



CARSON REFINERY

LEARNING & DEVELOPMENT

PRESENTS

MODULE: LAD-OFS-042

HAND TOOLS

A LEARNING TOOL FOR
ENHANCED SAFETY KNOWLEDGE & SKILLS
OF CRAFTSPERSONS AND PROCESS OPERATORS

PROPRIETARY INFORMATION
TO BE MAINTAINED IN CONFIDENCE

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Prerequisites: Prior to beginning study on this module, the student must have completed the Carson Refinery HSSE Overview Training.

Overview: In this module, the safe work practices regarding commonly used hand tools will be discussed. Each student must:

- Read and study the materials as presented.
- Complete the “Self-Study” questions.
- Check the answers to the “Self-Study” questions. Ask the instructor for assistance on any questions that were missed.
- Complete an ONLINE test after completing the four modules.
- Complete a “Performance Evaluation” with an instructor.
- Complete a “Participant Feedback” form (optional) and, when completed, send it to your Training Coordinator or the Learning & Development Office at Carson One.

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Performance Objectives: Upon completion of this learning module, all students will, with 100% accuracy, according to the module:

1. Given a specific job task in their operating area requiring at least eight different hand tools:
 - A) Select the necessary hand tools for the task..
 - B) Demonstrate to the instructor the specified procedures to use the selected tools safely.
2. Upon completion of the specified task, clean the tools and return them to the proper storage location.

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LEARNING OBJECTIVES

As a result of this training the student will, with 100% accuracy, according to the information presented in this learning module:

1. Given a simplified diagram, identify the following tools:
 - A) Vise
 - a) Bench vise
 - b) Utility vise
 - c) Pipe vise
 - B) Grease gun
 - C) C-Clamp
 - D) Screwdrivers
 - a) Flat blade
 - b) Phillips-type
 - c) Offset
 - E) Hammers
 - a) Ball-peen
 - b) Soft-face
 - c) Mallets
 - d) Sledge hammers
 - e) Non-sparking
 - F) Wrenches
 - a) Box-end wrench
 - b) Open-end wrench
 - c) Adjustable wrench
 - d) Spud wrench
 - e) Pipe wrench
 - f) Striking wrench
 - g) Strap wrench
 - h) Allen wrench
 - i) Spanner wrench
 - j) Face pin wrench
 - k) Valve wrench
 - A) Sockets
 - a) Socket set
 - b) Ratchet
 - c) Breaker bar
 - d) Extension bar
 - e) Universal-joint
 - f) Adapters
 - B) Pliers
 - a) Adjustable
 - b) Needle nose
 - c) Vise-grip
 - d) End-nippers
 - C) Hacksaw
 - D) Chisels
 - a) Cold chisel
 - b) Cape chisel
 - c) Diamond point
 - d) Round nose
 - E) Pipe taps
 - F) Files
 - a) Flat file
 - b) Round file
 - c) Half-round
 - d) Three cornered
 - G) Wedges
 - H) Pipe cutters
 - I) Packing hooks
 - J) Wire brush
 - K) Crow bar
 - L) Drift pin
 - M) Steel square
 - N) Level
 - O) Butcher knife

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LEARNING OBJECTIVES

As a result of this training the student will, with 100% accuracy, according to the information presented in this learning module:

2. List the types of vices and state the function of each.
3. State the function of a grease gun.
4. State the function of a C-Clamp.
5. List the types of screwdrivers and state the function of each.
6. Identify the general rules associated with the safe use of hammers.
7. List the types of hammers and state the function of each.
8. List the types of wrenches discussed in the text and state the function of each.
9. Recognize the difference between an adjustable and non-adjustable wrench.
10. State the rules for safe use of adjustable wrenches and the rules for safe use of a pipe wrench.
11. Identify each of the following, state it's function, and list the steps necessary for safe use
 - A) Socket set
 - B) Ratchet
 - C) Breaker bar
 - D) Extension bar
 - E) Universal-joint
 - F) Adapters
12. List the types of pliers and state the function of each type.
13. Given a hacksaw, state it's function and list the procedural steps to safely:
 - A) Change out the blade.
 - B) Cut a piece of metal.

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LEARNING OBJECTIVES

As a result of this training the student will, with 100% accuracy, according to the information presented in this learning module:

14. Identify a chisel and state it's purpose.
15. List the steps necessary to safely use a chisel along with restoring the head and sharpening the instrument.
16. State the function of pipe taps.
17. List the steps necessary to safely use pipe taps along with the precautions that must be observed.
18. List the types of files, state the function of each, and state the rules for safe use.
19. Identify each of the following, state it's function, and list the steps necessary for safe use:
 - A) Wedge
 - B) Pipe cutters
 - C) Packing hooks
 - D) Wire brush
 - E) Crow bar
 - F) Drift pin
 - G) Steel square
 - H) Level
 - I) Butcher Knife

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INTRODUCTION:

At BP Carson Refinery, the employee must be able to use an assortment of hand tools in order to perform his/her everyday job tasks¹. Hand tools are a valuable asset that can make an Employees job easier if used safely and effectively.

Many of the tools seen in this module will already be familiar to you. Check your habits to be sure you use the tools properly and safely. Using hand tools requires skill with your hands and good judgment in choosing a tool for the job. These skills come with experience, and your experience will be increased by your full participation in this training module.

LEARNING ACTIVITIES:

The hand tools that will be discussed in this module may be used by the Craftsperson or Process Operator in everyday job tasks. The module will demonstrate how to use the tools safely and properly; pay particular attention to the safe practices that are mentioned. Following are the tools that will be covered in this module:

1. Vices
 - A) Bench vise
 - B) Utility vise
 - C) Pipe vise
 2. Grease gun
 3. C-Clamp
 4. Screwdrivers
 - A) Flat blade
 - B) Phillips-type
 - C) Offset
 5. Hammers
 - A) Ball-peen
 - B) Soft-face
 - C) Mallets
 - D) Sledge hammers
 - E) Non-sparking hammers
 6. Wrenches
 - A) Box-end wrench
 - B) Open-end wrench
 - C) Adjustable wrench
 - D) Spud wrench
 - E) Pipe wrench
 - F) Striking wrench
 - G) Strap wrench
 - H) Allen wrench
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 - J) Face pin wrench
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7. Sockets
 - A) Socket set
 - B) Ratchet
 - C) Breaker bar
 - D) Extension bar
 - E) Universal-joint
 - F) Adapters
 8. Pliers
 - A) Adjustable
 - B) Needle nose
 - C) Vise-grip
 - D) End-nippers
 9. Hacksaw
 10. Chisels
 - A) Cold chisel
 - B) Cape chisel
 - C) Diamond point
 - D) Round nose
 11. Pipe taps
 12. Files
 - A) Flat file
 - B) Round file
 - C) Half-round
 - D) Three cornered
 13. Wedge
 14. Pipe cutters
 15. Packing hooks
 16. Wire brush
 17. Crow bar
 18. Drift pin
 19. Steel square
 20. Level
 21. Butcher knife

¹ Although other tools are described in this module, Operators in the Refinery Site should only use tools as specified by Mediation Settlement Agreement #96 - 74

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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.

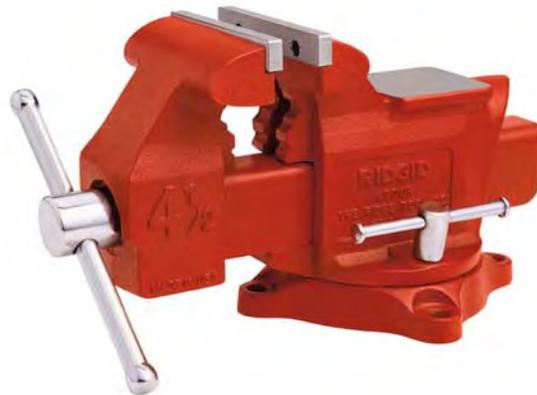


Figure 2

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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

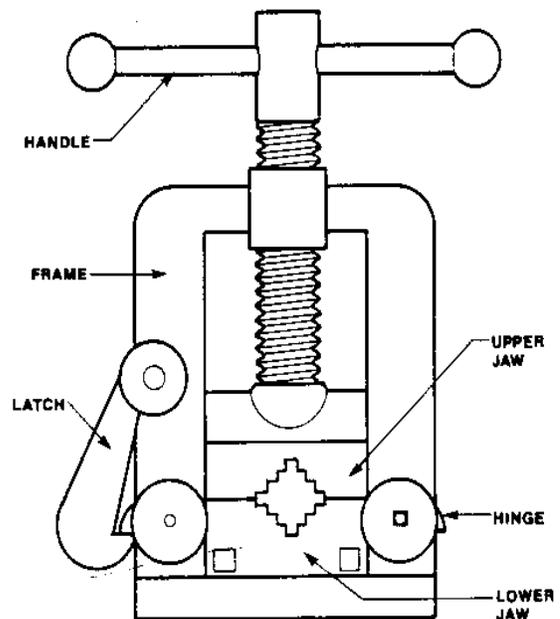


Figure 4

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CARE AND USE OF VISES

Listed below are a number of rules pertaining to the care and use of vises which apply to all types of vises:

1. Keep the screw threads clean and well lubricated.
2. Keep the gripping teeth of the vise clean at all times.
3. Do not attempt to attain additional leverage on a vise handle by the use of an extension.
4. Do not attempt to bend pipe in the jaws of a pipe vise.
5. Use soft metal caps on the jaws of bench vises when they are used to grip finished surfaces.
6. Always hammer toward the stationary jaws of any vise.

GREASE GUN

Lever grease guns can deliver a maximum pressure of 10,000 PSI. The unit is spring primed and equipped with a check valve, an air-bleed valve and a special loader fitting. The gun will operate with partial lever strokes for use in close quarters.

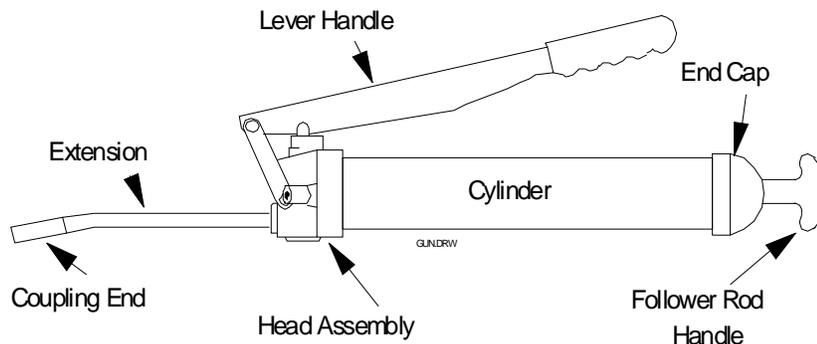


Figure 5

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GREASE GUN (Continued)

CARTRIDGE LOADING

1. Separate head assembly from cylinder.
2. Pull follower rod out and engage groove on follower rod with offset hole in end cap.
3. Remove cap from end of cartridge and insert opened end into cylinder.
4. Remove seal from other end of cartridge.
5. Screw head assembly onto cylinder.
6. Release follower rod from end cap offset hole and push into cylinder.

SUCTION FILLING

1. Remove head assembly from cylinder.
2. Insert open end of cylinder two inches below surface of lubricant.
3. Slowly pull back follower rod, drawing in lubricant until groove in follower rod can be engage with the offset hole in end cap.
4. Screw head assembly onto cylinder.
5. Release follower rod from end cap offset hole and push into cylinder.

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GREASE GUN (Continued)

BULK LOADING (USING LOADER PUMP ONLY):

1. Pull and rotate the follower rod to lock the rod to the follower.
2. Wipe loader fitting clean.
3. Insert loader fitting into valve of loader pump.
4. Operate loader pump to fill cylinder until groove on follower rod is exposed.
5. Push and rotate the follower rod to disengage the rod from the follower and push the follower rod into the cylinder.

CAUTION: Some guns are equipped with a bulk loader fitting for use with hand powered, low pressure loader pumps. Modification to substitute a high pressure grease fitting so that air or electric powered pumps can be used for loading can result in damage to the gun and serious personal injury. This will also void the 1 yr. warranty.

OPERATION - GREASING EQUIPMENT

1. Clean any dirt or grease from the fitting to be lubricated.
2. Attach the coupling end of the extension or hose assembly to the lubrication fitting.
3. Operate the lever gun handle with full or partial strokes, until desired amount of lubricant is dispensed.

CAUTION: These guns can develop up to 10,000 PSI pressure. Excessive lubrication may damage equipment.

IMPORTANT: To ensure long service, and efficient operation of coupler, do not yank it off fitting. Remove coupler by tilting sideways and roll coupler off of fitting.

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GREASE GUN (Continued)

MAINTENANCE

Common causes of lever gun malfunction are air pockets, malfunctioning check valves, and defective lubricant cartridges. If gun fails to pump lubricant, follow these steps.

1. Pull and rotate the follower rod to lock the rod to the follower.
2. Slowly push follower inward, toward head, while depressing air-bleed valve to eliminate air pockets.
3. If pumping on the lever now sends lubricant through the coupler, push and rotate the follower rod to disengage the rod from the follower and push the follower rod into the cylinder.
4. If lubricant still does not pump out, sharply tap gun head on a block of wood several times.
CAUTION: Do not tap gun head on hard surfaces such as metal or concrete.
5. Pump lever until lubricant appears at coupler.

NOTE: If using lubricant cartridge, and problem persists after performing steps 1 through 5, discard defective cartridge and replace with a new one. If cartridge has an irregular inner surface, the steps above probably will not force gun to pump lubricant.

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C-CLAMPS

C-Clamps are often used when objects must be worked on in awkward position. They are also used to clamp two pieces of material in place while being worked on such as welding. To tighten the c-clamp turn the handle clockwise while holding the work between the base and the swivel head.

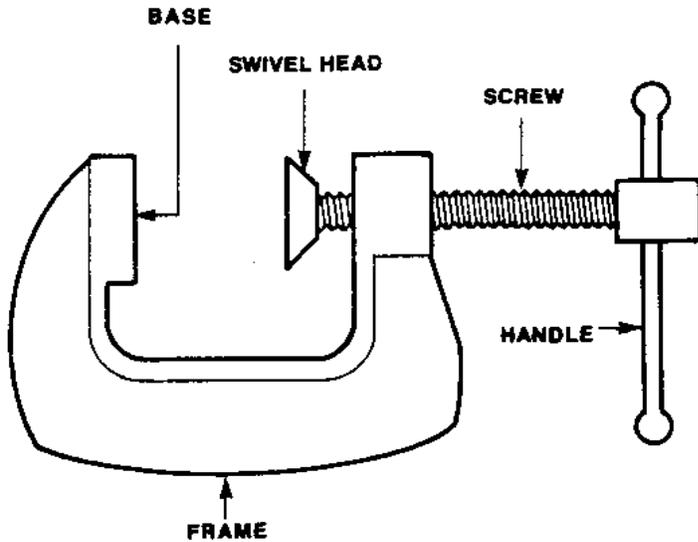


Figure 6



Figure 7

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SCREWDRIVERS

FLAT BLADE

These screwdrivers are generally classified by size according to the combined length of the blade and shank. The blade is hardened and tempered to prevent wear and bending. A correctly ground blade will be ground flat for the portion of the tip entering the screw, and then gradually taper out to the diameter of the shank. Clearance between the screw slot and sides of the blade should be kept to a minimum, insuring a snug fit to prevent slippage, and to prevent damage to the screw slot when force is applied to the screwdriver.

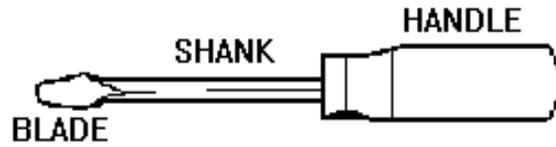


Figure 8

The shank and blade are constructed in proportion to the size of the screw the blade will fit. Therefore the application of pliers or pipe wrench to the shank, or of a crescent wrench to the blade for obtaining additional turning power, will probably damage the screwdriver. Special screwdrivers with heavy square shanks are constructed for use with a wrench and are the only screwdrivers that should be used for this work.

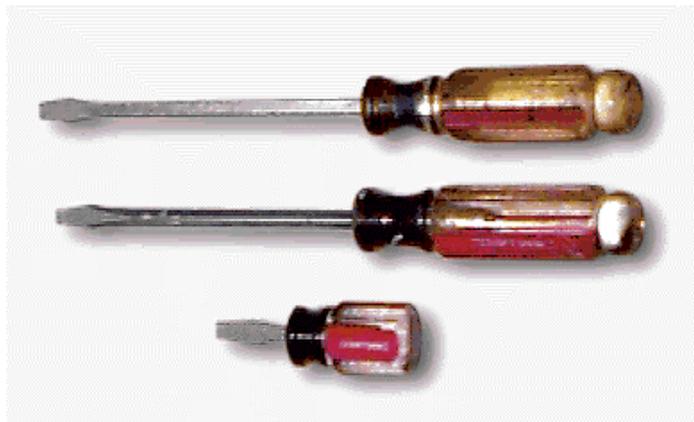


Figure 9

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SCREWDRIVERS (Continued)

PHILLIPS-TYPE

This screwdriver has a flat tip with four blades that fit into a Phillips-type screw. The tip of a Phillips-type should fill the screw. If the screwdriver is too large, it will slip out of the slots of the screw. If the screwdriver is too small, it cannot grip the slots of the screw. In either case, the screw head may be damaged.

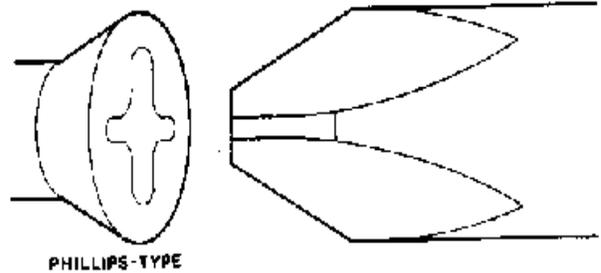


Figure 10: Phillips screwdriver

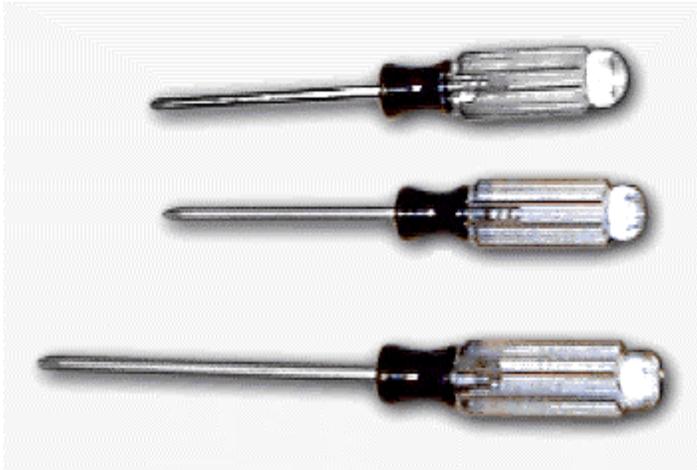


Figure 11

OFFSET SCREWDRIVER



Figure 12

These have a blade at each end to turn the screws when working space is limited. After each turn of the screwdriver, alternate from one blade to the other.

The Phillips offset is similar to the flat blade offset except that it has two different size blades.

Figure 13



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SCREWDRIVERS (Continued)

Here are a few general rules regarding the use of screwdrivers:

- Use a tool-holder to carry screwdrivers. If you fall with a screwdriver in your pocket, you could be injured.
- Place screwdrivers on the workbench, with blades pointing away from you. It is safer and more convenient to grasp the handle.
- Use the correct size screwdriver for the job. The blade should fit snugly in the screw slot. The width of the blade should be equal to, or slightly smaller than, the length of the screw slot.
- Keep the screwdriver in a direct line with the screw at all times when driving or removing the screw.
- Never use pliers or a pipe wrench on the shank of a round shank common screwdriver.

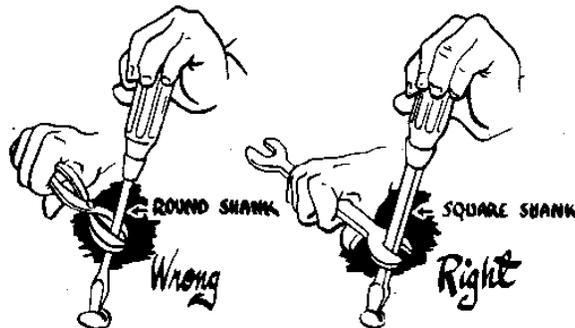


Figure 14

- Do not use a screwdriver as a substitute for a chisel at any time.
- Do not use a screwdriver as a pry or pinch bar. Screwdrivers with bent shanks are difficult to use and also difficult to straighten.
- When dressing a worn or broken screwdriver, grind off a little metal at a time and dip the tip in water frequently to prevent loss of hardness.
- Keep the screwdriver clean and free from rust.

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HAMMERS

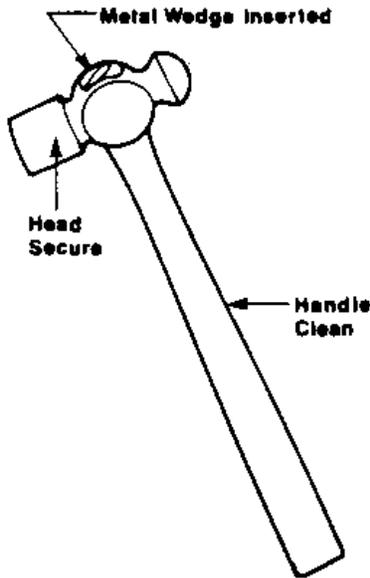


Figure 15

BALL-PEEN

This is the Operator's and Craft persons general purpose hammer: it is used for cutting gaskets, adjusting brackets, driving out bolts, and in work where it is necessary to use a chisel or drift pin. These hammers are classified according to the weight of the head (without the handle) which may vary from 6 ounces up to 2 1/2 pounds. The head of the hammer is usually of hardened tool steel, the handle is usually made of hickory and will vary in length according to the weight of the head, and the wedge may be of either steel or wood. The wedge is used to fasten the head to the handle. The round end of the hammer is used to peen when working metal.



Figure 16



SOFT-FACED

These hammers are less likely to cause damage to the work because the heads of these hammers are made of plastic, rawhide, brass, or lead. Soft faced hammers are designed to transfer damage from the work to the tool. Because of this unique design they are ideal for all types of surface protective driving and when used with the proper hardness tip resist marring painted or polished surfaces.

Figure 17: Soft Faced Hammer

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HAMMERS (Continued)

Replaceable tips are designed not to work loose or fly off. They are resistant to oil, gasoline and common industrial chemicals and resist picking up and transferring chips to other work. The holder are available in standard and “dead blow” models. “Dead blow” holders have shot-loaded heads to increase driving force, eliminate rebound and reduce worker fatigue. Both have strength and safety proven fiberglass handles.

MALLETS

These have soft heads made of rubber, wood, rawhide, or plastic. Use mallets to avoid damage to the work while striking.



Figure 18 Rawhide Head Mallet

SLEDGE HAMMERS

These have much heavier heads and longer handles and are used principally for heavy duty work such as breaking concrete, driving wedges, and hitting hammer wrenches. The head of the sledgehammer is usually of hardened tool steel and the handle is usually made of hickory and will vary in length according to the weight of the head.



Figure 19: Sledge Hammer

NON-SPARKING

These are used when working near flammable gases and fluids. These hammers are made of a special alloy that does not spark when they strike another piece of metal.



Figure 20: Non-Sparking Hammer

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HAMMERS (Continued)

Here are a few rules to remember about the care and use of a hammer:

- Hold the end of the handle for maximum force.
- Choke up on the handle for additional control.
- Use eye protection (goggles or safety glasses) chips may fly from the hammerhead or the item being struck.
- Never use a hammer with a loose head or split handle.
- Keep the pounding face of the head smooth and free from nicks and dents.
- Never use the handle of a hammer as a pry, or as a substitute for a soft-faced hammer.
- Keep the face of the hammer flush and parallel with the work whenever possible.
- Keep the handle and head of a hammer clean at all times.

WRENCHES

Wrenches, like the screwdrivers, are designed to deliver a twisting or turning force. They consist of two principal parts: the head with adjustable or non-adjustable jaws for gripping the work, and the handle to provide leverage for turning the work. The length of the handles on non-adjustable wrenches varies according to the size nut the wrench was designed to turn. In general, the smaller the nut, the shorter the handle. This limits the leverage that can be applied by hand, which in turn lessens the chance of stripping the threads or breaking the nut. Handles for adjustable wrenches are in proportion to the largest work that can be gripped by the wrench. Therefore, when using an adjustable wrench on small parts, care must be exercised by the worker to prevent damaging the work. Experience tells the worker when the part is seated and further force is unnecessary.

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Non-adjustable wrenches come in a variety of shapes and sizes. Their fixed jaws or openings are constructed to fit only one specified size nut. Some advantages of this type of wrench over the adjustable type are:

- Less possibility of rounding corners on parts due to a snugger fit of the jaws on the work.
- Less possibility of stripping threads or breaking the part since the handle is proportioned to the size opening on the head of the wrench.
- Less wear on the wrench since there are no movable parts.
- Greater accessibility to obstructed bolts due to the many shapes and forms in which these wrenches can be forged.

BOX-END

This wrench has a head that is totally enclosed and may have four, six, or twelve jaws (points). At least four jaws grip the part at all times. The jaws of the box wrench, however, grip the part only on the corners. The main advantages of the box wrench over the open-end wrench are there is much less possibility of the wrench slipping, and the wrench may be placed on the nut in many more different positions because of the greater number of jaws. Box wrenches also are available with a ratchet device so that it does not have to be removed from the nut for each turn when working in tight quarters.

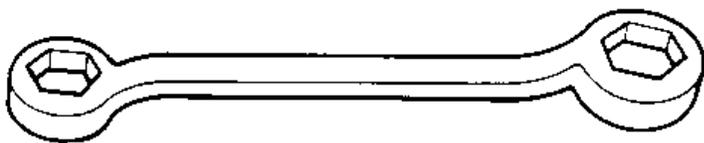
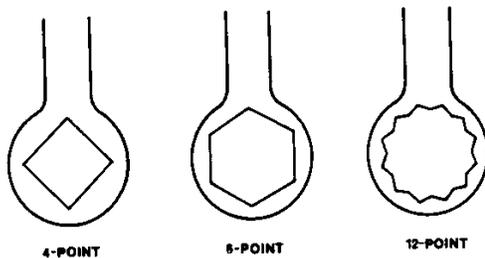


Figure 22: Box Wrench



**Figure 21: Ratcheting
Box Wrenches**

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LEARNING & DEVELOPMENT
HAND TOOLS**

WRENCHES (Continued)

OPEN-END WRENCH

This is a tool containing one or two heads with two fixed jaws per head. The part to be turned can have two sides, four sides, six sides, etc., provided that the sides are parallel and the same distance apart as the jaw openings of the wrench.



Figure 23

The jaws may be parallel with the center line of the handle, or they may be offset 15 or 22 1/2 degrees. Offsetting the jaws permits a greater turning angle on parts surrounded by obstructions. With this type of wrench, great care must be taken to get the head of the wrench completely over the nut. If just the tips of the jaws are engaged, there is danger of ruining the nut or breaking the jaws, which may cause the wrench to slip and cause an injury.

COMBINATION WRENCH

This has the advantages of both types of wrenches, the box-end and the open-end, is a more commonly used wrench.



Figure 24

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HAND TOOLS**

WRENCHES (Continued)

ADJUSTABLE WRENCH

This tool is commonly called a “Crescent” wrench and is similar to open-end wrenches in shape and purpose. The main difference is that the adjustable wrench has one movable jaw which gives the advantage of being able to adjust the opening between jaws to fit the part to be turned. Movement of the adjustable jaw, either in or out depending upon the distance across the flats of the nut, is accomplished by means of a knurled worm located in the head of the wrench. This worm mates with rack-like teeth in the movable jaw.

The size of the adjustable wrench is determined by its overall length in inches. The following table gives the maximum opening of the jaws for the various sizes.



Figure 25

| <u>Wrench Size</u> | <u>Jaw Opening in Inches</u> |
|--------------------|------------------------------|
| 4 | 1/2 |
| 6 | 3/4 |
| 8 | 15/16 |
| 10 | 1-1/8 |
| 12 | 1-5/16 |
| 15 | 1-11/16 |
| 18 | 2-1/16 |

Although the adjustable wrench is very versatile, it was not invented with the idea of displacing the open-end, box-end, etc. The adjustable wrench should be used only if the other wrenches are not available, or if the part to be turned is an odd size.

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WRENCHES (Continued)

A few rules to keep in mind when using this type of wrench are:

- Be sure the jaws of the wrench firmly grip the part to be turned before applying force to the handle. This precaution will prevent not only work spoilage, but will save a lot of skin on the knuckles.
- Place the wrench on the part to be turned, so that the stationary jaw absorbs the brunt of the load. In other words, when pulling the wrench, the movable jaw should be inboard or closest to the body. Exerting force against the movable jaw may spring, crack, or break the movable jaw entirely. The procedure just mentioned applies only when snugging down or breaking loose a bolt. If obstructions are present around the job, and the part is turning freely, the wrench can be flipped over, placing the force against the movable jaw in order to obtain a greater swinging arc.
- Keep the adjusting worm and movable jaw free of rust and dirt. Oil the parts periodically. The time cleaning and oiling the tool will pay off in ease and speed of operation on the job.
- Avoid hammering or using a piece of pipe on the wrench to obtain greater leverage. Something will give and it might be the wrench. On stubborn nuts or bolts, use either a larger wrench or a wrench designed to take a beating such as a hammer wrench.



Figure 26

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WRENCHES (Continued)

SPUD WRENCH

This is an open-end or a box end wrench with the handle portion shaped like a tapered pin. Spud wrenches are used in fitting up pipe joints and structural steel. The tapered handle serves as a fit-up pin. It

is placed in bolt holes of mating flanges and pried one way or the other until the bolt holes line up. After the bolts are in place and the nuts or the bolts run up as far as possible by hand, the open-end wrench part of this tool comes into use for the final tightening of the nuts.



Figure 27

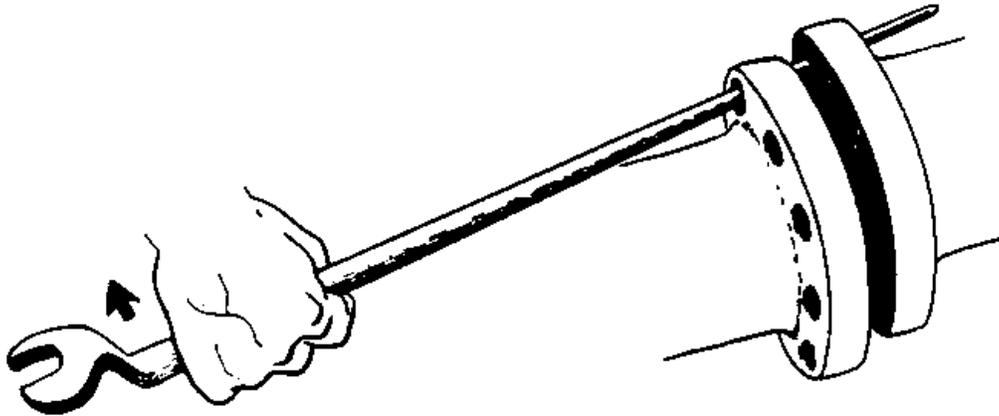


Figure 28

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WRENCHES (Continued)

PIPE WRENCH

This tool is designed exclusively for turning round stock. It should never be used on hexagonal or square stock where another more positive gripping wrench could be applied. The wrench should never be pulled sideways to spring or bend the pipe as this may damage the housing of the wrench.



Figure 29

The jaws of the pipe wrench have teeth machined at an angle on the jaw faces. The teeth on the movable jaw are machined to face inward while the teeth on the stationary jaw are machined to face outward. The teeth provide the grip for turning the part and should be kept clean and sharp to prevent slippage when the force is applied to the handle. The biting or digging into the work by the jaw teeth invariably leaves marks, which is one of the necessary evils encountered when using the pipe wrench. It should be obvious that the teeth would be damaged if this wrench were used on any hardened stock.

Pipe wrenches can be obtained in sizes from 6 to 60 inches. The size of the pipe wrench is the overall length of the wrench, and not the capacity or size of pipe which can be handled.

In the following table are listed wrench sizes from 6 to 48 inches and the capacity of each.

| <u>Wrench Size in Inches</u> | <u>Pipe Capacity</u> | <u>Recommended Pipe Size</u> |
|------------------------------|----------------------|------------------------------|
| 6 | 1/8 - 1/2 | 1/8 |
| 8 | 1/8 - 3/4 | 1/4 - 3/8 |
| 10 | 1/8 - 1 | 1/2 - 3/4 |
| 14 | 1/4 - 1-1/2 | 1 |
| 18 | 1/4 - 2 | 1-1/4 - 1-1/2 |
| 24 | 1/2 - 2-1/2 | 2 - 2-1/2 |
| 36 | 1/2 - 3-1/2 | 3 |
| 48 | 1 - 5 | 4 - 5 |

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WRENCHES (Continued)

A few rules to remember in the use and care of the pipe wrench:

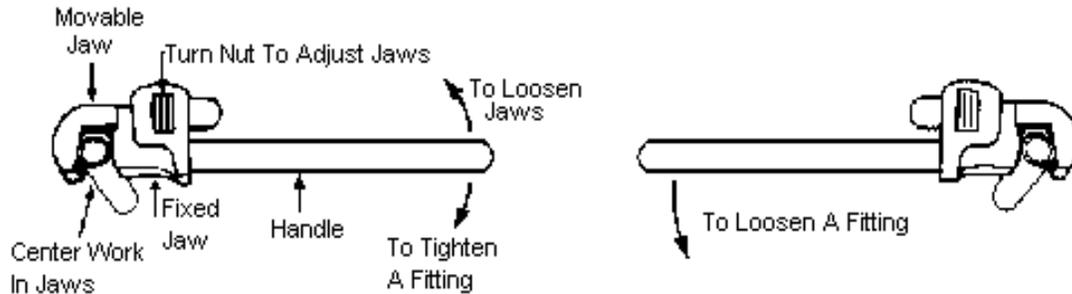


Figure 30

Work to be turned should be gripped in the center of the jaw faces for better operating efficiency. The movable jaw is hinged to the handle permitting it to swing in a controlled circular arc. This feature aids in releasing the jaw teeth when swinging the handle back to remove the wrench or to obtain a new bite. Pulling the wrench in the wrong direction allows the movable jaw to slip and no force can be applied.

- Do not subject the pipe wrench to side strains. Even the strongest pipe wrench will suffer from this wrong usage.

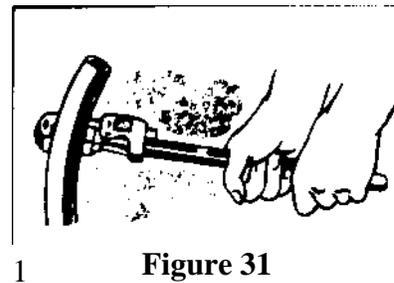


Figure 31

- Do not apply pipe wrenches on hardened steel objects such as set screws, etc. Such practice causes undue wear on the teeth.

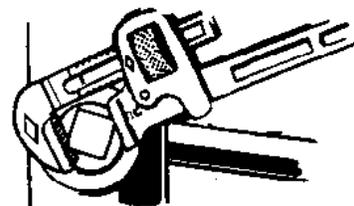
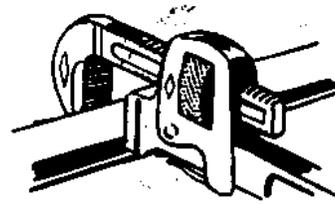


Figure 32

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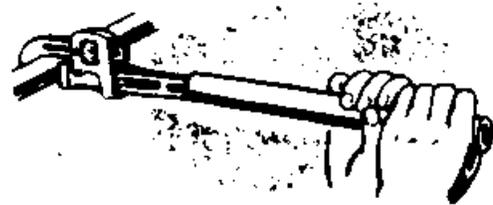
WRENCHES (Continued)

- Do not grip pipe too near the front or too far back in the jaws of the wrench. Careless application causes slipping and wear.



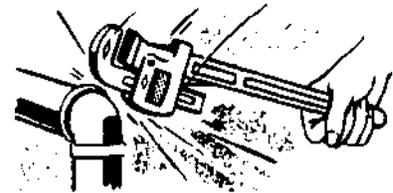
3 **Figure 33**

- Do not put extended leverage on the wrench handle. The extra load will strain the wrench excessively. Shorter life results.



4 **Figure 34**

- Do not use a pipe wrench in place of a hammer. It is not designed to withstand the impact and shock. Always use a hammer.



5 **Figure 35**

- Keep teeth clean. Give them a chance to grip firmly. Dirty teeth cause slipping. Slipping causes wear and perhaps accidents.



6 **Figure 36**

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WRENCHES (CONTINUED)

STRIKING WRENCH

This is also called a hammer wrench and is a tool designed for use with a hammer on stubborn parts that cannot be set or broken loose with the standard box wrench. Care must be used when tightening parts with this tool so that it doesn't strip the threads or break the stud or bolt. Before using this wrench to

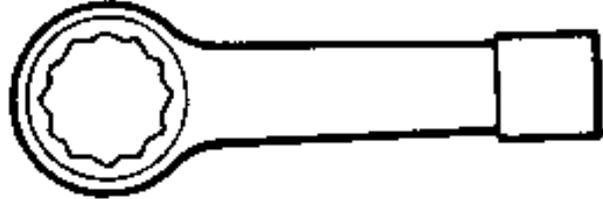


Figure 37

loosen a tight nut, check to see whether the bolt or nut has a left or right-handed thread. Also, when using the hammer wrench, most of the time there are two people working together, one to hold the wrench and the other to strike it with the hammer. At this time it is very important that the two communicate to make certain that their hands are clear of the striking area of the wrench.

STRAP WRENCH

This is used for turning plated or polished pipe or any round stock on which the preservation of the surface finish is important. It is also used to grip hardened material that cannot be gripped by a pipe wrench.

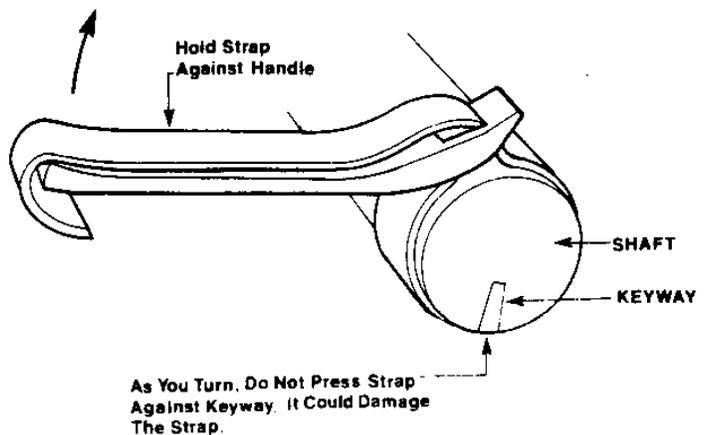


Figure 38

A flexible woven strap serves as the gripping medium, and is the only part of the wrench to come in actual contact with the work. The strap grips the work by means of friction; therefore, care should be taken using the wrench to keep the strap clean and dry at all times. Dirt and grime on the strap can ruin a polished surface quickly should the wrench happen to slip.

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Strap wrenches come in a variety of sizes with a capacity range from 1/8 to 12-inch pipe.



Figure 39

Non-sparking strap wrenches are usually made of bronze and are used when working near flammable gases and fluids.

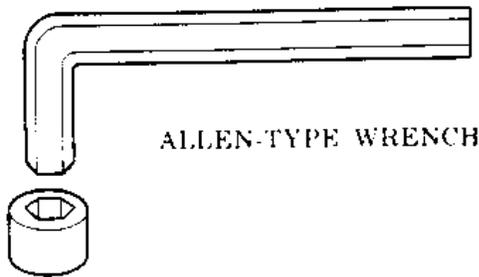


Figure 40

HEX OR ALLEN WRENCHES

These are “L” shaped tools formed from hexagonal (six-sided) bar stock. The hexagonal shaped leg of the wrench fit into a hexagonal opening in the head of set or cap screws, with the longer leg acting as a handle to obtain maximum leverage. After the screw is turning freely, the legs can be reversed to speedup removing time.

Allen wrenches come in sets and vary in size from 1/8 to 3/4 inches. These sizes are the diameter of the corresponding screws for the Allen wrench. This means the actual size of the wrenches themselves will be smaller. For example, the distance across the flats on an Allen wrench for a 1/8 set screw will be approximately 1/16 inches. The proper size wrench will fit snugly into the head of the screw. If an Allen wrench is too small, it could round off the inside flats of the screw.



Figure 41

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HAND TOOLS**

WRENCHES (Continued)

SPANNER WRENCH

This wrench is used to turn special nuts that have a slot or hole. There are two types of spanner wrenches, fixed and adjustable. The adjustable type with a hinge is used most often.

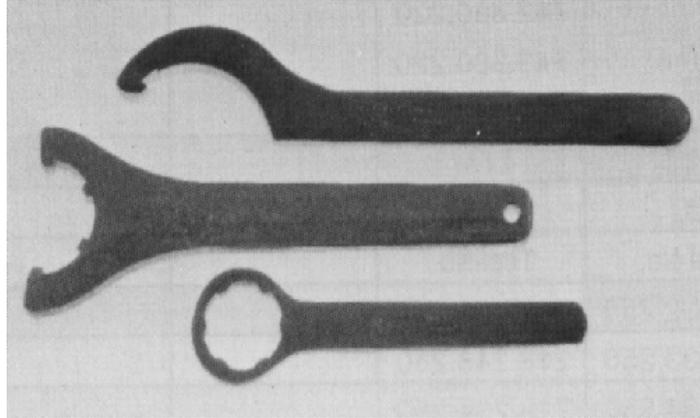


Figure 42

Use an adjustable hook spanner if the nut or bolt has a slot on the outside. Insert the hook into the slot. Pull the spanner toward its open side to tighten or loosen the fitting. To prevent the spanner from slipping, make sure there is good contact between the hook and the slot.

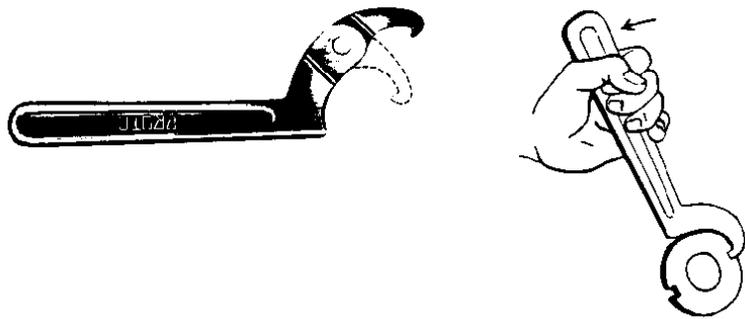


Figure 43

If the nut or bolt has holes in its face, use a face pin spanner. Insert the face pin spanner into the hole of the nut or bolt. A face pin spanner can also be used to turn a threaded flange.

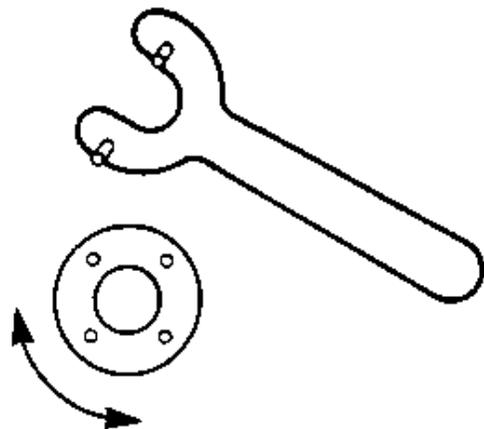


Figure 44 Face pin spanner wrench

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WRENCHES (Continued)

7

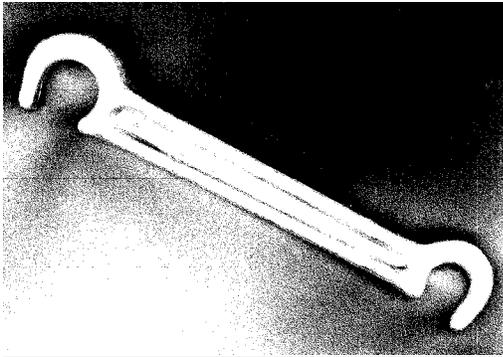


Figure 45

VALVE WRENCH

This is sometimes called a bone wrench and is one of the most frequently used tools of the worker. There is a small, double ended wrench which the worker can carry on their person. There is also a series of larger, single ended wrenches which are used on the larger size valves. These larger wrenches are normally hung at designated locations on the operating unit.

The double ended wrench is designed to be carried by the worker for use on the smaller size valves on the unit. It has a loop shaped opening on each end of the wrench. One end is smaller than the other. The opening is placed over the circular handle on the valve and the worker uses the wrench handle for leverage to turn the valve handle open or closed.

The larger size wrenches are intended for use on valves too large for the double ended wrenches. These wrenches have large handles that are easy to pull on. **They are not intended to be used as hammers!** The use of cheater handles, such as pipe spools, **must** be avoided also. These wrenches are constructed of aluminum and can break if cheaters are used.

There are a number of modified valve wrenches in use in the plant. These wrenches have one end of the smaller size valve wrench added to the handle of a small pipe wrench. This combination gives the advantage of the added leverage of the pipe wrench handle to the valve wrench. Care must be taken not to over-tighten the smaller valves and break the valve handles.

Bergman SAFTY-SPANNER Co.
MFR'S CODE NO. 1833

SIZE RECOMMENDED TO BE
USED ON VALVE HANDWHEELS

5 to 10 inches in Diameter -- our 14 inch #101
6 to 16 inches in Diameter -- our 18 inch #102
14 to 48 inches in Diameter -- our 26 inch #103

IMPROVED AND
GUARANTEED

MADE OF ALUMINUM - MAGNESIUM ONLY

| NUMBER | SIZE | WEIGHT | OPENING |
|--------|---------|--------|--------------|
| 101 | 14 inch | 2 lbs. | 1-3/8 inches |
| 102 | 18 inch | 3 lbs. | 1 1/2 inches |
| 103 | 26 inch | 7 lbs. | 2 1/2 inches |

SPECIAL FOR YOUR OWN 1 INCH PIPE HANDLES

| | | | |
|------|-----------|--------|--------------|
| 105A | Head only | 3 lbs. | 2-1/8 inches |
| 105B | Head only | 9 lbs. | 2-1/8 inches |

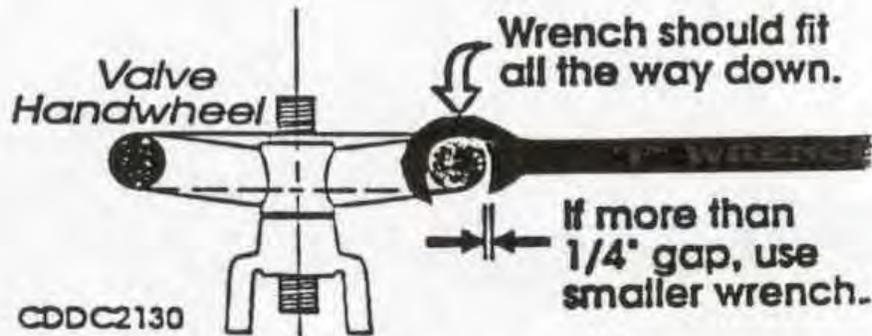
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SAFE USE OF VALVE WRENCHES

The following guidelines should be followed when using valve wrenches.

1. When opening or closing valves, use a valve wrench. Pipe wrenches are not designed for turning valve wheels.
2. Place the wrench on top of the valve wheel. Using the wrench on the underside of the wheel may increase the possibility of the wrench slipping (see Figure A on the following page).
3. Be sure the top of the wrench opening is resting on the wheel. If the wrench does not fit all the way down to this position, a larger wrench will be required (see Figure B on the following page).
4. Be especially careful not to place yourself in a position that could result in bodily injury in the event of wrench slippage or failure.
5. Brace yourself firmly and pull, rather than push, when using a wrench. If the position of the valve makes it necessary to push, then do so with the flat of your hand rather than gripping around the wrench.
6. The force of the pull should be exerted parallel to that of the valve wheel (see Figure A on the following page). Do not pull up or down at an angle.
7. Never use a “cheater bar” to apply excess leverage to a wrench.
8. Be sure the wrench is snug-up against the valve wheel spoke before applying force.
9. If you expect to work on a valve that may be hard to turn, use lubricating oil and a wire brush to work the valve loose. If the correct size wrench does not open the valve after it has been lubricated and brushed, something is wrong. Take the time to re-evaluate the situation to ensure you have taken all the right steps.
10. When and where possible, regularly exercise valves that may be difficult to operate. A gate valve can be close approximately 50% without significantly affecting downstream flow or pressure.

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SOCKETS

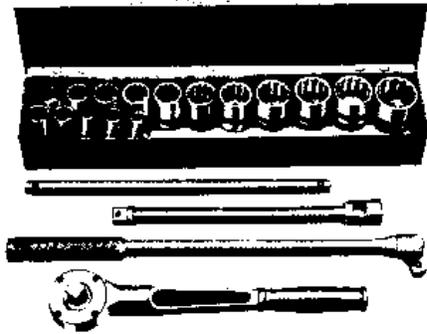


Figure 46

Socket (heads) are similar to the enclosed heads of the box wrench except that they are detachable from the handle. A variety of handles can be used for turning each head. The size stamped on the socket indicates the distance across the flats of the bolt head or nut it will fit. To pick the correct socket for a given size bolt or nut, simply measure the distance across the flats of the bolt or nut and use the socket stamped with the corresponding measurement.

SOCKETS

These come in various sizes, but each socket has a socket end and a drive end. They are also made in different types for different applications such as regular, thin wall, deep-well, and impact.

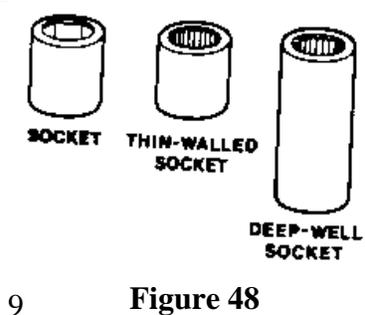


Figure 48

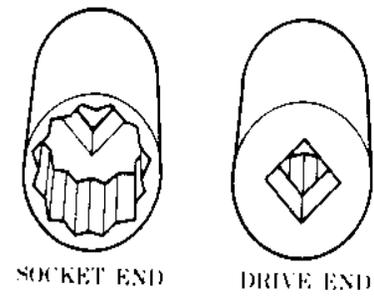


Figure 47

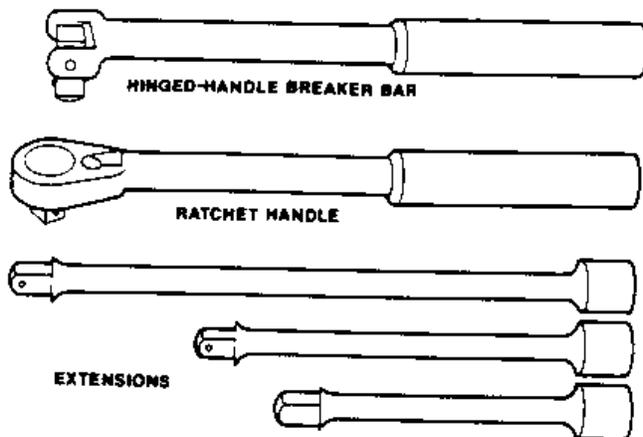


Figure 49 Breaker bar, Ratchet and Extensions

RATCHET

Ratchet drive is the most common handle used with a socket set. In cases where the handle itself can be swung through only a limited arc, the ratchet allows complete tightening or loosening of the nut without removing the socket from the nut. The ratchet is engaged for tightening or loosening the nut by adjusting a small lever on the handle. To remove a socket, just pull it off. (On some ratchet handles, there is a button to press while pulling.)

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SOCKETS (Continued)

BREAKER BAR

This driver is used when a lot of force is needed to break a nut or bolt free. After the breaker bar is used, switch to a ratchet handle to speed up the removal of the bolt or nut.

EXTENSION BARS

These are an accessory which makes the socket wrench even more useful. Extension bars of various lengths fit between the sockets and the handle and allow work in places which in places which could not otherwise be reached.

UNIVERSAL JOINT

This has a swivel feature which also fits between the socket and the handle and may or may not be used in conjunction with an extension bar. It also allows work on nuts which cannot be reached in any other manner.



10 **Figure 50**



ADAPTER

ADAPTERS

Adapters are used when the size of the socket drive does not match the size of the drive lug.

11 **Figure 51**

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PLIERS

ADJUSTABLE PLIERS

These also known as slip joint pliers are made for holding, and gripping. Pliers are particularly useful to hold hot or sharp items. Pliers can be damaging and dangerous if not used correctly. A screwdriver, a nut, or a bolt can be damaged if turned with pliers. Slip-joint pliers are the type most commonly used. “Slip-joint” refers to the way the jaws adjust. A pin slides into a slot to reduce or expand the jaws. The size can only be adjusted when the jaws are all the way open. Channel lock pliers are the most often used adjustable pliers. To adjust the spread of the jaws, open the pliers and slide the pin into a groove. Make sure the jaws are parallel when gripping an object.



Figure 52

NEEDLE-NOSE

These pliers have long thin, pointed jaws. They are used to manipulate wire and to install and remove cotter pins. Needle-nose pliers can easily be damaged because of the thin jaws. To avoid breaking and chipping them, don't use too much force.

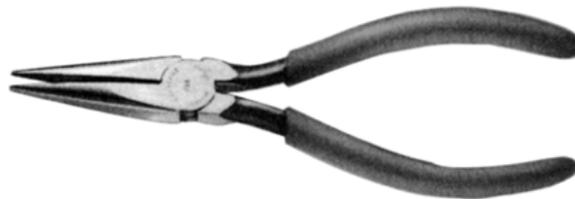


Figure 53: Needle nose pliers

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PLIERS (continued)

WISE-GRIP

These pliers are handy tools because they can be used for several different applications. They can be used as a portable vise, clamp, pliers, and adjustable wrench. Jaws remain clamped on work, leaving hands free, then snaps open when you press the quick-release lever on the lower



Figure 54

handle.

END-NIPPERS

These tools are used when working with wire, as with insulation and building scaffolds. They have a cutting edge on the end of the pliers which makes it easy to twist or cut wire as needed.



Figure 55

HACKSAW



Figure 56

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HACKSAW (continued)

A Hacksaw is used for cutting various types of metal such as steel, brass, aluminum, cast iron, and copper. It consist of a blade, a frame, and a handle. The handle of the hack saw can be either a straight or pistol-grip type.

The blade is long and thin with cutting teeth on one edge. A hole is located on each end of the blade by which it is connected to the frame. The size of the blade is determined by the center distance of the holes. Blades vary in length from 8 to 12 inches and have from 14 to 32 teeth per inch.



Figure 57

The teeth are set, or bent at an angle to the sides of the blade, which causes the cut to be slightly wider the thickness of the saw blade, thus reducing friction and binding.

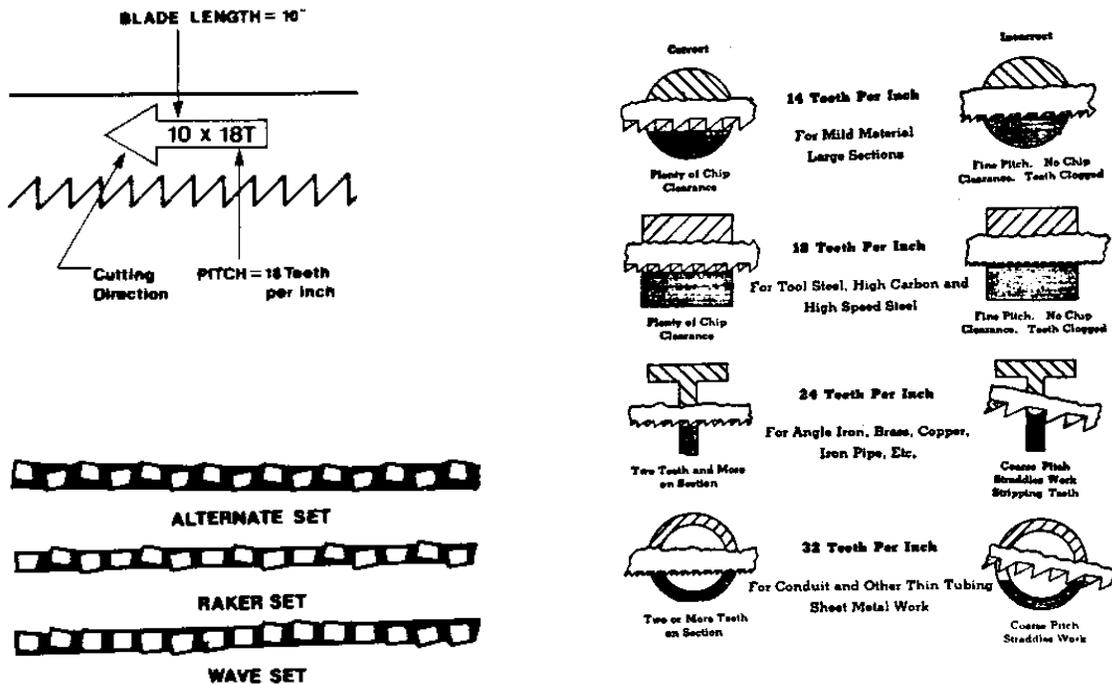


Figure 58 Hacksaw blades and types of teeth.

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HACKSAW (Continued)

Some hack saw blades are made with only the teeth hardened, others are hardened entirely. Before cutting a piece of metal, decide upon the best blade for the job. A completely hardened blade is best for sawing brass, tool steel, cast iron, and stock of heavy cross-section. It works better on this type of material because it does not have the tendency to buckle or run out of line when pressure is applied. Flexible or semi-hardened blades work best for sawing hollow shapes and metals of light cross-section, such as channel iron, thin-walled tubing, sheet tin, copper, aluminum copper, and babbitt.

Selecting the blade with the correct number of teeth is based on two factors; the shape and the relative hardness of the material to be cut. In general, it is all right to use a blade that will have at least three teeth bearing on the work at all times.

12

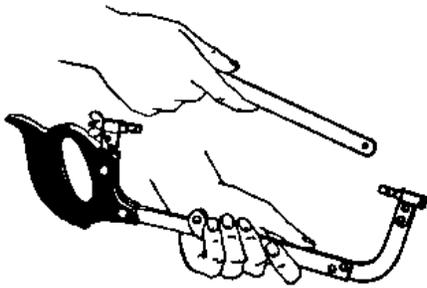


Figure 60

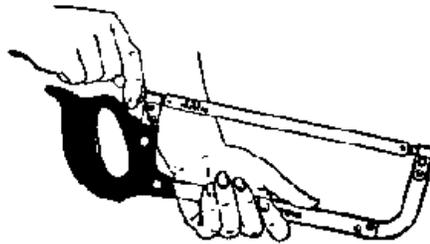


Figure 59

To insert blade in hacksaw frame.

To

tension the blade.

The hack saw frame holds and guides the blade, and can be rigid or adjustable. At the front end of the frame (opposite the handle) is a stationary pin for holding one end of the blade. Another pin is located at the back of the frame (handle end), and is so arranged that it can be moved forward or backward to adjust the blade tension. Only enough tension should be applied to keep the blade taut and free from twisting. A blade should be placed in the frame with the teeth slanted toward the rigid pin or front end.

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HACKSAW (Continued)

In use the hack saw should be held with the right hand on the handle and the left hand on the front end. The saw blade should be placed on the work so that at least three teeth will be on the work at all times. Since the teeth will cut in one direction only, and they should be facing forward, pressure is applied only on the forward stroke. On the back stroke, pressure is relieved, and the saw is slightly lifted to prevent dulling the teeth. A full stroke should be used with enough downward pressure to keep the teeth cutting and the frame in line with the blade so that it will not wander. Short, quick strokes accomplish little but overheating of the blade and you.

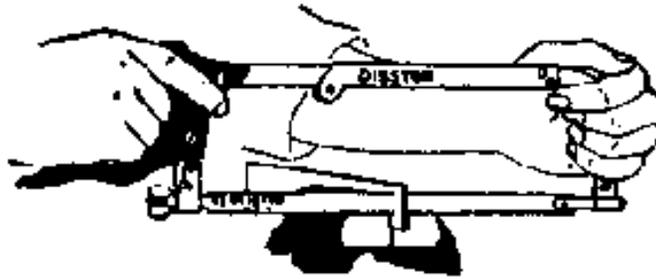


Figure 61
Proper way to hold the hacksaw frame when sawing.

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HAND TOOLS**

CHISELS

A few general words about chisels will serve all the specific types mentioned later. The chisels used by the worker are designed to cut metal. They are made from tough, high carbon steel, forged from hexagonal (six-sided) or octagonal (eight-sided) bar stock. The chisel is heated, forged to the desired shape, and then annealed to give it a uniform internal metal structure.



The chisel blade is then hardened and tempered. Hardening permits the chisels to cut the different materials encountered on the job. Tempering removes the brittleness from the blade and prevents shattering of the cutting edge when the chisel is used. A chisel will not cut metal with a hardness equal to, or greater than, its own.

A cold chisel has a wide, straight, double-beveled cutting edge. The angle of the beveled edge depends upon the type of material on which the tool is to be used. The tougher the material the greater will be the angle. For mild steel, the angle should be about 50 to 60 degrees, for cast iron 60 to 70 degrees, for brass 40 to 50 degrees, and for softer materials such as babbitt, copper, etc., about 35 degrees.

The size of a chisel is determined by the width of its cutting edge. A few of the many jobs cold chisels can be used on are: cutting off bolts and rivet heads, cutting sheet metal, and marking mating parts.

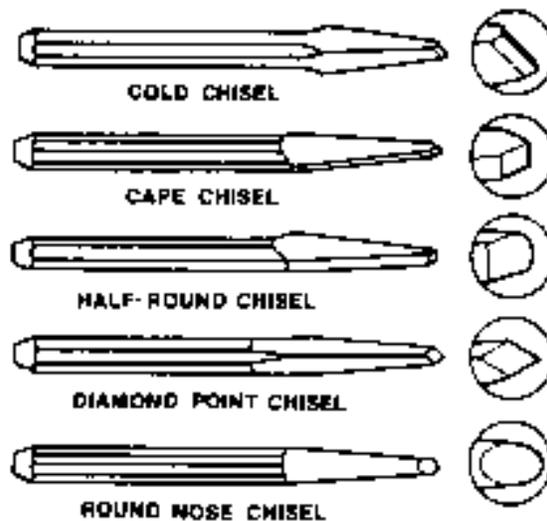


Figure 62: Types of chisels

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CHISELS (Continued)

Cape Chisel is used for cutting keyways, channels, and splitting pipe inside fittings. It is used on various other jobs which will not permit the entry of a cold chisel. This tool has a double beveled cutting edge similar in shape, but smaller in width, than the cold chisel.

The angle formed by the beveled edges should be the same as for the cold chisel depending upon the type of metal being cut. The blade is tapered back from the cutting edge to the shank to prevent its binding when cutting in grooves.

Diamond Point Chisel has a single bevel cutting edge with the cutting face forming a rough outline of a diamond. The angle formed between the axis of a chisel and the face of the cutting edge should be about 60 degrees. Diamond point chisel are used to cut oil grooves, square corners, to draw a wandering starting drill back to center, and to split pipe in place of the cape chisel.

Round Nose Chisel has a single bevel and a half-round cutting edge. The angle between its cutting face and its axis should be approximately 60 degrees. Round nose chisels are used for the same type of work for which diamond point or cape chisels are used.

USING A CHISEL

When cutting or chipping with a chisel, the depth of the cut is controlled by the angle at which the chisel is held to the work. Keep your eyes on the cutting edge to see what it is doing and not on the chisel head. Swing the hammer lightly at first to develop a feel and rhythmic swing; then increase your blows to suit the job. One very important rule to remember when using the chisel is **ALWAYS WEAR SAFETY GOGGLES OR GLASSES WITH SIDE SHIELDS**.

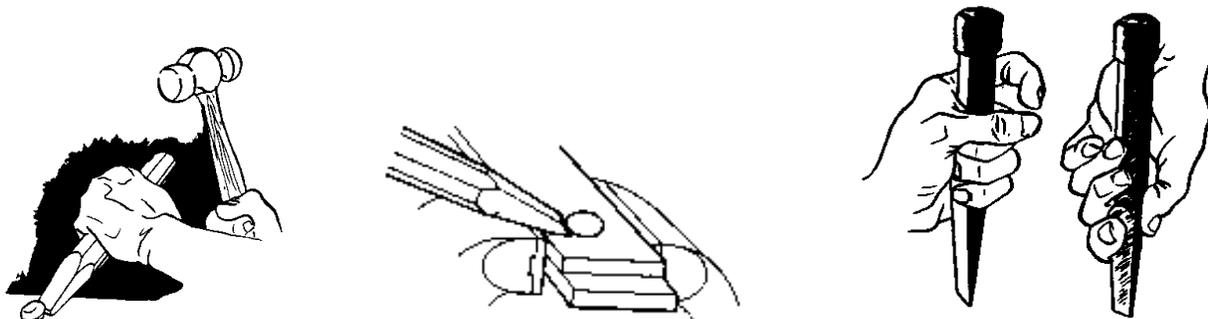


Figure 63: How to hold and use a chisel.

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CHISELS

Using A Chisel (continued)

The head of a chisel that has been in service for any length of time has a tendency to become upset or spread out like a mushroom as a result of hammering. Using the chisel in this condition can be dangerous since you never know when these upset pieces are going to break off and hit someone. The upset metal should be ground off so the head end is slightly tapered and the face of the head is flat. A dull chisel will not do the job, and may even be dangerous, as there is tendency to strike it extra hard in order to make it cut. Dull chisels should be turned in to the tool room for sharpening.

- To use a chisel:
- Keep one side of the blade along the surface of the work.
- Put the cutting edge of the chisel against the item to be cut.
- Hold the chisel firmly, so you won't lose control.
- Swing the hammer so that it is in line with the chisel.
- After each swing, put the cutting edge of the chisel back against the item.
- Keep your eye on the cutting edge of the chisel as you swing the hammer.

TO RESTORE THE HEAD:

- Grind the chisel to put it back in shape.
- Hold the head of the chisel at an angle to the grinding wheel.
- While one hand applies pressure , the other hand turns the chisel. Move the chisel back and forth across the grinding wheel to remove the mushroom and restore the head.

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CHISELS (Continued)

TO RESTORE THE CUTTING EDGE:

- Grind the cutting edge at about a 60 degree angle.
- Press the cutting edge lightly against the grinding wheel to avoid overheating.
- Dip the chisel in water frequently to cool it.

Note: Wear eye and face protection during all grinding operations. Chips from the chisel or wheel can injure you.

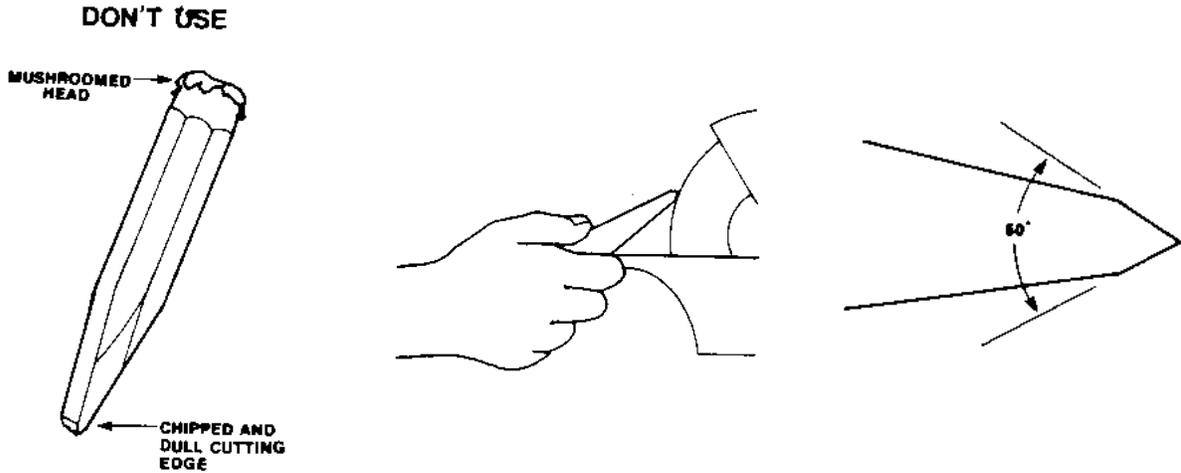
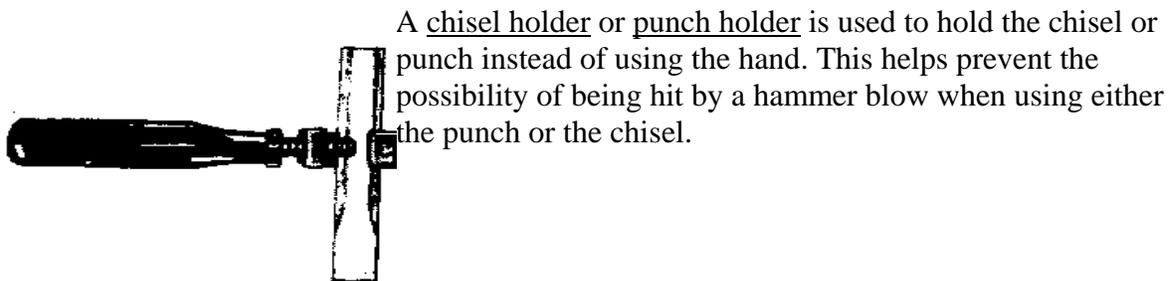


Figure 64: When and how to sharpen a chisel.



**Figure 65
Chisel or punch holder.**

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PIPE TAPS

Pipe Taps are used to cut the internal threads (female threads) for any pipe joint. The tap looks like a threaded rod with a number of flutes machined lengthwise on its surface. These flutes are to provide a cutting edge for the teeth, clearance for the removal of chips, and a passageway for lubricating oil to reach the cutting edges. The opposite end of this tool is formed into a square lug to facilitate turning with a tap wrench.

The cutting teeth are set at an angle with the center axis, and taper 3/4" per lineal foot of thread. This taper is provided so that the threads will produce a tightly locked joint.

Taps should be well lubricated throughout the threading operation. Once started in the hole, they should be turned about 1/4 of a turn and then backed off until the chips are felt breaking loose. This operation is repeated until the thread is completed. If the tap was turned continuously, the chips would build up and might bind and break the tap.

Taps are usually held with either an adjustable tap wrench handle or a T-tap wrench. They are both designed to be turned by hand. Never add a wrench or length of pipe to the handle for greater leverage. Breakage of the tap could easily result from such misuse. The T-wrench has an adjustable chuck that grips the square shank of the smaller sized taps. The larger size taps are usually held by the adjustable hand wrench that is tightened by turning one of the handles. Care must be taken to hold the tap straight when starting a thread using either of these tap wrenches.

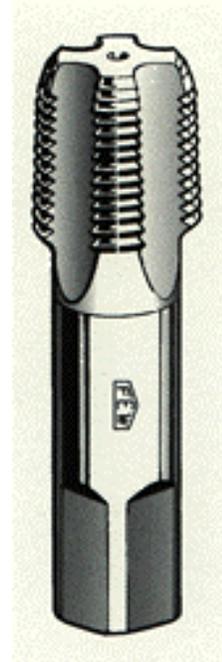


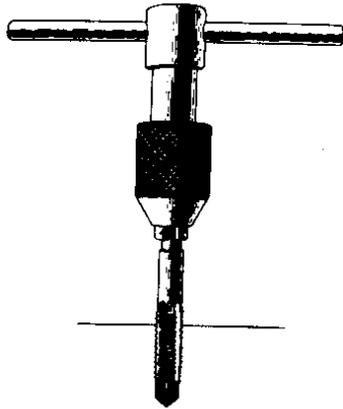
Figure 66: Pipe Tap



Figure 67: Adjustable Tap Wrench Handle

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TAPS (Continued)



(A) T-tap wrench used for the smaller size taps.



(B) Adjustable tap wrench used for any size taps. Shown with tapered reamer that is sometimes used before tapping.

Figure 68 T-tap wrench and adjustable tap wrench.

TAPPING PROCEDURE

To start the threads:

- Install the taper tap into a tap wrench and tighten it.
- Align the taper tap with the hole.
- Apply cutting fluid to lubricate and cool the tap.
- Turn the tap wrench forward about a half-turn, and then backward about a quarter-turn. The forward motion cuts the metal; the backward motion breaks the chips of metal free.
- Remove the tap and flush the hole with cutting fluid.

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TAPPING PROCEDURE (Continued)

To cut the threads:

- Install the plug tap into the tap wrench.
- Thread the plug tap into the existing threads until it starts to cut.
- Apply cutting fluid.
- Turn the tap wrench forward about a half-turn, back about a quarter-turn. This cuts and chips out the metal.
- Polish the threads occasionally with a back and forth motion.
- If tapping a blind hole, stop when you feel resistance. Remove the tap and flush the hole with cutting fluid.

To thread the bottom of a blind hole:

- Install the bottoming tap into the tap wrench.
- Thread the bottoming tap into the existing threads until it starts to cut.
- Apply cutting fluid.
- Turn the tap wrench in the same forward and backward motion as with the plug tap.
- When you feel resistance, remove the tap and flush the hole with cutting fluid.

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TAPPING PROCEDURE (Continued)

PRECAUTIONS:

- If the tap feels spongy, there may be chips in the bottom of the hole. Remove the tap, and flush the hole with cutting fluid before continuing.
- Taps are brittle. Do not push them sideways or force them against the bottom of a blind hole. The tap can break inside of the hole. If it does break, use a tap extractor to remove it.

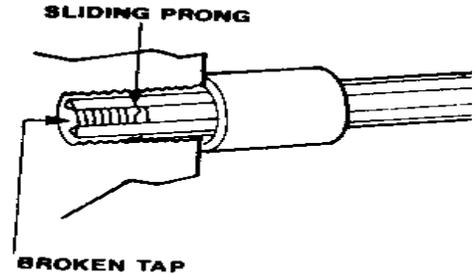


Figure 69: Tap extractor

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FILES

A file is a hardened steel tool, having a multitude of small cutting teeth machined on its working surface. It is used for removing material from the surfaces of substances softer than itself. Files are classified by length, shape, and the cut of their teeth. A file is sized by length in inches as measured from the tip to the base of the tang. The tang is the long pointed butt end which is used to hold the handle. If the file is used without a handle, there is always danger of driving this sharp tang into the hand or wrist. New handles should be installed by tapping the file, handle first, onto the bench from a height of 4 to 6 inches. This tapping should be continued until the tang is well seated in the handle hole. The types of files are single cut and double cut, they are graded as bastard cut, second cut, and smooth cut. They also, are made in different shapes flat, half-round, round, and three-cornered.

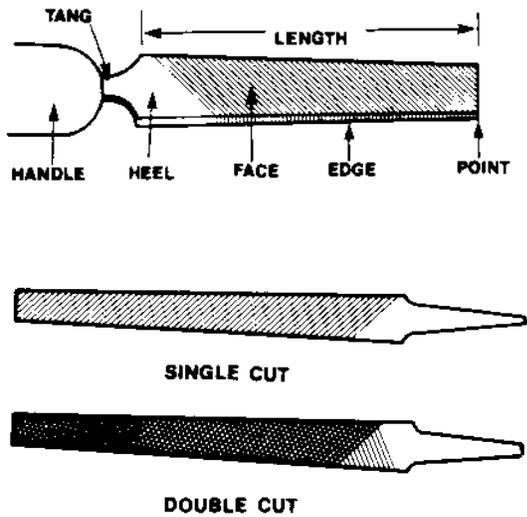


Figure 70

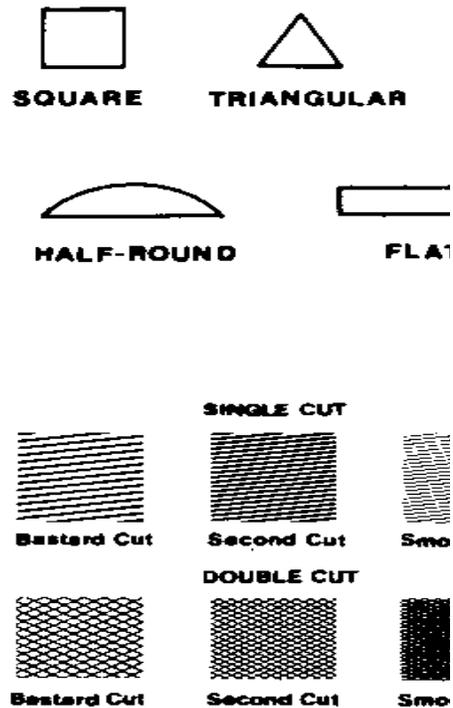


Figure 71: File description and types of cut.

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FLAT FILE

These can be made in any of the grades or types mentioned above. This is a flat tool used for rough filing on either flat or round stock. It is available in length from 4 to 16 inches with the 10 and 12 inch sizes being most common. It is normally used to remove the cutting burr on the outside surface of all sizes of pipe and on the inside surfaces of pipe that is too large to be cleaned by the small hand reamers. This file might also be used for sharpening soft scrapers and packing hooks.



Figure 72 Flat file.

ROUND FILE

This is used for enlarging circular or concave or for removing the burr on the inside edge of pipe. Smaller sizes of the round file are commonly called rat-tail files. When holes need enlarging and corners rounding, a round file is the solution. This file tapers to a point making it adaptable on a variety of hole sizes.



Figure 73 Round file.

HALF-ROUND

This file is made with one side flat and the other side convex, this tool can be used effectively on both concave and convex surfaces, or can be used for filing flat surfaces. It can be used interchangeably with either of the files mentioned above.



Figure 74 Half-round file.

SQUARE FILE

This is used when filing slots, grooves, keyways, inside corners and square holes. Tapered toward the point, all four sides are equal filing surfaces.



Figure 75: Square File

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THREE-CORNERED

This file is primarily used for filing internal angles and for sharpening hand saws, this file is used a great deal for smoothing slightly damaged threads where enough thread is undamaged to insure a tight joint.



Figure 76 Three cornered file

HOW TO USE A FILE

The amount of material removed, and surface finish, are factors controlled by tooth spacing. As the teeth are spaced farther apart they are larger. This is called coarseness. Coarse files are used to remove a large amount of material in a short time; however, coarse files leave a rough surface finish on the work.

The file will cut in one direction only; that is, on the forward thrust, away from the body. The file should be held flat on the work with only enough pressure to keep it cutting. Pressure should be applied to the file only on the forward or cutting stroke, and then completely lifted from the work on the back stroke. Dragging the file on the back stroke doesn't accomplish any work and serves only to dull the teeth.

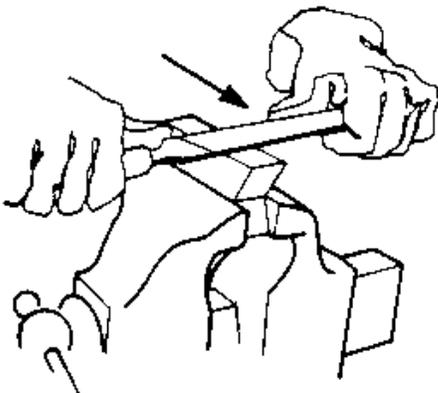


Figure 77

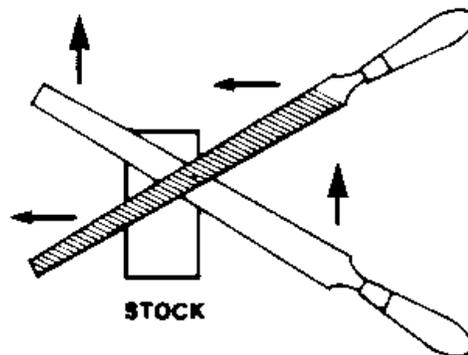


Figure 78

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FILES

How To Use A File (continued)

It should be remembered that the file is made of extremely hard metal and is therefore quite brittle. If a file is struck against a bench or some other object, it is possible to break off some teeth, or fracture the file completely. A wire brush will do a fair job of cleaning file teeth but a really effective job can be done by using a *file card*. This is a small brush having short, wire bristles about ¼-inch in length. It also has a short, pointed pick for digging out stubborn chips which the brush cannot removed.

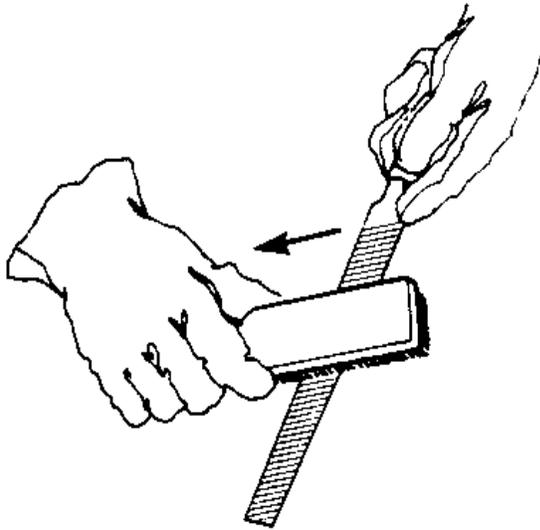


Figure 79 Clean teeth

The points mentioned for the care and use of all types of files may be summed up as follows:

- Keep the file teeth clean at all times.
- Do not use the file as a pry bar. Files are very brittle, and will break easily when used in this manner.
- Never use a file in place of a hammer, and do not strike a file with a hammer under any circumstances.
- Keep files away from water, and store them in a dry place.
- Never use a file which does not have a handle on it.
- When not in use, store the file so that it cannot be bumped by objects which might damage its teeth.

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WEDGES

Wedges may be any size, and may be made of any durable material although brass is the most common. The angle of the wedge is usually less than 30 degrees, but there is no set standard. They are used to separate adjacent objects by being driven between them, sharp edge first. Typical applications are: raising heavy piping or machinery, separating flanges in a piping system for the installation of blinds or gaskets, and the separation of pumps from its case.



Figure 80

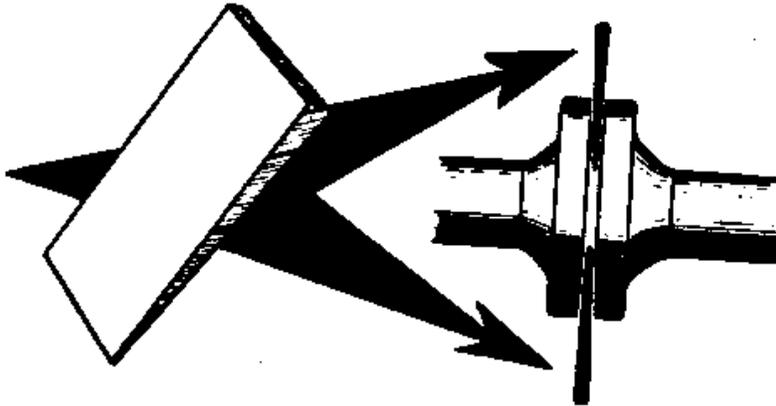


Figure 81

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PIPE CUTTERS

The one-wheel pipe cutter does its work while rotating around the pipe being cut. The cutting device itself is a small, sharp-edged wheel. The handle is attached to the threaded shank. As the handle is turned, the pipe is clamped between the wheel and guide rolls which are mounted on pins and free to rotate. The cutting wheel does not actually remove any metal, but pushes it aside as the handle is turned and the wheel advances into the pipe. The metal that is pushed aside forms the shoulder and the burr on the end of the pipe.



Figure 82 One wheel pipe cutter

The cutter should be placed around the pipe from below so that it is easy to see when the wheel is exactly on the mark where the cut is to be made. The handle of the cutter is then screwed down until the pipe is gripped between the wheel and the rollers. A preliminary swing of the cutter is made all around the pipe and the light cut checked to make sure the wheel is cutting in a single groove. If it is necessary to move the cutter, it must be loosened and reset. Side force will break the cutting wheel. The wheel may also break if the cutter is too tight on the first turn. Before continuing the cut, oil should be applied liberally to the wheels, rollers and the pipe. The cutter is then screwed tighter for each turn and the same process repeated as many times as necessary to sever the pipe. This type of cutter is available for 1/8 to 6-inch pipe, although it is common only in the smaller sizes.

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PIPE CUTTERS (Continued)

The three and four wheel cutters are exactly the same as the one-wheel cutter described previously, with the exception that the rollers are replaced by additional cutting wheels. As a result, a limited swing of the handle (roughly 1/3 and 1/4, respectfully, the way around the pipe) will produce a continuous groove. These tools permit cuts in trenches and other places with restricted working room. When placing the three-wheel or the four wheel cutter on the pipe, great care must be exercised to insure that all the wheels are cutting in the same groove.



Figure 83 Four wheel cutter

Most cutters that are installed on pipe threading machines are of the one-wheel type. They operate the same way as the hand pipe cutter except that it is fixed mounted to the machine.

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PIPE CUTTERS (Continued)

Another type of pipe cutter is the link pipe cutter which is seldom used but available from the tool room when needed. The close spacing of the several cutting wheels permits a complete cut around the pipe with only a small swing of the handle. This feature is particularly useful when work is done in the midst of other piping, near a wall or in a trench. The cutter is placed around the pipe by disconnecting any of the links. Be sure to line up the links so they will all cut in the same groove, the cutter should be rocked back and forth while slowly screwing down the handle. A little oil in the cut and on the wheel pins will prolong the life of the cutter.

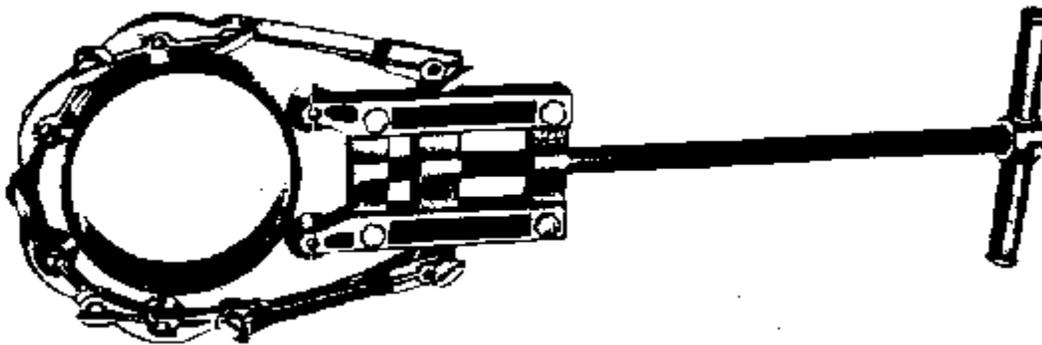


Figure 84 Link Cutter



Figure 85: Another Type of Link Cutter

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PACKING HOOKS

Packing hooks may be simply piece of light steel rod with one end looped for a handle and the working end bent over a short distance and sharpened. In awkward places it is often necessary to use a flexible hook which consists of a steel corkscrew attached to a T-handle piece of wire rope. Either type may be from 6 to 16-inches long and is used for removing old packing from stuffing boxes of pumps and valves.

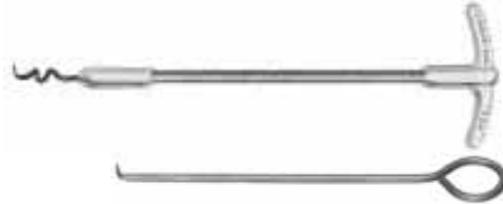


Figure 86: Typical packing hooks

WIRE BRUSH

Wire brushes are cleaning tools consisting of clusters of wire bristles set in a wooden handle. Each bristle in the brush acts as a small scraper and should be used primarily as such. When a wire brush is used to dig dirt out of corners or as a hammer to break up clusters of scale or rust, the bristles are likely to be bent. When this happens, they are no longer able to scrape effectively. These brushes, or their short bristles relatives, the file cards, are often used to clean the teeth of files. The wire brush is normally used for cleaning threads and gasket surfaces, and for removing rust, paint, dirt, and corrosion from other metal parts.



Figure 87 Wire Brush

CROW BAR

Crow bars are used as a pry bar for moving piping and heavy machinery and equipment.

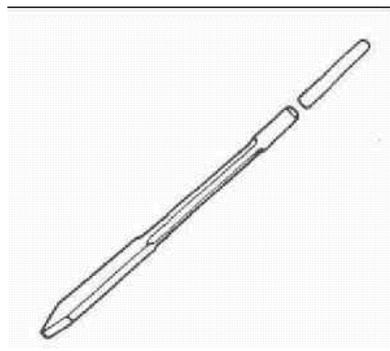


Figure 89 Crow bar.



Figure 88: Goose Neck Bar

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DRIFT PIN

The drift pin is used for aligning two holes of a set of flanges where great force is required to bring the pieces into alignment. They are made of various diameter stock, tapered, and about 6 to 8-inches long, and are intended to be driven by a hammer.



Figure 90 Drift pin

STEEL SQUARE

The steel square is a measuring and gauging device that is constructed like two rules fastened together at right angles. Its primary uses are in aligning and squaring-up pipe, fitting, and flanges for welding; and in laying-out and locating the centers of bends. Many of these squares are imprinted with tables that aid in marking off rafter cuts and bracing lengths. A common size has a body 2 x 24-inches, and a tongue 16 x 1½-inches, and is about 1/8-inch thick.



Figure 91 Steel square

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LEVEL



Figure 92 Standard level

Levels are used to establish true horizontal and vertical positions. The horizontal position is called level and the vertical position is called plumb. The term *level* means any straight line or plane that is parallel to a body of still water. The term *plumb* means perpendicular to the level line. The average large level is about 2-½ feet long and 2-inches wide and contains one or more glass vials

containing a non-freezing liquid. The level vial is set parallel to the main axis. Since the vial is not quite filled with liquid, it contains a bubble of air that is free to move back and forth, always rising to the high point. Two lines are scribed across the vial which indicate when the bubble is in the center of the vial. When the bubble is centered, the level is horizontal. A level may also have a second vial, set at exactly 90 degrees to its main axis, for checking the plumb of vertical members. Both vials operate on the same principle.

To check the accuracy of a level, place it on a flat surface and note the bubble position. Then reverse the ends and again note the bubble position. If the bubble does not line up exactly in the same position each time, the vial is incorrectly set and will not give true readings. Some levels are equipped with adjusting screws for correcting vial inaccuracies. Level bodies are usually constructed of wood, aluminum, or cast iron.

The level is a semi-precision instrument; therefore, it must not be used for any other purpose than determining the inclination of a surface. Never use a level as a pry bar or hammer and take every precaution to keep its face clean and free from nicks. Even a few grains of sand or dirt adhering to one of the level faces can impair its usefulness. Always store a level so that it is in no danger of falling or being bumped by other tools.

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LEVEL (Continued)

Two other types of levels used are the torpedo and the line levels. The torpedo is often used because they have a magnet on one side and can be attached to metal when checking for level or plumb. The line level is used when measuring requires taking measurements from a long level benchmark. The use of the line level requires the use of a string line that is held tight in order to get an accurate reading.



Figure 93: Torpedo Level

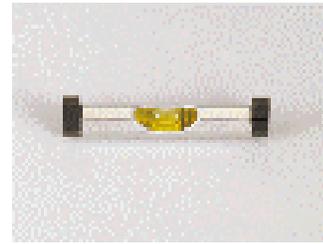


Figure 94: Line Level

BUTCHER KNIFE

The butcher knife is used for cutting rope, cleaning gasket surfaces on flanges and equipment, removing gaskets from between flanges, etc. They are about 10" long and have a wooden handle. They should never be carried in your hand because if you fall you could be injured. The tool room provides a scabbard that is used to carry the butcher knife.



Figure 95

*Our Thanks and Appreciation
to Texas City Refinery
For the Original Design and Development
of this Learning Tool.*

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SELF-STUDY TEST

1. What kind of items are held in a bench vise?
 - A. Items with flat surfaces
 - B. Items with round surfaces
 - C. Items with odd surfaces

2. You should use soft metal jaw covers to protect the _____ of the work?
 - A. Vise
 - B. Individual
 - C. Surface

3. What is the pipe vise especially designed for?
 - A. to handle flat plate
 - B. to handle pipe or round objects
 - C. to handle square stock

4. Name two common types of screwdrivers.
 - A. _____
 - B. _____

5. Can you use pliers or pipe wrench on the shank of a screwdriver?
 - A. Yes
 - B. No

6. The ball-peen hammer is the worker's general purpose hammer.
 - A. True
 - B. False

7. Soft faced hammers are used to prevent damage to the work surface.
 - A. True
 - B. False

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8. Dead blow holders are a soft faced hammer that the head is loaded with?
- A. Dirt
 - B. Plastic
 - C. Shot
9. The main use of a sledge hammer is to do light duty work.
- A. True
 - B. False
10. If needed the handle of a hammer can be used as a soft face to protect the work surface.
- A. True
 - B. False
11. Box-end wrenches are open on the jaws.
- A. True
 - B. False
12. Open-end wrenches are open on the jaws.
- A. True
 - B. False
13. The advantage of the combination wrench is that it has both open-end and box-end wrenches.
- A. True
 - B. False
14. The adjustable wrench is commonly called a monkey wrench.
- A. True
 - B. False

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15. With the adjustable wrench you can use a piece of pipe to get more leverage.
- A. True
 - B. False
16. The spud wrench is used to align flanges with the tapered pin end.
- A. True
 - B. False
17. The pipe wrench is designed exclusively for turning round stock or pipe.
- A. True
 - B. False
18. The pipe wrench is tough and can be used as a hammer.
- A. True
 - B. False
19. The pipe wrench should never be used to pull or bend pipe.
- A. True
 - B. False
20. The striking wrench is designed for use with a hammer on stubborn bolts.
- A. True
 - B. False
21. The strap wrench has a woven strap.
- A. True
 - B. False
22. Non-sparking wrenches are usually made of bronze.
- A. True
 - B. False

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23. The Allen wrench is I shaped.
- A. True
 - B. False
24. The spanner wrench is used to turn hex nuts.
- A. True
 - B. False
25. The face pin wrench is used to remove pins.
- A. True
 - B. False
26. Sockets are similar to the enclosed heads of a box-wrench.
- A. True
 - B. False
27. The ratchet handle is seldom used with a socket set.
- A. True
 - B. False
28. The breaker bar drive is used when a lot of force is needed to break a nut or bolt free.
- A. True
 - B. False
29. The extension bar is an accessory used to get more leverage on ratchet.
- A. True
 - B. False
30. The universal joint adapter has a swivel feature which allows work on nuts which cannot be reached in any other manner.
- A. True
 - B. False

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31. Adapters are used when the size of the socket drive does not match the size of the drive lug.
- A. True
 - B. False
32. The adjustable pliers that are most often used are channel lock pliers.
- A. True
 - B. False
33. Needle nose pliers have long thin pointed jaws.
- A. True
 - B. False
34. Lock wire pliers are used to twist the safety wire that prevents nuts or bolts from coming loose as equipment vibrates.
- A. True
 - B. False
35. Vise grip pliers are pliers used in a vise.
- A. True
 - B. False
36. End nippers have a cutting edge on the end of the pliers.
- A. True
 - B. False
37. Hacksaws are used for cutting various types of metal.
- A. True
 - B. False
38. Some hacksaw blades are made with only the teeth hardened others are hardened entirely.
- A. True
 - B. False

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39. A chisel will cut any metal even those harder than the chisel itself.
- A. True
 - B. False
40. A cold chisel can be used to cut off small bolts.
- A. True
 - B. False
41. The cape chisel has a double beveled cutting edge similar in shape, but smaller in width, than the cold chisel.
- A. True
 - B. False
42. The diamond point chisel has a single bevel cutting edge with the face forming a rough outline of a diamond.
- A. True
 - B. False
43. The round nose chisel has a double cutting round edge.
- A. True
 - B. False
44. Pipe taps are used to cut the internal threads of any pipe joint.
- A. True
 - B. False
45. Flat files are used to sharpen soft scrapers.
- A. True
 - B. False

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46. Rat tail file is a small version of the round file.
- A. True
 - B. False
47. Half round files are made with one side flat and the other side round.
- A. True
 - B. False
48. Three cornered file is primarily used for filing internal angles and for sharpening hand saws.
- A. True
 - B. False
49. A file will cut in both directions.
- A. True
 - B. False
50. A file card is used to clean the file teeth.
- A. True
 - B. False
51. Wedges are used to separate flanges in piping systems.
- A. True
 - B. False
52. One wheel pipe cutters can be used in cramped spaces where only a 1/2 turn can be made on the pipe.
- A. True
 - B. False
53. Packing hooks are used for removing packing in valve stuffing boxes.
- A. True
 - B. False

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54. A wire brush is used to clean the threads of a bolt.
- A. True
 - B. False
55. Crow bars are used as pry bars to move heavy objects.
- A. True
 - B. False
56. A drift pin is used to align Pumps.
- A. True
 - B. False
57. Steel square is used for checking out the steel.
- A. True
 - B. False
58. Levels are used to establish true horizontal and vertical positions.
- A. True
 - B. False
59. Level means any straight line or plane that is parallel to a body of still water.
- A. True
 - B. False
60. The butcher knife is used to cut rope or clean gasket surfaces.
- A. True
 - B. False

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Answers to Self-Study

- | | | |
|--|--------------|--------------|
| 1. A | 25. B. False | 53. A. True |
| 2. C. | 26. A. True | 54. A. True |
| 3. B. | 27. B. False | 55. A. True |
| 4. 1. FLAT BLADE 2. PHILLIPS Note: They may also name the flat blade offset or the Phillips offset. | 28. A. True | 56. B. False |
| | 29. B. False | 57. B. False |
| | 30. A. True | 58. A. True |
| | 31. A. True | 59. A. True |
| | 32. A. True | 60. A. True |
| 5. No | 33. A. True | |
| 6. A. True | 34. A. True | |
| 7. A. True | 35. B. False | |
| 8. C. Shot | 36. A. True | |
| 9. B. False | 37. A. True | |
| 10. B. False | 38. A. True | |
| 11. B. False | 39. B. False | |
| 12. A. True | 40. A. True | |
| 13. A. True | 41. A. True | |
| 14. B. False | 42. A. True | |
| 15. B. False | 43. B. False | |
| 16. A. True | 44. A. True | |
| 17. A. True | 45. A. True | |
| 18. B. False | 46. A. True | |
| 19. A. True | 47. B. False | |
| 20. A. True | 48. A. True | |
| 21. A. True | 49. B. False | |
| 22. A. True | 50. A. True | |
| 23. B. False | 51. A. True | |
| 24. B. False | 52. B. False | |

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Participant Feedback

Return this form your Training Coordinator or to the Learning & Development Services Office at Mail Code B-06.

Please use the following scale to rate each of the items below:

| | | | | | |
|------------------------------|-------------------------|----------------------------|-------------------------|-------------------------|------------------------|
| <i>Excellent</i> 5 | <i>Good</i> 4 | <i>Average</i> 3 | <i>Fair</i> 2 | <i>Poor</i> 1 | <i>N/A</i> 0 |
|------------------------------|-------------------------|----------------------------|-------------------------|-------------------------|------------------------|

With regard to the training material as presented:

- | | Rating |
|---|--------|
| 1. Relationship to operations duties. | _____ |
| 2. Usefulness on the job. | _____ |
| 3. Ease of understanding the materials. | _____ |
| 4. Form of the presentation. | _____ |
| 5. Content of the presentation. | _____ |

Other comments:

Suggestion for module changes/updates:

Thank you for your participation!

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