

- 19) Which of the following can help extend lengths where required?
- a) Grappling bar
 - b) Threaded rod and rod coupling
 - c) Coach-screw

2. Hand tools

Overview

Purpose

To enable the gas technician/fitter to choose the correct tool for the correct job. This will save time, money, and energy.

Objectives

At the end of this Chapter you will be able to:

- indicate the correct tools for the task;
- demonstrate how to use hand tools safely and efficiently; and
- identify tools the piping industry uses.

Terminology

Term	Abbreviation (symbol)	Definition
Millimetre	mm	Unit of length.

Requirements for using hand tools

It is very important for a gas technician/fitter to be able to identify and select the proper tool for the job at hand. It is also important to maintain and store tools properly and use them in a safe, effective way.

This section describes some of the general requirements for selecting, storing, maintaining, and using these tools.

The *Types of hand tools* section that follows describes many of the tools that the gas technician/fitter use, helping you to select the correct one for the job.

Selecting tools

When selecting the correct tool for a job, you must consider the following:

- design features (Find the right tool for the job!);
- the work space;
- the type of work that you must do;
- the materials that you must work on;
- the size(s) of the part(s);
- the types of fasteners you used;
- limits on the force that you may apply;
- safety; and
- speed and efficiency.

Using an inappropriate tool may damage the workpiece, ruin the tool, slow you down, or be completely ineffective. Also, as a gas technician/fitter, you must always consider your safety as well as of other workers.

Maintaining and storing tools

It is very important to maintain your tools in good order. Well maintained and properly stored tools are more effective, safer, and easier to use. They also have a longer working life, reducing replacement costs.

Maintenance

This improves their function and ensures their long working life. Good maintenance is mostly common sense, as follows:

- Keep tools that can rust dry.
- Protect the sharp edges of cutters, saw, and chisels when you lay them down.
- Handle fragile tools with care.
- Dry moisture-exposed tools and lightly oil them before putting them away.
- When tools have moving parts, lubricate them at points of wear.
- Tighten wooden handles on tools at the first sign of looseness.

Storage

Leaving tools lying about or jostling against others can pose risk of damage for the tools. Stealing or misuse of expensive tools is also possible if you do not keep them in a secure place.

Appropriate storage should:

- encase small or easily damaged tools;
- protect cutting edges and filing surfaces;
- accommodate the size and weight of the tool;
- prevent jostling or dropping of the tool;
- protect tools from the weather, dampness, and corrosive materials;
- keep tools secure against theft;
- prevent people who are unqualified to use the tools from getting injured; and
- keep tools clean.

Using tools safely

Careless handling or incorrect use of many of the tools that gas technicians/fitters use can be dangerous.

Before using a tool, do the following:

- 1) Use the prescribed safety clothing and equipment.
- 2) Check that you have the right tool for the job. Check the tool's function and size and the materials you are working on.
- 3) Check that the tool is in good order. All parts must be secure and cutting edges sharp.
- 4) Check the area for objects that might impede your or the tool's movement as you work.
- 5) Check that the work piece is held firmly in the proper position.
- 6) Stand or sit in the correct position for using the tool.

As you use the tool, make sure you follow proper procedures for that tool. Work safely to protect yourself, other workers, and the materials you are working on.

Types of hand tools

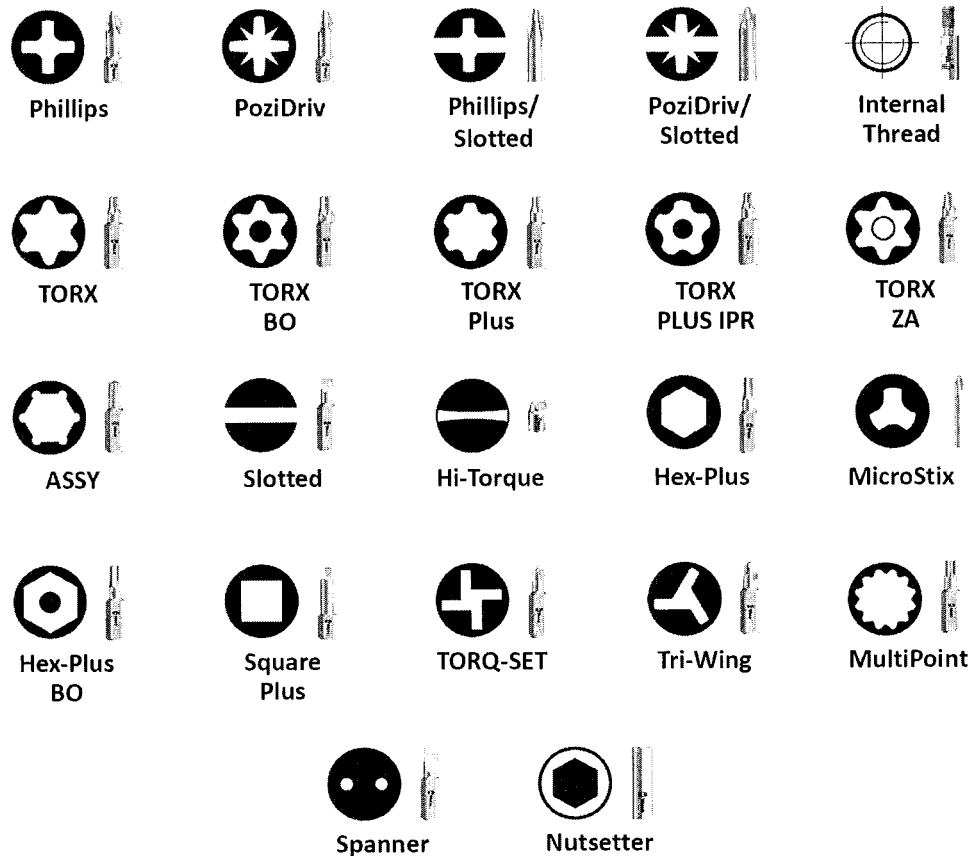
The use and understanding of hand tools is a must for the gas technician/fitter. There are tools for nearly every situation you can come across in the industry. It is important to be able to identify the tool you need.

General tools

Screwdrivers and Allen keys

Screwdrivers are available in many designs, sizes, and lengths. The most commonly used ones are the regular (straight blade), Phillips, and Robertson screwdrivers, and Allen keys. Figure 2-1 shows the tips they can have for various screw head shapes.

Figure 2-1
Screwdriver tips
 Image courtesy of Wera

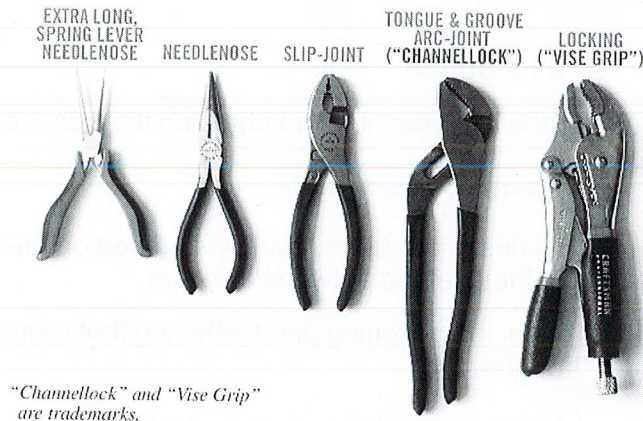


Pliers

Pliers help increase gripping power. The following three pliers are the most commonly used types in the piping trades:

- Arc-joint pliers come in various sizes with maximum capacities up to 4 in (100 mm). The tongue and groove design provide maximum power at all openings.
- Water pump pliers such as Tongue-and-groove pliers have a maximum capacity of 2 in (50 mm). The multiple slip joint setup provides for rapid changes of jaw opening.
- Combination pliers such as slip-joint pliers are easy to use for a multitude of tasks from opening spring-loaded hose clamps to bending metal. The jaws come with cutters for snipping wires.

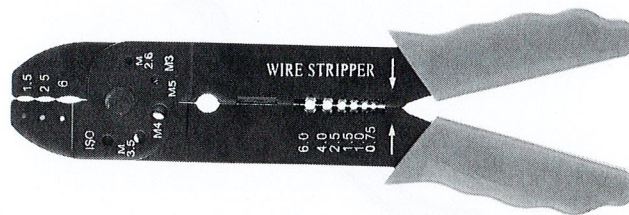
Figure 2-2
Pliers



Wire stripper

A wire stripper (or wire stripping pliers) is a tool that facilitates removal of insulation from electrical conductors. It usually has different hole sizes to accommodate removing insulation from wires of different gauges (Figure 2-3).

Figure 2-3
Wire stripper



Snips

Keep at least one pair of snips in your tool box to cut such things as sheet metal duct work, sheet metal piping, and hanger strapping or grappling bar. Never use snips to cut wire (it nicks the blades). Figure 2-4 shows three common types:

Figure 2-4
Snips



Wrenches

There are two main types of wrenches:

Type	See	Description
Open-ended wrench	Figure 2-5	<p>Ideal for loosening or tightening that requires very little torque.</p> <p>Mostly double-ended.</p> <p>Its designated size, usually stamped on the side, is the fixed size of the opening between the jaws.</p>
Box wrench	Figure 2-6	<p>Ideal for loosening and tightening that require a high amount of torque.</p> <p>Surrounds or “boxes” the bolt head or nut.</p> <p>The box head circular opening usually has 6 or 12 notches (points). It is safer than the open-ended wrench because it is less likely to slip. It is good for working in close quarters because you can take as little as 1/12 turn with this at one stroke.</p>

Figure 2-5
Open-ended wrench

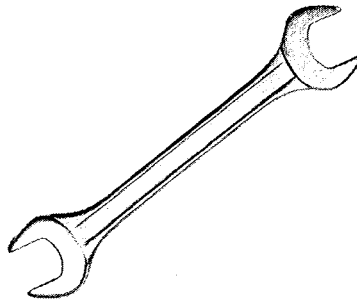
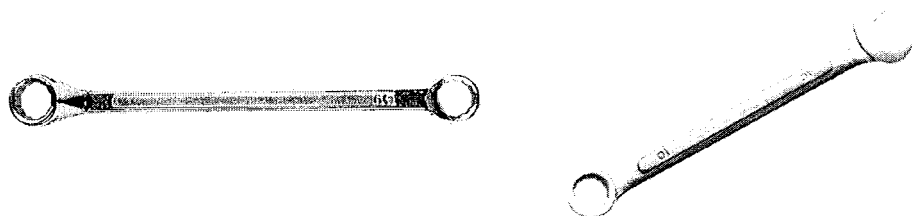


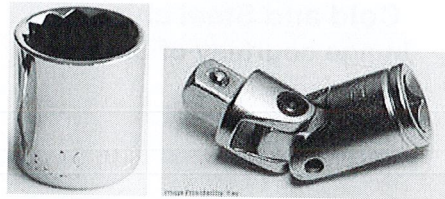
Figure 2-6
Box wrench and combination wrench



Socket drives

The common socket drive (Figure 2-7) is like a box wrench, but is a detachable socket that the gas technician/fitter must use on various handles. A set usually contains various size sockets (1/4 in to 3/4 in) or (10 mm to 19 mm) and a ratchet.

Figure 2-7
Socket drives



Chisels

Chisels work on wood or on steel. For good workmanship, you must keep them ground and sharpened. Ensure that you use eye protection when chiseling to protect your eyes from flying particles.

Steel chisels

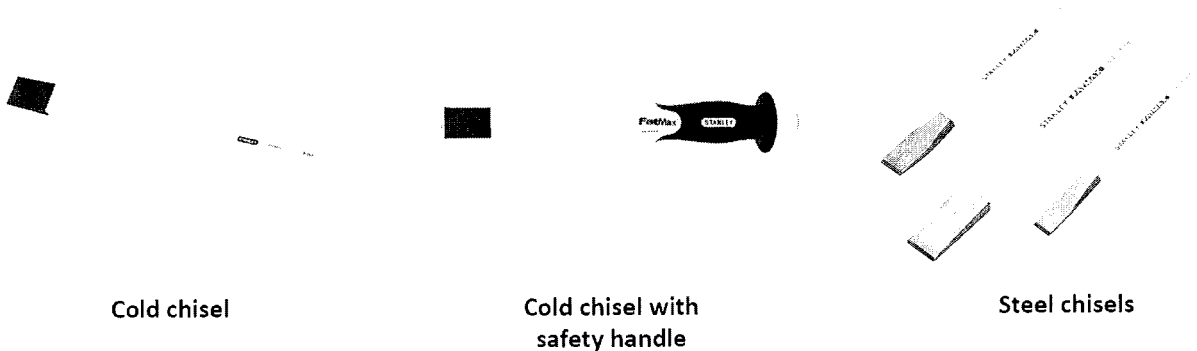
Steel chisels have various shapes for different jobs:

Type	Description
Flat, cold chisel Figure 2-8	<p>The most common type and has a flat, wide cutting face for cutting or chipping metal or concrete.</p> <p>Some applications are cutting thin plate, shearing off rivet or bolt heads, and removing weld spots. It is very useful when dismantling equipment with corroded or seized components such as brackets. Its cutting edge is ground axially along the chisel. The included angle of the cutting face is 70°.</p>
Cape chisel	<p>Has a relatively small point.</p> <p>It cuts keyways or slots in metal and facilitates dividing work so you can use a cold chisel to finish the job.</p>
Round nose chisel	<p>Has its cutting-edge ground at 60° to the main axis.</p> <p>One edge is ground flat and the other round.</p>
Diamond point chisel	Has a solid point that can help cut V-grooves, draw holes, and holes in flat stock.

Figure 2-8
Flat, cold, steel chisel



Figure 2-9
Cold and Steel chisels
Image courtesy of DeWalt

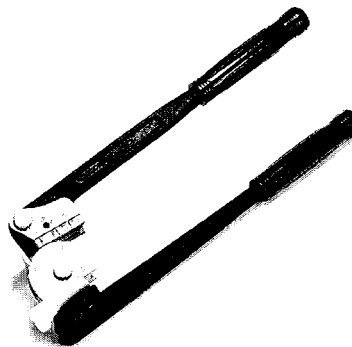


Tubing benders

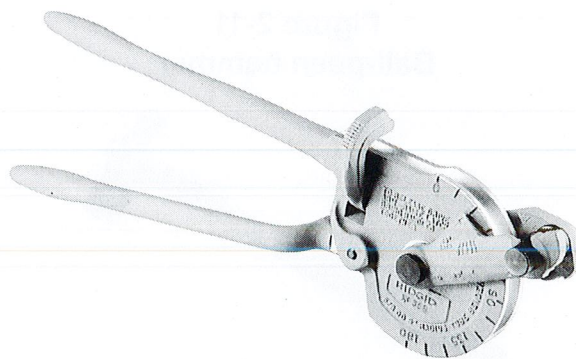
There are several types of tubing benders, but they operate similarly for bending tubing up to 3/4 in diameter. The three most common types are lever, geared-ratchet, and outside-spring (Figure 2-10).

Tube bending kits (Figure 2-10d) that are available have a number of different size heads and a range of tube sizes to meet the needs of gas technicians/fitters.

Figure 2-10
Tubing benders
Image courtesy of RIDGID®; RIDGID® is the registered trademark of the Ridge Tool Company.



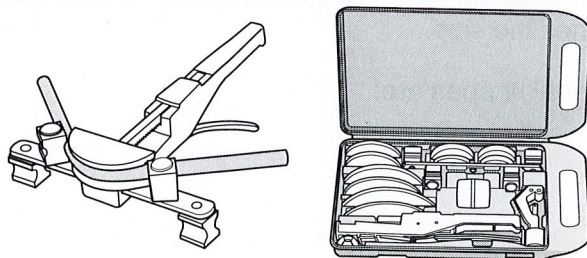
(a) Lever



(b) Geared ratchet



(c) Outside spring



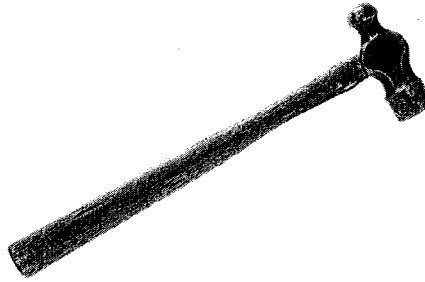
(d) Tube-bending kit

Hammers

Head weight (weight without the handle) characterizes hammers. The gas technicians/fitters kit includes two basic types of hammers :

Type	Description
Ball-peen hammer Figure 2-11	<p>May have weight of 0.11, 0.17, 0.23, 0.34, 0.5, 0.75, or 1 kg.</p> <p>The round-shaped part of the head helps shape metal.</p> <p>The face is slightly domed so that it does not leave marks on struck metal. You can also use it to strike punches.</p>
Claw hammer	<p>Its main uses are drawing, pulling, and driving nails.</p> <p>It has a steel head with a wood or steel handle.</p>

Figure 2-11
Ball-peen hammer



Files

Files help smooth and shape parts by hand. They are made of heat-treated, high-carbon steel. This steel is hard and ensures an effective cutting surface, but it is brittle. Because of this, files may break if used to pry objects.

In use, the file becomes clogged—this is called pinning. It can then scratch the workpiece. To prevent pinning, rub chalk into the teeth before filing. Use a file scorer or brush to clean the file.

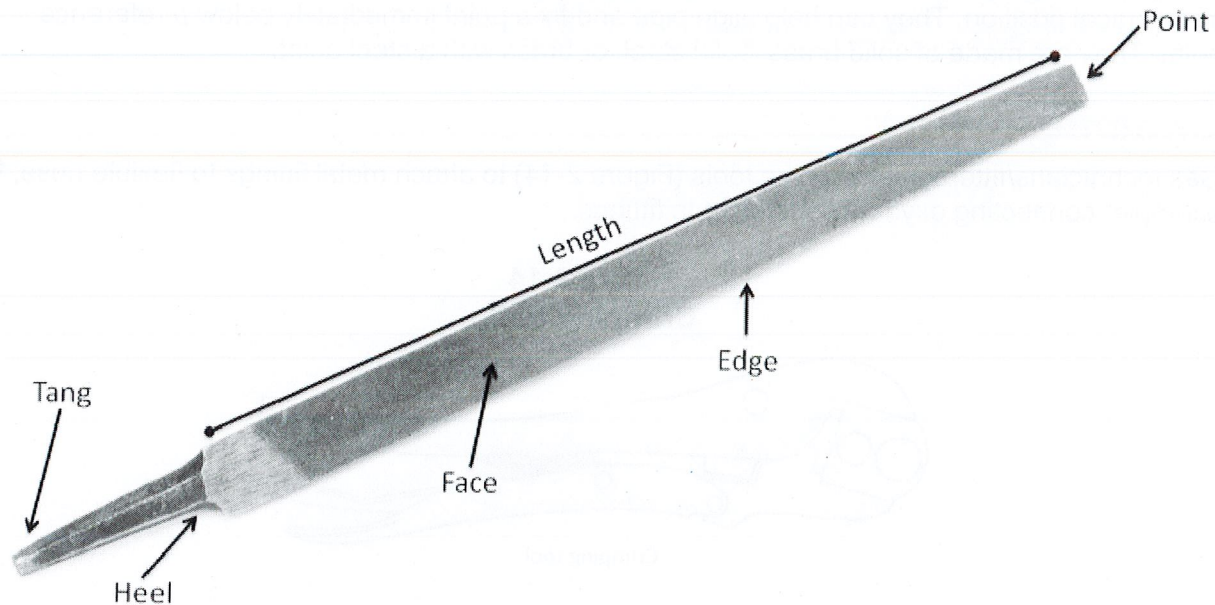
Files are available in various shapes, sizes, and coarseness. The length from the heel to the point (Figure 2-12) determines the size.

Some common cross-sectional shapes are:

- flat (mill);
- square;
- triangular (three-square);
- half-round; and
- round (rat tail).

To protect the filing surfaces, store files in a cardboard sleeve.

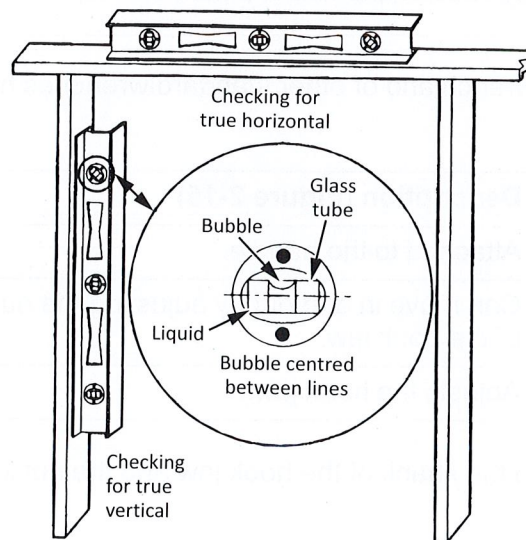
Figure 2-12
Parts of a file



Spirit levels

Spirit levels (Figure 2-13) helps ensure that objects are plumb, level, or have the proper grade. Their sizes range from a few inches to several feet in length. They are most often made from die-cast aluminum.

Figure 2-13
Using a spirit level



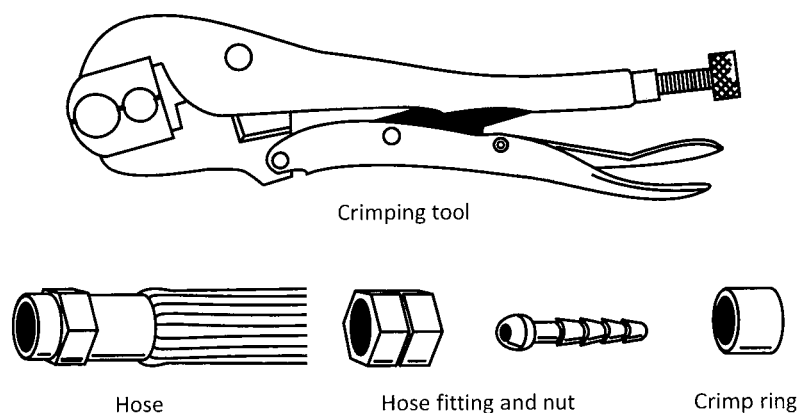
Plumb bobs

Plumb bobs are heavy, balanced, pointed weights suspended from a strong cord to determine a true vertical position. They can help align pipe and fix a point immediately below a reference point. They are made of solid brass, solid steel, or brass with a steel point.

Crimping tools

Gas technicians/fitters use crimping tools (Figure 2-14) to attach metal fittings to flexible hose, for example, connecting oxyacetylene hose to fittings.

Figure 2-14
Crimping tool



Pipe wrenches

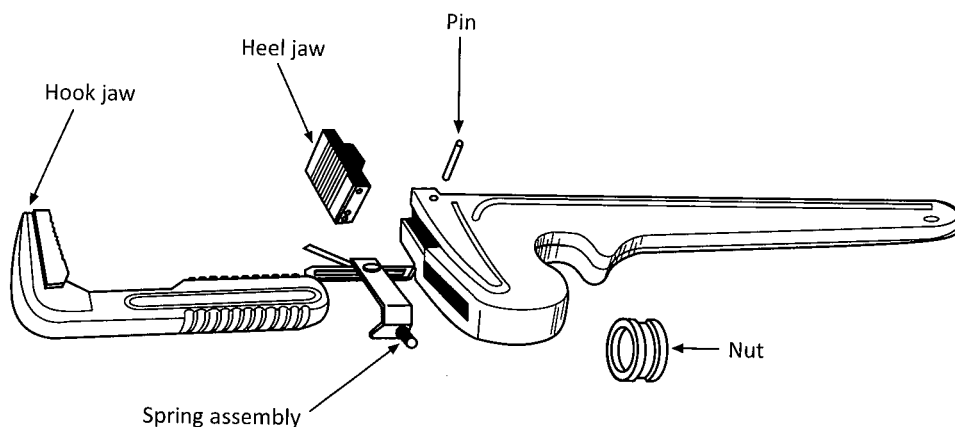
Gas technicians/fitters use various wrenches for gripping and turning pipe and fittings. The type of wrench selected for a job depends on pipe size, pipe material, and the amount of working space available.

The jaws of the straight pipe wrench and of other standard wrenches have teeth for gripping round objects.

Pipe wrench part	Description (Figure 2-15)
Heel jaw	Attached to the handle.
Hook jaw	Can move in and out by adjusting the nut on the threaded section of the hook jaw.
Nut	Adjusts the hook jaw.

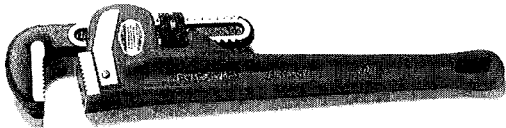
The wrench housing hold both the shank of the hook jaw and the nut in position.

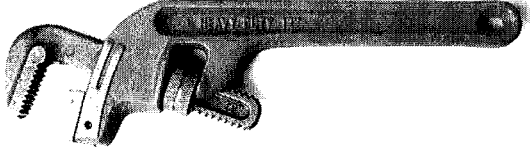
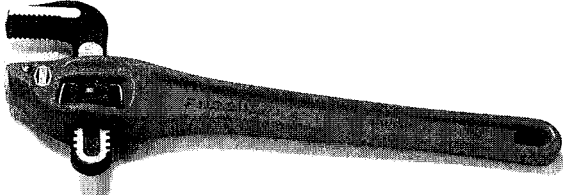
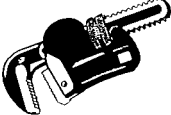
Figure 2-15
Parts of a pipe wrench



Standard pipe wrenches

The types of standard pipe wrenches are:

Type	Description	Size and pipe capacity
Straight pipe wrench (Figure 2-16)	<p>Available in ten models, each designed for a certain range of pipe sizes.</p> <p>The length of pipe wrenches designate their sizes.</p> <p>Like the other standard wrenches shown here, this wrench comes with either an aluminum or cast-iron handle.</p> <p>Figure 2-16 Straight pipe wrench Image courtesy of RIDGID®; RIDGID® is the registered trademark of the Ridge Tool Company.</p> 	<p>Available in ten models.</p> <p>The smallest is 6 in (150 mm) long and has a pipe capacity of NPS 3/4.</p> <p>The largest is 60 in (1500 mm) long for use on larger sizes to NPS 8 pipe.</p>

Type	Description	Size and pipe capacity
End pipe wrench (Figure 2-17)	<p>Has an angled opening.</p> <p>You use this when working in tight quarters or next to a wall or a corner.</p> <p style="text-align: center;">Figure 2-17 End pipe wrench</p> 	<p>Made in eight sizes.</p> <p>Pipe capacity ranging from NPS 3/4 to NPS 5 in.</p>
Heavy-duty offset pipe wrench (Figure 2-18)	<p>Has a jaw opening parallel to the handle and a narrower hook jaw head.</p> <p>These features allow easy entry to tight spots.</p> <p style="text-align: center;">Figure 2-18 Heavy-duty offset wrench Image courtesy of RIDGID®; RIDGID® is the registered trademark of the Ridge Tool Company.</p> 	<p>Several models are available in the market.</p> <p>Pipe capacities of NPS 2, NPS 2-1/2, and NPS 3.</p>
Vertical pipe wrench (Figure 2-19)	<p>You can use this on either vertical or horizontal pipe in closely confined areas.</p> <p>It is especially useful for underground valve locations.</p> <p style="text-align: center;">Figure 2-19 Vertical pipe wrench</p> 	<p>Pipe capacity is NPS 2.</p>

Hexagonal wrenches

The hexagonal wrench (Figure 2-20) may have either of these two designs:

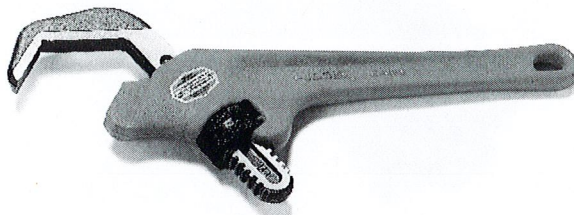
- straight; or
- offset.

Both types give a multi-sided grip, but the main difference between the two is the extra-wide opening of the offset.

Figure 2-20

Hexagonal wrench

Image courtesy of RIDGID®; RIDGID® is the registered trademark of the Ridge Tool Company.



Adjustable wrenches

Adjustable wrenches (Figure 2-21) have a thin adjustable head for working in close quarters and are useful for tightening or loosening nuts and bolts on flanged fittings and valves. There are over a dozen models and jaw openings ranging from 1/2 in to 2-1/2 in (12 mm to 60 mm).

Figure 2-21

Adjustable hexagonal wrench



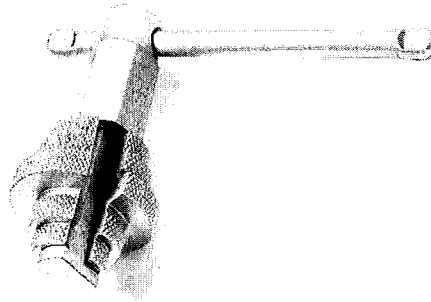
Internal wrenches

The internal wrench (Figure 2-22) holds pipes, nipples, and fixture connections in place from the inside while a gas technician/fitter tightens down a nut. The knurled head is reversible to handle sizes from 1 in to 2 in.

Figure 2-22

Internal wrench

Image courtesy of RIDGID®; RIDGID® is the registered trademark of the Ridge Tool Company.



Cutting tools

Pipe cutters

Pipe cutting is done either by hand or with power tools. Cutters are available in a number of designs and sizes. Their use depends on the size and material of the pipe you cut and the situation under which you carry out the cutting operation.

Cutting the end of the pipe squarely is very important if you need to thread the pipe. The correctly selected cutter does the best job quickly and accurately. You should never use a hacksaw to cut pipe, because it could not cut the pipe squarely and the result may be badly cut threads and broken dies.

Most pipe cutters (Figure 2-23) have a hook-shaped frame with a cutter wheel at the end. A sliding housing containing two rollers that hold the pipe in position against the wheel is mounted on the stem of the hook. A screw that is tightened as the tool rotates around the pipe moves the sliding housing, forcing the cutter wheel into the pipe. The rollers tend to roll down the external burr raised on the pipe as the cutter wheel moves the metal.