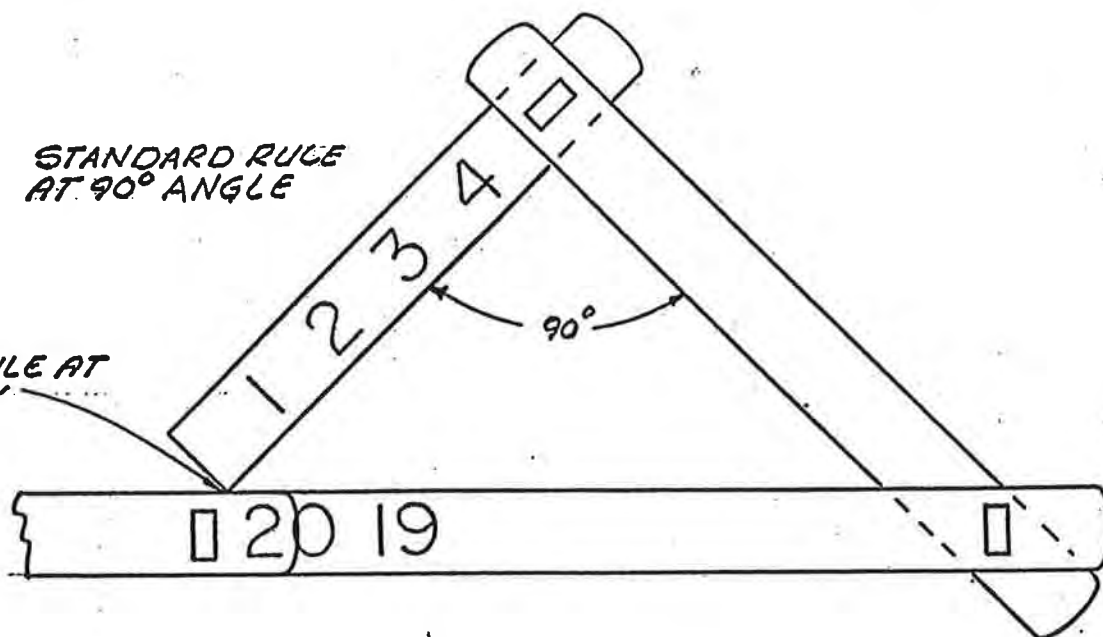


Standard Rule at 45° Angle

Note: 45° and 90° angles can be developed with a Zig-Zag rule as shown in illustration.

STANDARD RULE
AT 90° ANGLE

TIP OF RULE AT
20 1/4" MARK



Standard Rule at 90° Angle

The proper angle to grind a flat chisel is 70° total included angle. When grinding a chisel, it is easy to remember that 70° is closer to a right angle than it is to 45° , so a chisel should be ground just under a right angle. When cutting soft materials, it is wise to decrease the angle of the cutting edge. When grinding a round-nosed chisel to the required 60° angle, remember that the round-nosed chisel is ground only on one side so the angle must be ground accordingly. Also with cape and diamond point chisels.

When grinding the cutting edge of the chisel, dip the chisel in the cooling water frequently to keep chisel cool at all times. After grinding the cutting edge of each chisel, turn the chisel end for end and grind the end of the shank to a small taper. Never allow a chisel to become mushroomed.

In general, the softer the work to be chiseled, the less the angle, also the finer the job, the smaller the angle.

22. Hand Hack Saws

Hack saw blades come with 32 teeth, 24 teeth, 18 teeth, and 14 teeth to the inch.

- 32 teeth - should be used to cut metals thinner than $1/8$ inch thick, such as sheet metal, tubing, etc.
- 24 teeth - should be used on $1/8$ to $1/4$ inch thickness such as light angles, channels, pipe, etc.
- 18 teeth - should be used on $1/4$ to 1 inch thick materials such as cast iron, drill rod, angle iron, etc.
- 14 teeth - should be used on materials 1 inch thick and heavier, such as bars of brass or copper, heavy cast iron, hard rubber, etc.

Two to three teeth should always be in contact with the metal being cut. If the metal gets between the teeth, strong pressure may strip the teeth or break the blade.

Use a good frame, adjusting the tension to hold the blade straight and taut, but not too strong. Too much tension may break the blade at the pin holes, especially if the blade is twisted. If the blade is not tightened properly, it will not cut straight.

The blade should be inserted in the frame with the teeth facing forward. Bear down on the forward stroke, enough to make the teeth cut, raising the frame on the return stroke to avoid dragging the teeth on the metal, which dulls the teeth. The blade does not cut on the back stroke. Thirty to forty cutting strokes per minute is the regular hand blade speed.

In starting a cut, do not start on a corner if it can be avoided. Start on a flat surface if possible.

If a stroke must be started on a corner, a very light steady stroke should be used until the sharp corner has been cut through and two or three teeth are cutting at the same time. In regular cutting, use a long steady stroke, cutting with the full length of the blade. Avoid short jerky strokes.

Do not use fine teeth on soft metals as the teeth will clog so they will not bite into the metal. Use more pressure and coarser teeth on heavy stock.

A wavy set blade starts easier on thin section material. This wider slot is necessary as thin section material has a tendency to close up back of the cut and the wider kerf prevents the binding of the blade in the work.

When finishing a cut, use a lighter stroke to avoid scratching your hand against the exposed metal as the saw completes the final cut. There have been many injuries as a result of the operator not being careful.

Pipe Cutting

The length of pipe received from the supplier will vary according to the practice of the manufacturer. Generally, pipe is made in random lengths of 16 to 22 feet, or in uniform lengths of 21 feet. This makes it necessary to cut the pipe to the proper length as the first operation.

Cutting pipe by hand can be done in two ways, using a hacksaw or a pipe cutter. In either case, the pipe must first be held securely. The common machinist type vise with smooth jaws will not do the job. A variety of pipe vises are made and are shown on *Figure 1, "Pipe Vises"*. Here you see two methods used to hold the pipe. The yoke type will pivot to open and receive the pipe and then the upper jaw is moved down by turning the screw, and the pipe is clamped in the bottom fixed jaw of the vise. In the chain type vise, a special roller chain with teeth on the inside is pulled by a screw thread to clamp the pipe to a bottom jaw on the vise. Both the yoke and the chain types are made for permanent mounting on a bench or for portable mounting. The pipe size capacity of these vises will vary, but the maximum size is usually 6 inches.

The cutting of pipe can be done by two methods-by sawing or by the use of a pipe cutter. The main objective in cutting pipe is to get a square cut, particularly when the pipe is to be threaded. When a hand hacksaw, similar to that shown at "A" on *Figure 2, "Pipe Cutting Tools"* is used, much care must be used to insure getting square cut. A blade having a minimum of **18 teeth per inch** should be used. A motor driven hand saw, similar to that shown at "B" on *Figure 2* in a pipe shop or taken to a job site.

The second method of cutting is the use of a pipe cutter. This tool consists of a **C shaped frame** in which a cutter wheel is fixed at one end and a two roller assembly on a slide rail at the other end.

In operation, the cutter is placed over the pipe with the cutter wheel at the parting line. The screw handle is turned to move the two rollers against the pipe. The cutter wheel is very hard and has a thin, knife-like edge as you see illustrated at “F” on *Figure 2, “Pipe Cutting Tools”*. The screw handle is tightened so that the cutter wheel digs into the pipe metal a slight amount. Then the cutter assembly is rotated 360 degrees several times or until it turns easily. Then the screw is tightened to set the cutter wheel deeper, and the tool is again rotated. This action is repeated until the cutter wheel digs through the wall of the pipe. **Actually, there is no cutting taking place, but rather a pushing aside of the pipe metal by the hard cutter wheel.**

It is relatively easy to get a square cut with the single wheel and roller cutter, because the wheel can be lined up on the cutting mark and the rollers brought up to the pipe squarely because of their width. In this combined wheel and roller cutter as shown at “C”, **the two rollers** can be replaced with cutter wheels in order to make it a faster acting tool. **At “D” is illustrated the four wheel pipe cutter** that is used for cutting 2-1/2 inch to 4 inch diameter pipe or in tight places where only a partial rotation of the tool is possible. More care must be taken in starting a cut with a 3 or 4 wheel cutter because there are no rollers to assure a 90 degree alignment.

Whenever a pipe is cut whether by means of a saw blade or a cutter wheel, a burr is left on the inside of the pipe. The saw blade does not leave as much of a burr on the inside as the cutter wheel does. In addition, the cutter wheel leaves a considerable burr on the outside of the pipe. **This outside burr will interfere with starting the pipe threader, and must be removed by using a file. The inside burr reduces the internal diameter of the pipe and also presents an area where blockage or clogging can start.**

To remove the internal burr, an internal reamer must be used. Three styles of these tools are shown in *Figure 4, "Pipe Reamers"*. All are hand operated with ratchet type action. The reamer shown at "A" has a pointed end and will remove the burr on pipes 1/8 inch through 2 inch in diameter. The reamer shown at "B" will handle pipe size 3/8 inch through 3 inch and the large reamer at "C" is used on pipes 2 inch through 4 inch in diameter. These reamers are inserted in the pipe and a light pressure is made on the center handle with one hand and the reamer is turned with the other hand by means of the ratchet handle. The tapered cutting edges will cut the burr off cleanly and leave the internal pipe surface smooth.

Pipe Threading

Before any attempt is made to cut threads on a pipe, the pipe should be cut to the proper length and the inside and outside burrs removed. The threads can be cut on the pipe ends by two methods – using a hand stock and dies or by a motor powered threading machine.

Figure 5, “Pipe Threading Hand Tools”, shows two typical hand stock and die sets that are used to cut threads on pipe by hand. At “A” you see a single unit which is the most common type. At “B” is shown the parts of this unit consists of. Four cutting dies (sometimes called chasers) are held in slots provided in the top part of the die head. The lower part of the die head is a sort of sleeve bearing which fits smoothly over the pipe end and guides the dies squarely into their cut. The entire die head assembly drops into the ratchet handle and is locked in place. The dies can be removed from the head and replaced when they become worn.

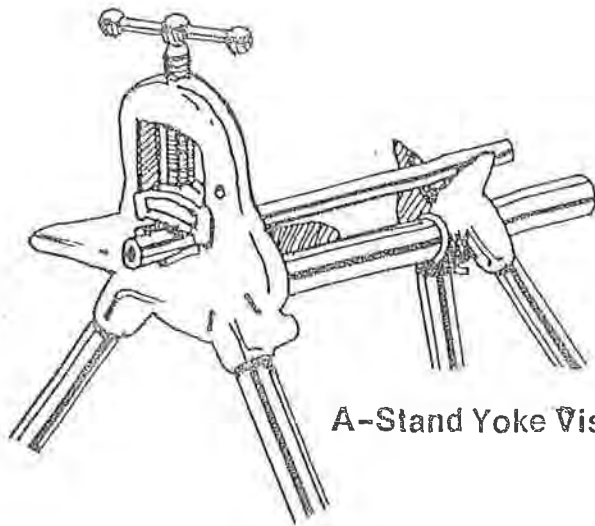
At “C” on *Figure 5*, “Pipe Threading Hand Tools”, we have a three way pipe threader. This is simply three die heads mounted in a single stock. In this manner, the same tool is available to cut any of three sizes of pipe, usually $\frac{1}{2}$ inch, $\frac{3}{4}$ inch and 1 inch. The cutting dies are replaceable, but there is no ratchet action of the handle.

In *Figure 6*, “Pipe Threading Machine”, you see a typical motor driven pipe threader. This has a hollow spindle which is motor driven. At the front end of the spindle, a chuck clamps the pipe securely and at the rear end of the spindle, a center device which closes in conjunction with the chuck supports the pipe. Three tools are pivot mounted on a single carriage, a cutoff tool, a reamer and the die head. When these tools are not in use, they are swung back, as you see the reamer and the cutoff tool position in *Figure 6*, “Pipe Threading Machine”.

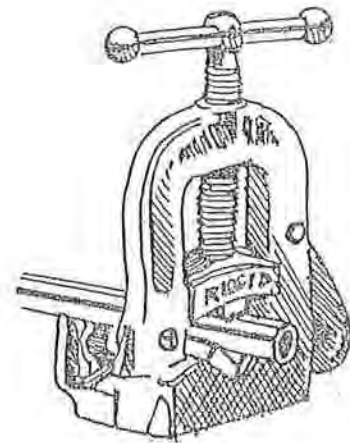
In operation, the pipe is entered at the rear of the machine and pushed through the spindle until the end protrudes beyond the chuck about three inches. Now the chuck is tightened and the motor started. The outside burr is filed off and then the reamer is swung down in the ready position. Then the carriage travel controller is turned slowly to feed the reamer into the end of the pipe. After the burr is cleaned out, the carriage is backed off and the reamer is swung back. Now, the die head is closed, which means that the cutting dies are moved inward to a position that allows them to cut proper depth threads. This closing is done by moving the lever you see at the top of the die head. Now, the die head is swung down into ready position and fed into the end of the pipe by the carriage travel controller. A slight pressure will cause the die head to start cutting, and once started, it will continue to cut until complete. You must watch the cutting operation carefully and be ready to open the dies throw-out lever when the end of the pipe is flush

with the cutting dies.

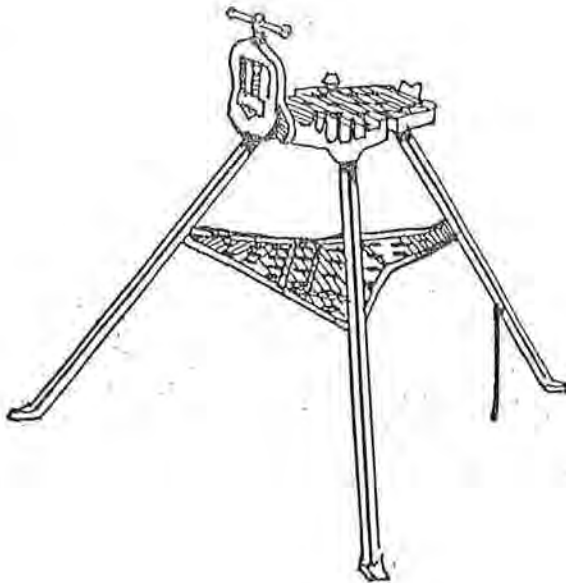
Opening the die is done by flipping the lever up. This moves the cutting dies outward and they no longer contact the pipe. Now the motor can be stopped and the carriage moved back until the die head is off the pipe. **Always remember to use an adequate amount of cutting oil when cutting the threads.** The cutoff tool can be swung into position and placed at the cutoff point with the carriage travel controller. As the pipe is revolved, the feed screw on the cutoff tool is turned to lead the cutter into the pipe for cutoff.



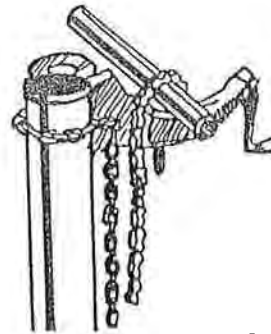
A-Stand Yoke Vise



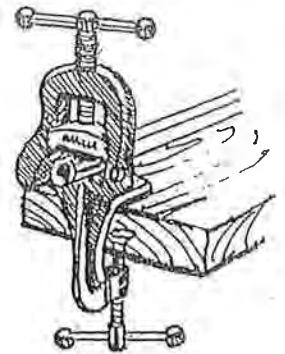
B-Bench Yoke Vise



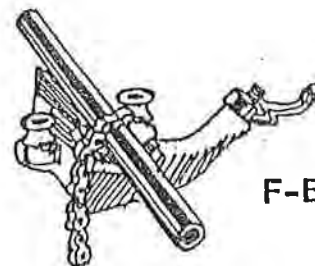
C-Portable Yoke Vise



D-Post Chain Vise



E-Portable Yoke Vise



F-Bench Chain Vise

Fig. 1 : Pipe Vises

VICES

BENCH VISE

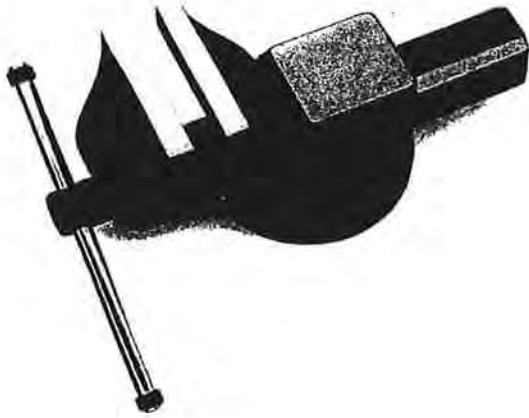


Figure 1

The Bench vise is designed for permanent attachment to a bench. It consists of two jaws, one stationary and one movable. Power for drawing the two vise jaws together is provided by a screw mating with threads in the stationary jaw. The handle fits through a hole in the screw shank. The base of this vise can be either stationary or have a swivel locking device to permit rotation. The wearing surfaces of the jaws are usually provided with replaceable hardened-steel inserts. These inserts may be serrated (grooved) for greater gripping power. The bench vise is not designed for use with pipe.

This bench vise is used to hold items with flat surfaces. It has parallel jaws that are designed to hold the work securely. Care must be taken when opening a bench vise, because if opened to far, the movable jaw will fall off and possibly cause damage to the vise or equipment and it may cause an injury.

UTILITY VISE

A more versatile model of the bench vise is sometimes called the utility vise. It has a set of pipe jaws located below the regular jaws for gripping round material, and a small anvil located on the back side of the solid jaw.



Figure 2

UTILITY VISE (continued)

The utility/bench vise also has some soft metal jaw covers that can be used to prevent scratching the surface of the work. When tightening the jaws on a piece of work use only enough force to hold the work, but not tight enough to damage the work. Generally the soft jaw covers should be used to hold objects softer than the permanent fixed and movable jaws.

Before each use, a bench or utility vise should be inspected for any defects and that it is in good working condition. The screw and slide of the vise should be lubricated from time to time. Normally, a light coat of grease keeps the vise moving smoothly.

PIPE VISE

The Pipe Vise is especially devised for handling pipe and other round materials. The principal parts of a pipe vise are a base including a solid jaw, a yoke including a movable jaw with an adjusting screw, and a handle. The screw is mounted vertically in the yoke and operates so that the moveable jaw moves downward for clamping. The v-shaped jaws are hardened and tempered and are removable for dressing or replacement. The yoke is hinged so that it can be swung out of the way when long pipe is inserted.

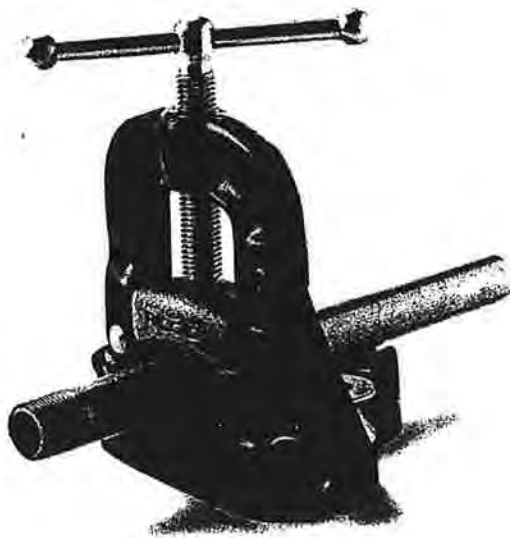


Figure 3

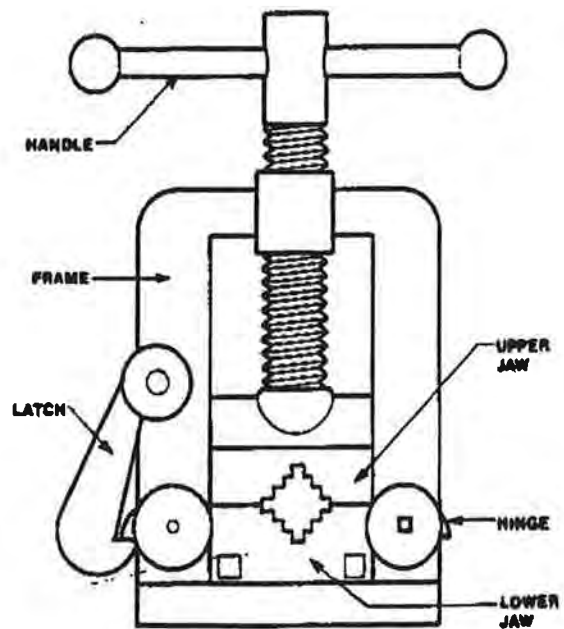
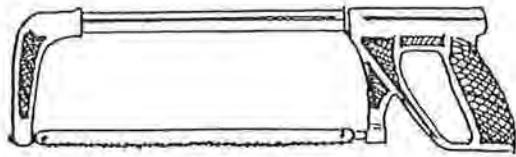
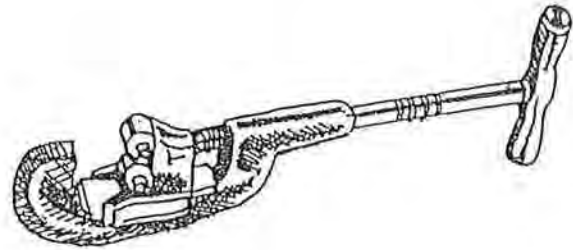


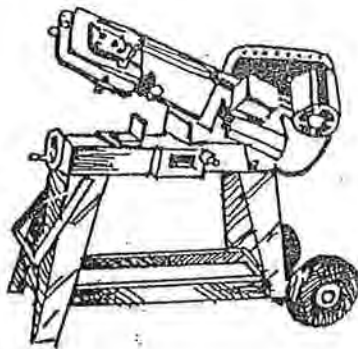
Figure 4



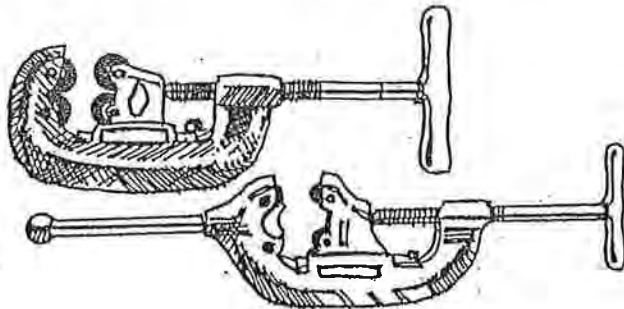
A-Adjustable For 10" And 12" Blades



C-Heavy Duty Pipe Cutters



B-Powered Band Saw



D-Heavy Duty 4-Wheel Pipe Cutter



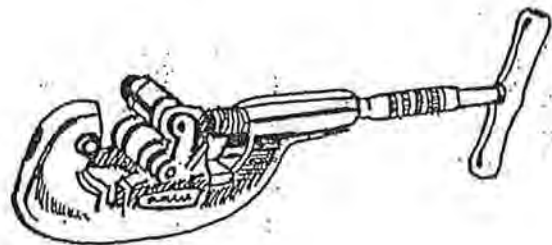
**Wheel For
Cast Iron
Pipe**



**Standard
Thin Wheel**



**Heavy Duty
Wheel**



E-Wide-Roll Pipe Cutters

Fig. 2 Pipe Cutting Tools

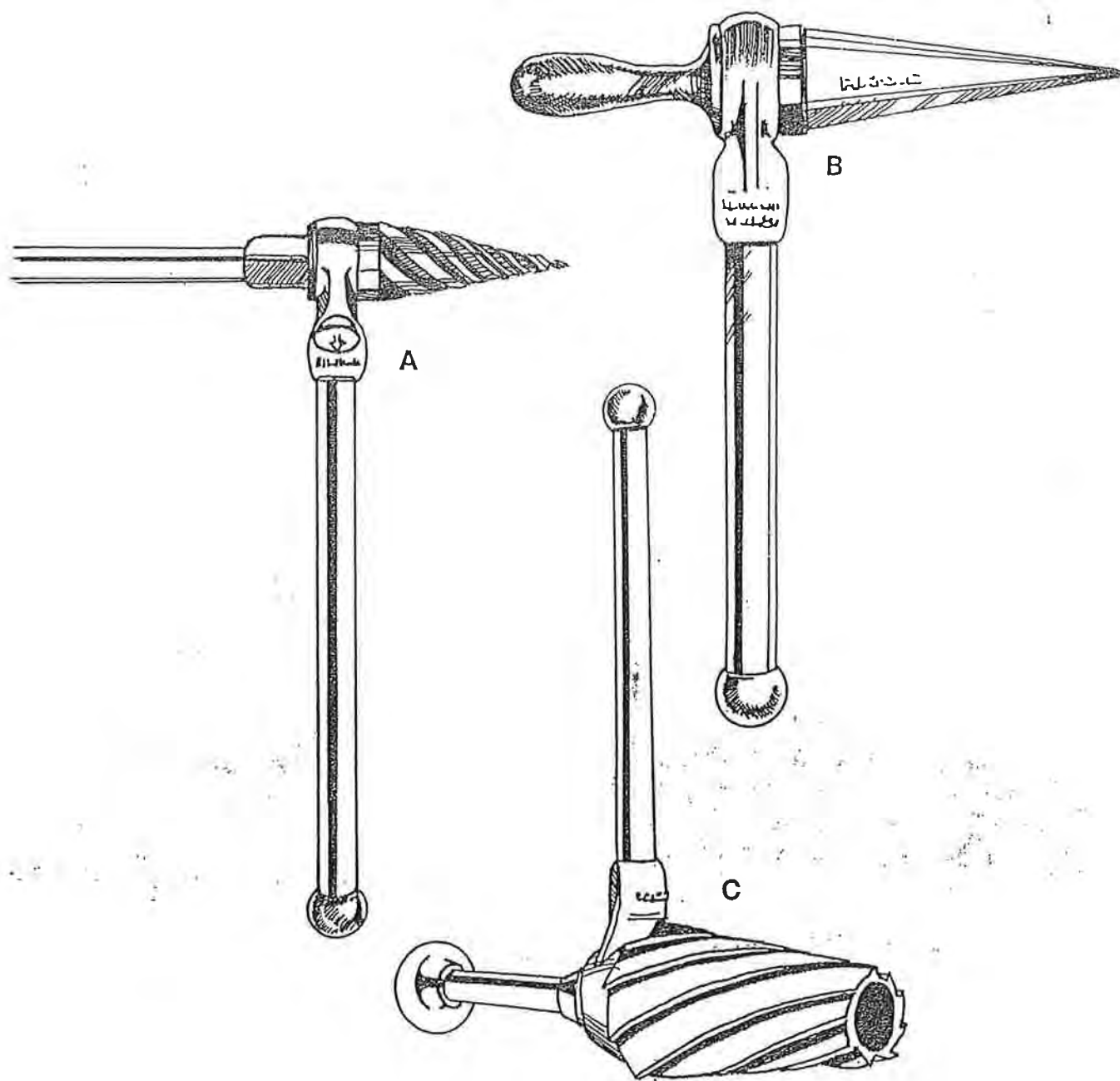


Fig. 4 Pipe Reamers

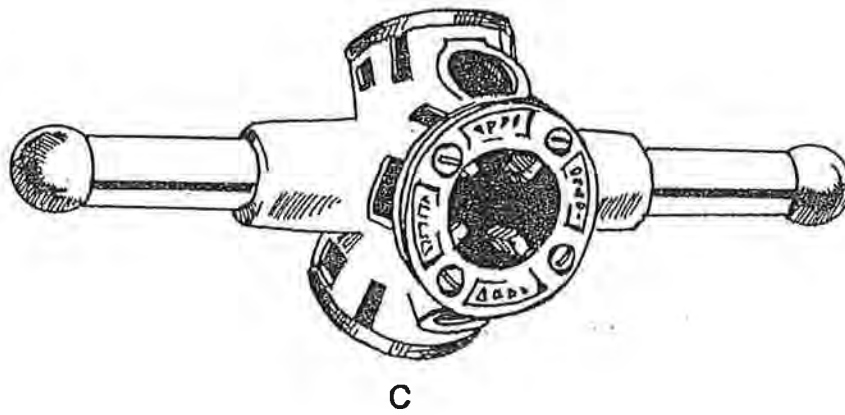
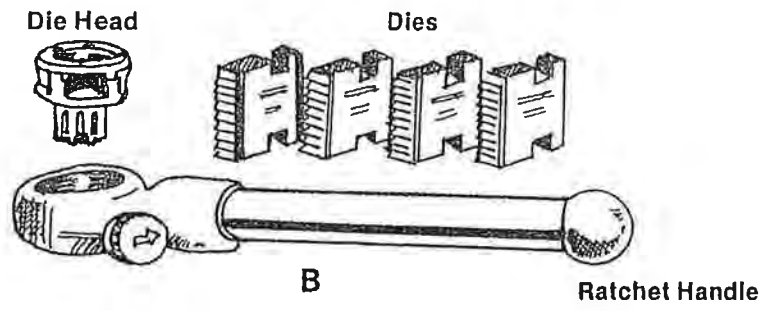
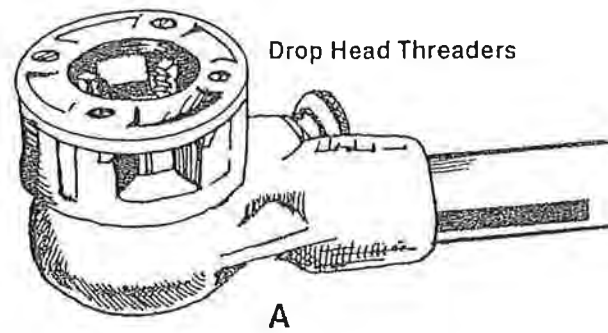
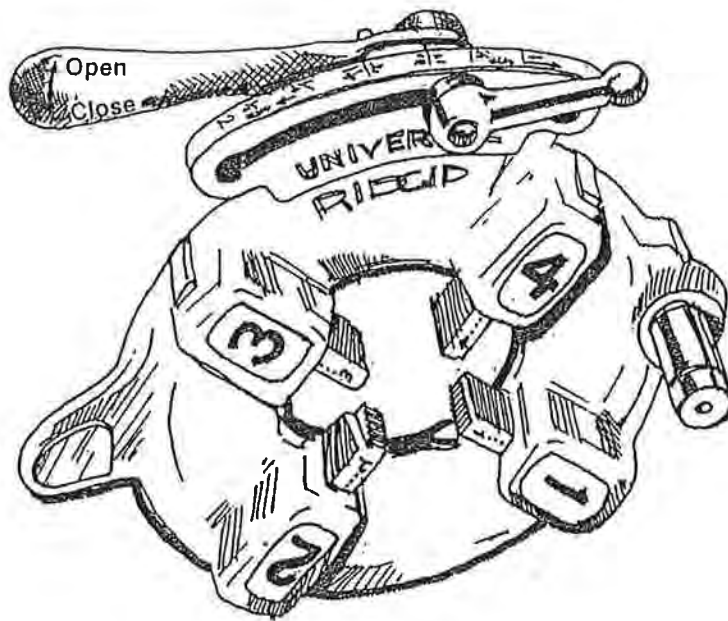
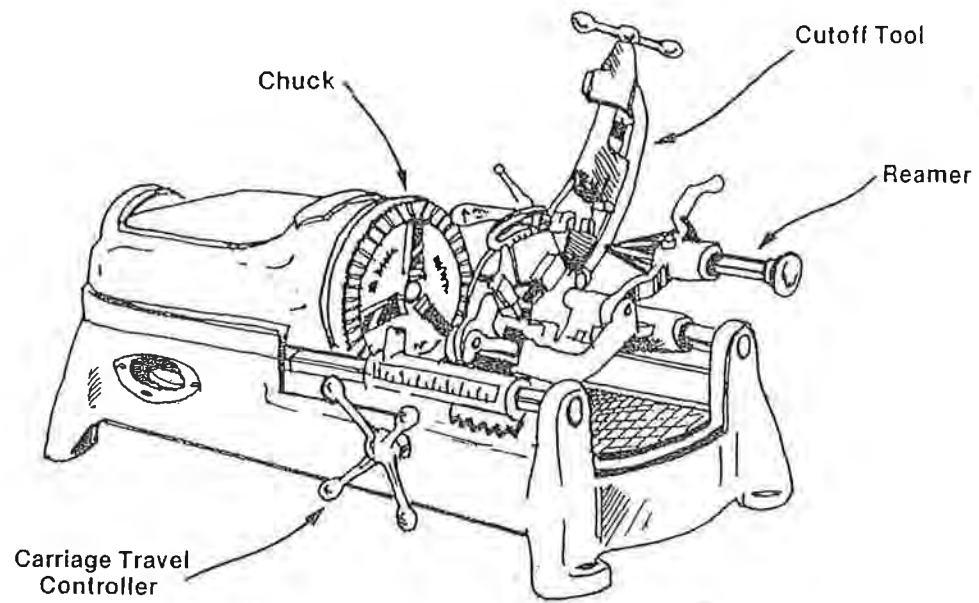
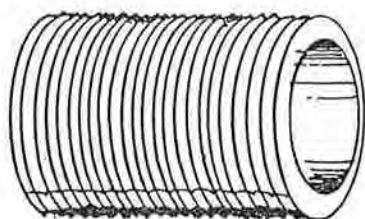


Fig. 5 Pipe Threading Hand Tools

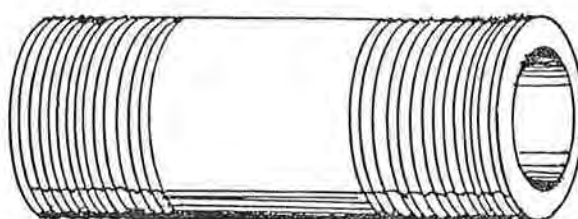


Die Head

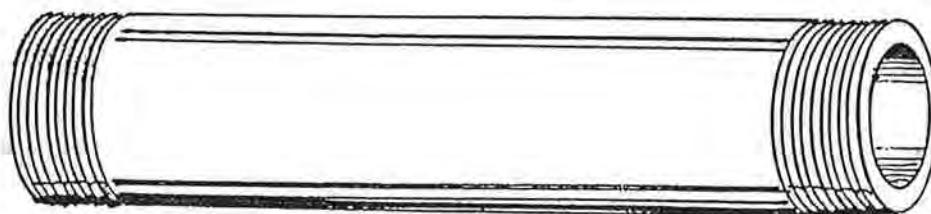
Fig. 6 Pipe Threading Machine



Close



Short
Or Shoulder



Long

RECOMMENDATIONS FOR USAGE OF TEFLON® THREAD COMPOUND AND TEFLON® TAPE

For proper assembly and thread sealing, certain precautions must be taken.

TEFLON® THREAD COMPOUND

1. Clean threads.
2. Apply compound evenly and spread thoroughly over threads.
3. Assemble parts and tighten.

TEFLON® TAPE

1. Clean threads.
2. Apply three layers to outside threads only, stretching tape to conform with contour of threads and extending beyond the first thread at end of pipe.
3. Assemble parts and tighten, being careful not to overtighten. Teflon® tape is not a lubricant. Certain precautions must be taken to prevent thread galling.

Teflon Tape

Premium Teflon Tapes 1/2" Width			
 <p>Packed 100 rolls per carton. Assorted sizes.</p>		Part Number	Size x Length
		TT50 260	1/2" x 260"
		TT50 520	1/2" x 520"
		TT50 1296	1/2" x 1296"
		TT75 260	3/4" x 260"
		TT75 520	3/4" x 520"
		TT100 520	1" x 520"
		TT50 260SS	1/2" x 260"
		TT50 260Y	1/2" x 260"
		TT50 260G	1/2" x 260"
		TT50 260P	1/2" x 260"

TT50 260SS GRAY STAINLESS STEEL TEFLON-THREAD SEAL TAPE

This tape has nickel pigment color added for use on all stainless steel fittings. Prevents galling, seizing or corrosion. A high density rating, this is the tape for coarse stainless steel threads. Also carries a temperature range of -450F to +550F. Exceeds Mil. Spec. T-27730A. UL Listed

TT50 260Y YELLOW GAS LINE TEFLON THREAD SEAL TAPE

Designed for gas lines of all types... Natural gas, propane and butane lines. Meets gas company standards world wide. Full density (1.6) makes this the heaviest tape available. Seals threads easily and quickly with confidence. Has a temperature range of -450F to +550F. Exceeds Mil. Spec. T-27730A UL Listed

TT50 260G GREEN OXYGEN TEFLON THREAD SEAL TAPE

Color coded green for oxygen applications. Grease free, density of 1.2. This is the tape for all your oxygen lines. Will not support combustion. Temperature range of -450F to +550F. Exceeds Mil. Spec. T-27730A UL Listed

TT50 260P PINK PLUMBERS TEFLON THREAD SEAL TAPE

For plumbers and pipe fitters. Colors coded pink to signify this is heavier than standard white thread seal tapes. A premium high density tape. Ensures leak free joints. Temperature range of -450F to +550F. Exceeds Mil Spec. T-27730A UL Listed

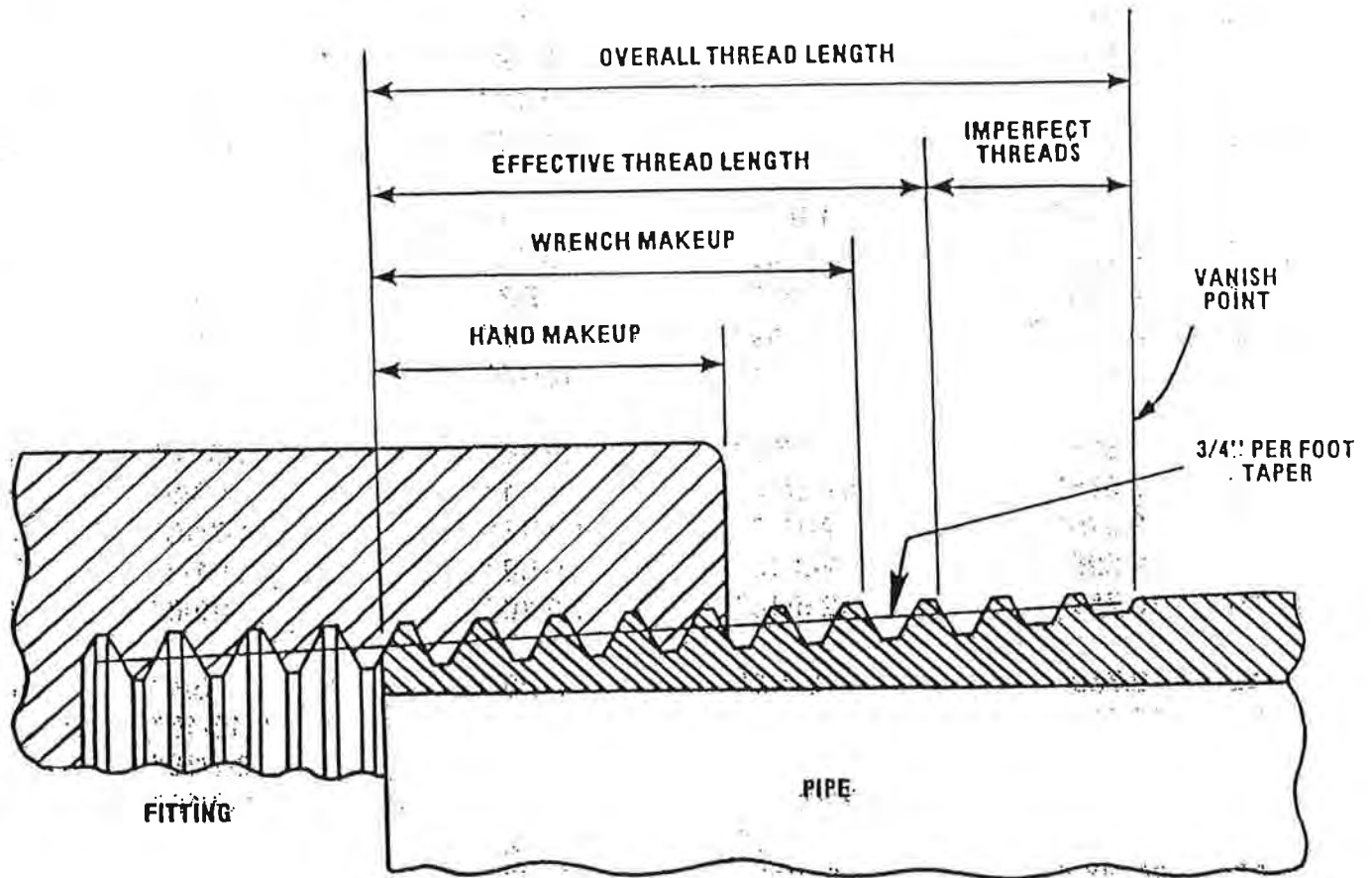


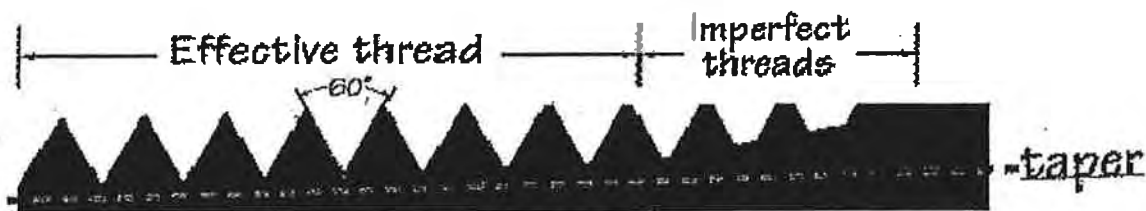
Fig. PO11.1 Pipe Threads

pipe threads

Pipe thread sizes are described much as bolt sizes are, although the shapes are different. For example, "½-14 NPT" identifies a pipe thread with a nominal inside diameter of ½ inch and 14 threads to the inch, made according to the NPT standard. If "LH" is added, the pipe has a left hand thread. In the United States, the pipe thread standards are:

- NPT American Standard Pipe Taper Thread
- NPSC American Standard Straight Coupling Pipe Thread
- NPTR American Standard Taper Railing Pipe Thread
- NPSM American Standard Straight Mechanical Pipe Thread
- NPSL American Standard Straight Locknut Pipe Thread

The word "taper" in several of these names points to the big difference between many pipe threads and those on bolts and screws. Many pipe threads must make not only a mechanical joint but also a leakproof one. To accomplish this, the threads become shallower the farther they are from the end of the pipe or fitting. The bottoms of the threads aren't on a cylinder, but a cone; they taper. The taper is $\frac{1}{16}$ inch in an inch, which is the same as $\frac{3}{4}$ inch in a foot.



Because of the taper, a pipe can only screw into a fitting a certain distance before it jams; unlike threading a nut on a bolt. The standard specifies this distance, the effective thread. It also specifies another distance, the engagement, the distance the pipe can be screwed in by hand, without much effort. For workers, instead of these distances, it is more convenient to know how many turns to make by hand and how many with a wrench.

The table shows the distances and number of turns called for in the standard. A tolerance of plus or minus one turn is allowed, and in practice threads are often routinely cut shorter than the standard specifies.

All dimensions are in inches.

American Standard Taper Pipe Threads (NPT)

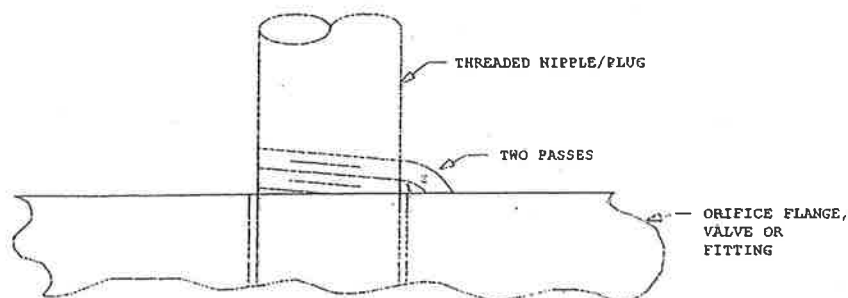
Nominal size (inside diameter)	Actual OD	Threads per inch	Length of engagement (tightened by hand)	Hand tight turns	Wrench makeup turns	Length of effective thread
1/16	0.3125	27	0.160			0.2611
1/8	0.405	27	0.180	4½	2½	0.260
¼	0.540	18	0.200	4	3	0.401
3/8	0.675	18	0.240	4½	3	0.408
½	0.840	14	0.320	4½	3	0.534
¾	1.050	14	0.340	4½	3	0.546
1	1.315	11.5	0.400	4½	3¼	0.682
1¼	1.660	11.5	0.420	4½	3¼	0.707
1½	1.900	11.5	0.420	4½	3¼	0.724
2	2.375	11.5	0.436	5	3	0.756
2½	2.875	8	0.682	5½	3	1.136
3	3.500	8	0.766	6	3	1.2000
3½	4.000	8	0.821	6½	3½	1.2500
4	4.500	8	0.844	6¾	3½	1.3000
5	5.563	8	0.937	7½	3¾	1.4063

The standard also defines larger pipes: every whole inch to 12 inches. At that point pipes begin to be sized by outside diameter instead of inside diameter: every inch from 14 to 20 inches OD, then every other inch to 30 inches OD.

PIPING GRAPHIC STANDARD

P19 - SEAL WELDING

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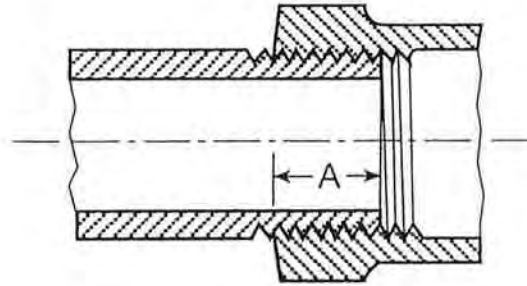
NOTES

1. SOCKET WELD CONNECTIONS ARE THE NORMAL AND PREFERRED SELECTION.
2. SEAL WELDING MAY BE USED FOR SEALING PLUG TO FITTING IN PLUGGED VENTS AND DRAINS AND FOR INSTRUMENT CONNECTIONS SPECIFIED IN ARCO INSTRUMENT STANDARDS.
3. ALL WELDING SHALL BE DONE USING AN ARCO APPROVED WELDING PROCEDURE FOR THE MATERIAL TO BE WELDED AND THE WELDING PROCESS TO BE USED.
4. IF COVERED ELECTRODES ARE USED, THE ELECTRODE DIAMETER SHALL PREFERABLY BE 3/32". IT SHALL NOT EXCEED 1/8".
5. CONNECTIONS TO BE SEAL WELDED SHALL BE DESIGNATED BY ENGINEERING.
6. THREADED CONNECTIONS TO BE SEAL WELDED SHALL BE MADE UP WITHOUT THE USE OF SEALING COMPOUNDS OR TEFLON TAPE. ALL CUTTING OILS SHALL BE REMOVED.
7. THE JOINT SHALL BE TIGHTENED TO FULL THREAD ENGAGEMENT. THE SEAL WELD SHALL COVER ALL EXPOSED THREADS OR 1/4" MINIMUM.
8. DO NOT SEAL WELD CAST IRON VALVES OR FITTINGS.
9. WHEN HEATING AND/OR WELDING VALVES, THE VALVE SEATS SHALL BE IN THE CLOSED POSITION AND BACKED OFF 2 HANDWHEEL TURNS.

REV.	DATE	DESCRIPTION	BY	CHK	APP.	DATE	DESCRIPTION	BY	CHK	APP.
ENGINEERING: VENTRA-TION			SEAL WELDING			ARCO Products Company				
AUTH.			PROJECT NO.			TOL. NO. ARCO DWG P 19 (10/90)				

LENGTH OF THREAD ON PIPE

LENGTH OF THREAD ON PIPE
THAT IS SCREWED INTO VALVES OR
FITTINGS TO MAKE A TIGHT JOINT



THREAD TAPER 1/16" PER INCH

PIPE SIZE	THREADS INCH	THREAD LENGTH	LENGTH "A"
$\frac{1}{8}$	27	$\frac{7}{16}$	$\frac{5}{16}$
$\frac{1}{4}$	18	$\frac{5}{8}$	$\frac{7}{16}$
$\frac{3}{8}$	18	$\frac{5}{8}$	$\frac{7}{16}$
$\frac{1}{2}$	14	$1\frac{13}{16}$	$\frac{9}{16}$
$\frac{3}{4}$	14	$1\frac{13}{16}$	$\frac{9}{16}$
1	$11\frac{1}{2}$	1	$1\frac{11}{16}$
$1\frac{1}{4}$	$11\frac{1}{2}$	1	$1\frac{11}{16}$
$1\frac{1}{2}$	$11\frac{1}{2}$	$1\frac{1}{32}$	$1\frac{11}{16}$
2	$11\frac{1}{2}$	$1\frac{1}{16}$	$\frac{3}{4}$
$2\frac{1}{2}$	8	$1\frac{9}{16}$	$1\frac{1}{16}$
3	8	$1\frac{5}{8}$	$1\frac{1}{8}$
4	8	$1\frac{3}{4}$	$1\frac{3}{16}$
6	8	$1\frac{15}{16}$	$1\frac{3}{8}$
8	8	$2\frac{3}{16}$	$1\frac{7}{16}$
10	8	$2\frac{3}{8}$	$1\frac{5}{8}$
12	8	$2\frac{9}{16}$	$1\frac{3}{4}$

