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ABSTRACT

This self-paced student training module on cutting tools, files, and abrasives is one of a number of modules developed for Pre-apprenticeship Phase 1 Training. Purpose of the module is to enable students to identify and explain the proper use and care of various knives, saws, snips, chisels, and abrasives. The module may contain some or all of the following: a cover sheet listing module title, goal, and performance indicator; study guide/checklist with directions for module completion; introduction; information sheets providing information and graphics covering the module topic(s); self-assessment; self-assessment answers; post assessment; and post-assessment answers. (YLB)

INDIVIDUALIZED LEARNING SYSTEMS

PRE-APPRENTICESHIP PHASE 1 TRAINING

CUTTING TOOLS, FILES AND ABRASIVES

Goal:

At the end of study of this module, the student will be able to identify and explain the proper use and care of various knives, saws, snips, chisels and abrasives.

Performance Indicators:

The student's knowledge will be measured by successfully completing a Self Assessment and a Post Assessment exam covering the topics discussed in this module.

Study Guide

To successfully complete this module, complete the following tasks in the order listed. Check each one off as you complete it.

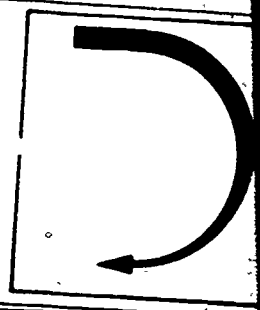
1. ____ Read the Goal and Performance Indicators on the cover of this module. This will inform you of what you are expected to gain from completing this module and how you will demonstrate that knowledge. Read the Introduction section to understand why this module is important.

2. ____ Study the Information section of this module to acquire the knowledge necessary to complete the Self and Post Assessment exams.

3. ____ Complete the Self Assessment exam and compare your answers with those on the Self Assessment Answer Sheet on the page immediately following the exam. Re-study or ask your instructor for help on any questions you have trouble with. The Self Assessment exam will help you determine how well you are likely to do on the Post Assessment.

4. ____ Complete the Post Assessment exam and turn your answers in to your instructor. It is recommended that you score 90% or better on the Post Assessment before going on to the next module.

Introduction

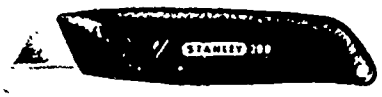


An apprentice must have a knowledge of the basic tools and methods used for cutting materials of various kinds. The cutting tools described in this module are those most commonly used for wood, metal, masonry, tile, linoleum, and plastics. They include knives, hatchets, hand snips or shears, pliers and nippers, chisels, saws and files. Abrasive wheels, stones and sheets can also be considered to be cutting tools. A thorough understanding of how, when and where to use each kind of cutting tool will enable the apprentice to cut materials faster, more effectively and with greater safety.

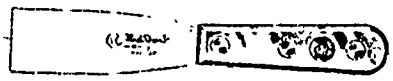
Information

KNIVES

A knife of some kind will be found in every worker's kit. Knives of various kinds serve a wide range of purposes--cutting, scribing, shaving and smoothing, for example. An ordinary pocket knife with two or three sturdy blades has many uses on the job. Some other knives used by various trades are illustrated in Fig. E-35.



UTILITY KNIFE
(REPLACEABLE BLADE)



PUTTY KNIFE

LINOLEUM KNIFE

Fig. E-35. Knives

SAFE USE OF KNIVES

The following rules for the safe use of knives should be observed by every apprentice:

- When using a knife, keep your mind on your work.
- Select the right knife for the job.
- Keep knife blades sharp; dull knives are likely to slip and cause injury or spoil work.
- Make sure that your hands and the knife handle are clean, dry and free of grease before you begin work.
- Cut away from your body rather than toward it.
- Don't use a knife as a rake, a fork, or a hook to stab or pull the piece being worked on.

- Never try to catch a falling knife.
- Hand a knife to fellow workers with the handle toward them, or let them pick it up themselves; never throw it.
- Never use a knife for prying.
- Keep knives in a tool box or in scabbards when they are not in use; don't place them on shelves, edges of tables, or any other place from which they might fall.

HATCHETS

Hand hatchets are often used in the construction trades for cutting away surplus wood, chopping hardened plaster and other jobs where hewing is called for. They are also used for rough nail-on work and nail pulling. Hatchets are made in several shapes and weights, the most commonly used types being the claw hatchet and the half hatchet. The claw hatchet has a flat, slotted head for driving and pulling nails; its blade may have a single-bevel or a double-bevel edge. The half hatchet is a lighter tool than a claw hatchet and its nail-pulling slot is in the blade rather than in the nailing head. (See Fig. E-36.)

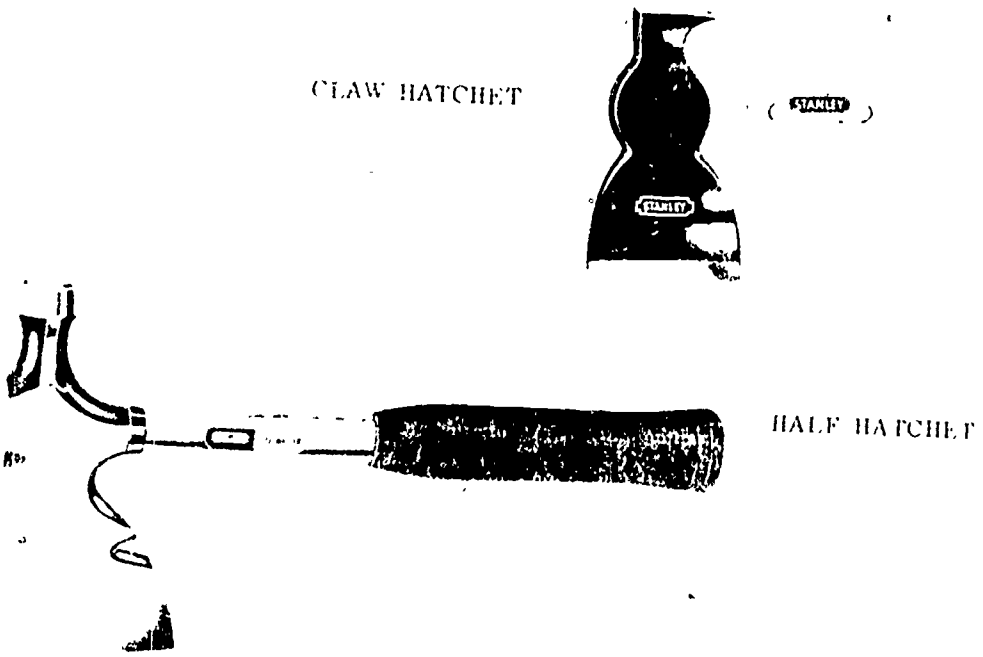


Fig. E-36. Hatchets

A dull hatchet should never be used for cutting or chopping; it can slip and cause injury or make a cut where none was intended. In certain instances, however,

hatchets are an exception to the rule that cutting tools should always be kept sharp. Hatchets are used for rough hammering and ripping as well as for cutting and a hatchet reserved for the rougher kinds of work is safer if dull than if sharp. In putting up stucco netting and in rough nailing, for example, the worker will often use an old hatchet, saving the sharp one for jobs requiring cutting.

The side or cheek of a hatchet is its weakest part and should not be used for pounding. When a hatchet handle needs replacing, it should be shaped, fitted and wedged as in the case of a hammer handle. The blade can be filed to sharpen it and smooth off nicks.

Like all other cutting tools, hatchets must be used and stored in accordance with good safety practice. When cutting with a hatchet, the worker should aim his or her blows carefully; a poorly aimed blow may glance off the work, out of control. A hatchet should never be swung in a direction where a glancing blow could hit the user or a fellow worker. The user's legs and feet are especially vulnerable to injury from glancing hatchet blows. A V-shaped metal shield placed over the blade when the hatchet is not in use will protect its edge and prevent it from inflicting cuts or damaging material.

HAND SNIPS

Hand snips or shears are used for cutting sheet metal, metal lath and other relatively light and soft materials. They are made in a variety of types and sizes for use with materials of different weights and for different kinds of cuts. (See Fig. E-37.)

Hand snips should be kept free of dirt. The bolt should be kept tight enough to allow the blades to close for about three-fourths of their length before resistance to closing is felt. No attempt should be made to cut hardened steel, nails, or wire with hand snips. Extra leverage should never be used on the handles; if the tool cannot be operated with one hand, the work is too heavy for it.

PLIERS AND NIPPERS

In addition to the gripping pliers discussed in a previous section, a wide variety of cutting pliers in several sizes are used in the skilled trades. Some pliers of this type, like the long-nose side-cutting pliers, combine the features of gripping and cutting pliers; others, like the diagonal-cutting pliers, are designed specif-

ically. (See Fig. E-38.) Another useful took in this category is the end-cutting plier or nipper.

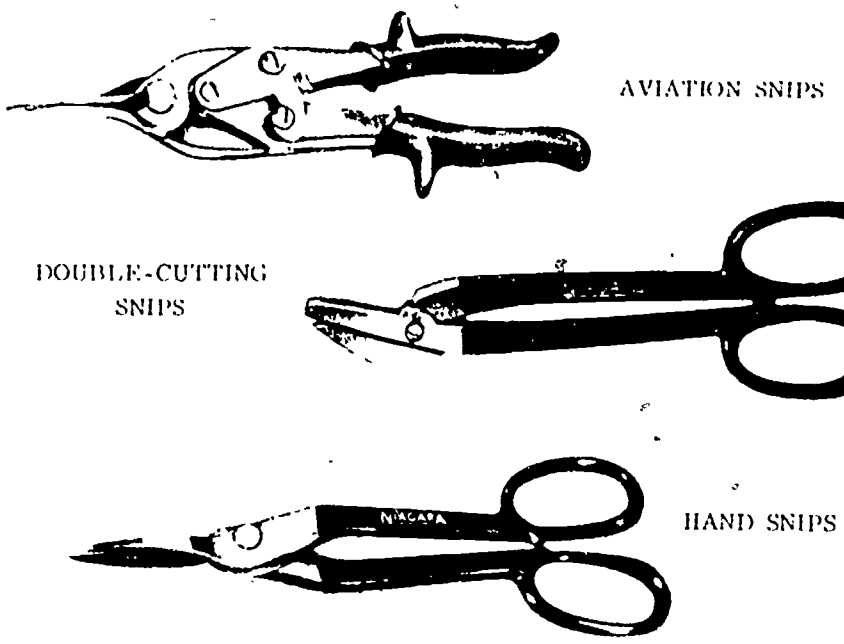


Fig. E-37. Hand snips

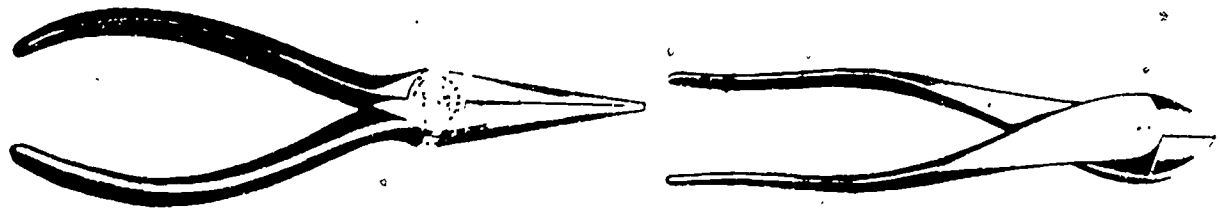


Fig. E-38. Cutting pliers

Pinched fingers can result if the plier is grasped too close to the joint; the tool should be held near the end of the handles. When cutting wire, the mechanic should hold the work and the tool so that the cut-off end of the wire is directed toward the ground; cut-off wire remnants are often propelled away from the pliers at high velocity. Goggles should be worn for this work.

CHISELS

Chisels are made for chipping, carving, or paring materials of various kinds. Wood chisels are made for cutting metal and other heavy materials.

WOOD CHISELS

Wood chisels are classified according to their construction and intended use. A wood chisel having the shank of the blade set into the handle is called a tang chisel; one with the handle set into a socket or ferrule on the shank is called a socket chisel. (See Fig. E-39.) A wood chisel intended for heavy use may be of one-piece, forged construction. The steel blade, which is heat treated to enable it to hold a keen edge, is proportioned according to the intended use of the chisel. A bevel-edge blade is tapered toward the cutting end; a straight-edged blade is uniform in thickness. Some common wood chisels, classified according to blade type, are the parking, butt, firmer and mortise types. Wood chisels intended for light use are pushed with the hand or driven with a light mallet; others, intended for heavier use, may be struck with a hammer.

SOCKET FIRMER CHISEL

TANG BUTT CHISEL

Fig. E-39. Wood chisels

Wood chisels are sized by their blade width, from 1/8 in. to 2 in. When ordering a wood chisel, one must specify not only the size but the other characteristics of the tool as well; for example, a 1/2 in., tang, straightedge, firmer chisel.

If a wood chisel becomes dull, it should be sharpened on an oilstone. A badly worn or nicked chisel should be reground before it is stoned. In grinding, care must be taken to maintain the original bevel angle. A wood chisel is used with its beveled edge down for making light, trimming cuts. With the beveled edge up, the chisel tends to remain on the surface of the wood. Cutting against the grain of the wood will generally result in heavy, splintery cuts; cutting with the grain will produce lighter, cleaner cuts.

CORRECT PROCEDURE FOR USING WOOD CHISELS

The apprentice should observe the following rules for the safe and effective use of wood chisels:

- Hold the work securely in a vise or with clamps to keep it from moving while the

cut is being made.

- Keep the blade of the chisel sharp; dull chisels slip rather than cut.
- When using a chisel, cut in a direction away from your body and keep both hands in back of the cutting edge.
- Control the chisel with the left hand, pressing firmly on the blade; exert cutting force with the right hand.

COLD CHISELS

Cold chisels are thick-bladed tools made for use in conjunction with a mallet or a hammer to cut metals--mild steel, cast iron and sheet metal, for example--and other relatively hard materials. A cold chisel of high-quality alloy steel will cut any metal that is not hardened or tempered; no attempt should ever be made to use a cold chisel to cut drill rod or other hardened-steel items.

Cold chisels are sized by the width of the cutting edge, and they range in length from about 4 in. to as much as 16 in. They are usually manufactured from hexagonal or octagonal stock, but some are made of round, square, or rectangular stock. Cold chisels are classified according to shape, the most popular type probably being the familiar flat cold chisel. Other common types include the cape chisel, the diamond-point chisel and the round-nose chisel. (See Fig. E-40.)

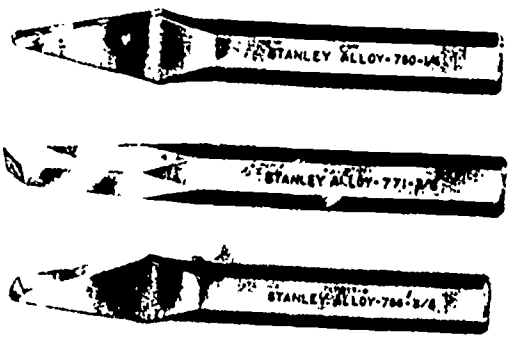


Fig. E-40. Cold chisels

The head of a cold chisel should not be allowed to become feathered or mushroomed with use. A chisel with such a head is dangerous to use until it has been dressed on a grindstone to remove the turned-down metal; the mushroomed metal tends to chip off when the chisel head is struck. The point of a cold chisel should also be kept correctly shaped and sharpened by grinding.

CORRECT PROCEDURE FOR USING COLD CHISELS

The apprentice should observe the following rules for the safe and effective use of cold chisels:

- When using a cold chisel, wear goggles to protect your eyes from flying chips. See that others in the work area are also protected from the hazard of flying chips. Never use a chisel with a mushroomed head.
- Select a chisel of the right size for the job. Whenever possible, use a mallet rather than a hammer to drive the chisel. If the hammer must be used, be sure its size is right for the chisel and be sure the hammer head is tight on the handle.
- Hold the chisel in your left hand, using your right hand for the driving tool. Hold the chisel near its midpoint so that your hand will not get the full force of the blow if you miss.
- Chip in a direction away from your body and don't use more force than is necessary to make the cut. Keep your eye on the cutting edge of the chisel when working.

SAWS

The common saws in widest use in the skilled trades are handsaws and hacksaws. Compass saws and keyhole saws are used for cutting to a curved line in wood or other soft materials. (See Fig. E-41.)

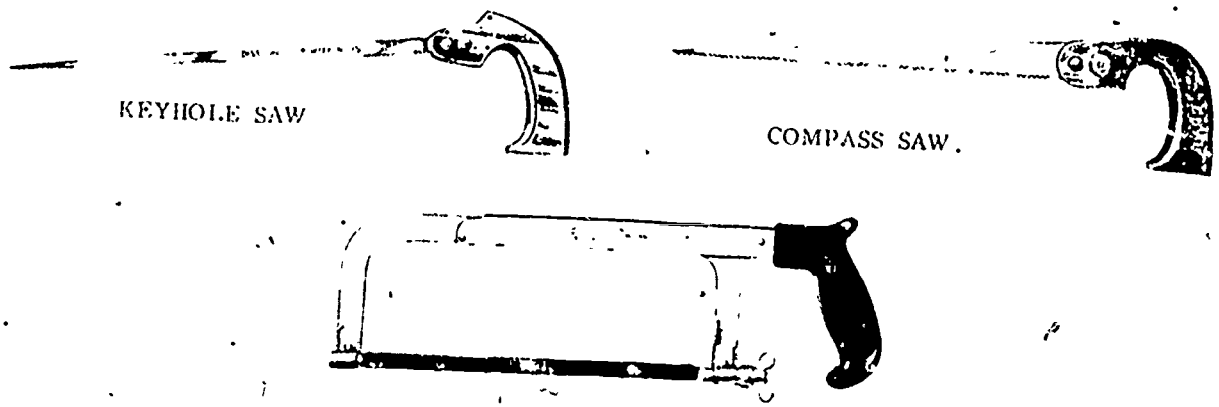


Fig. E-41. Saws

HANDSAWS

The term "handsaw" is generally used to mean either a crosscut saw (a handsaw for

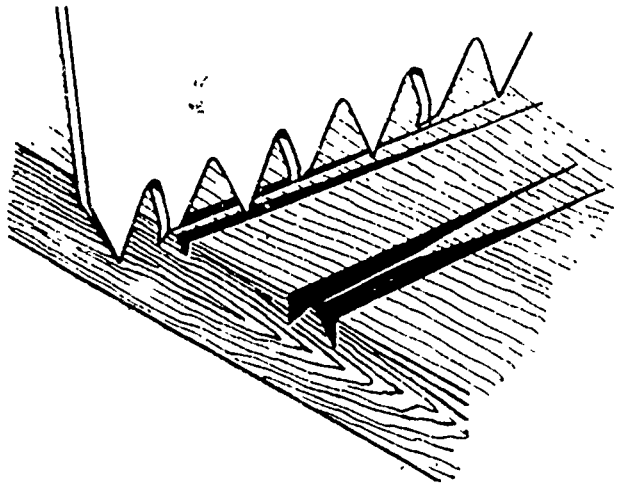
cutting wood across the grain) or a ripsaw (a handsaw for cutting wood with the grain). Handsaws are specified by the length and shape of the blade and the number of tooth points per inch of blade. The coarser the saw, the faster it cuts. The number of points to the inch is usually stamped on the heel of the blade.

The blade of a handsaw is of spring steel, so tempered that it can be filed and set and yet retain its cutting edge. Saw teeth are "set" to prevent the blade from binding in the cut, or kerf. The tips of the teeth are slightly bent, the bend alternating right and left along the teeth so that the cut or kerf will be slightly wider than the thickness of the blade. (See Figs. E-42 and E-43.)

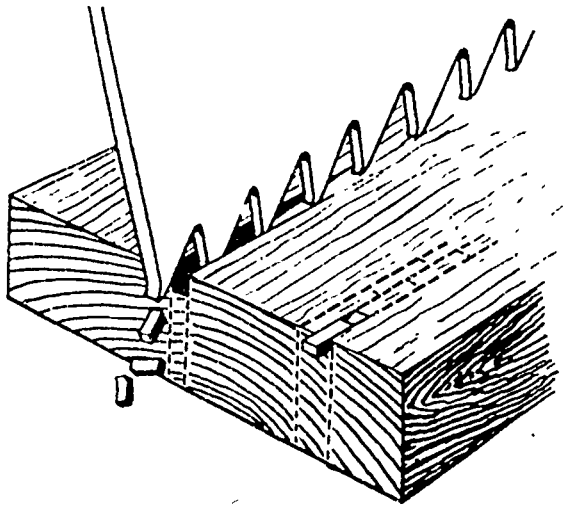
CORRECT USE AND CARE OF HANDSAWS

The mechanic should observe the following rules for the correct use and care of handsaws:

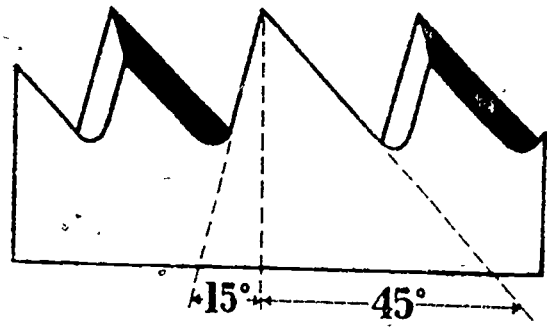
- To avoid sawing into nails or other metal objects, inspect the material before making the cut.
- When starting a cut, guide the saw with the thumb of your free hand held high on the blade. Never place your thumb on the material being cut; if the saw should buckle or jump out of the kerf, your thumb could be slashed.
- Keep the saw moving in a straight line and do not force it heavily through the work. Use just enough pressure to ensure a clean cut with no twisting or binding of the saw.
- When you are through using a saw, hang it up; never throw it down.
- Protect the cutting edge of the saw from accidental contact with other tools and protect yourself and others from accidental contact with the cutting edge. When the saw is not in use, keep the cutting edge covered with a slotted piece of wood.
- After using a saw, wipe it with light oil to keep it from rusting. If slight rust appears, rub the saw down with the fine emery cloth, then oil it.
- Touch up saw teeth with a file from time to time, but remember that the sharpening and setting of saw teeth calls for special tools and special techniques. Directions for refitting saws can be obtained from saw manufacturers.



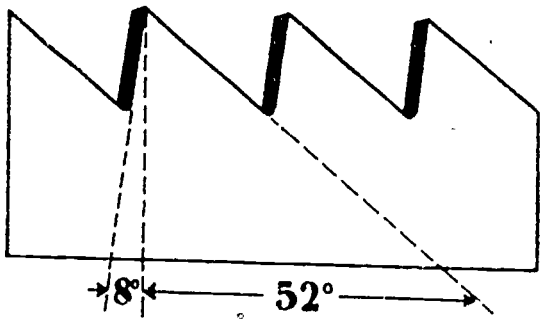
THE CROSSCUT SAW IS MADE FOR CUTTING ACROSS THE GRAIN. IT CUTS ON BOTH THE PUSH AND THE PULL STROKES. THE ALTERNATELY SET TEETH FIRST SCORE THE WOOD AS SHOWN. THEN, AS THE CUT DEEPENS, THEY PARE THE GROOVE AND CLEAR THE SAWDUST FROM THE RESULTING KERF.



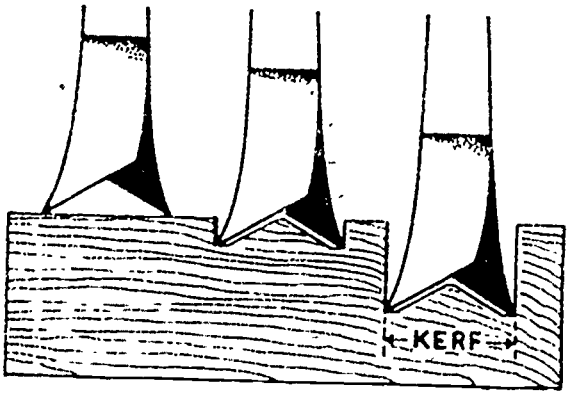
THE RIPSAW IS DESIGNED FOR CUTTING WITH THE GRAIN. THE CHISEL-LIKE TEETH CUT ON THE PUSH STROKE ONLY. SMALL PARTICLES OF WOOD ARE CUT LOOSE ACROSS THE GRAIN AND PUSHED OUT ON ALTERNATE SIDES OF THE KERF, AS SHOWN.



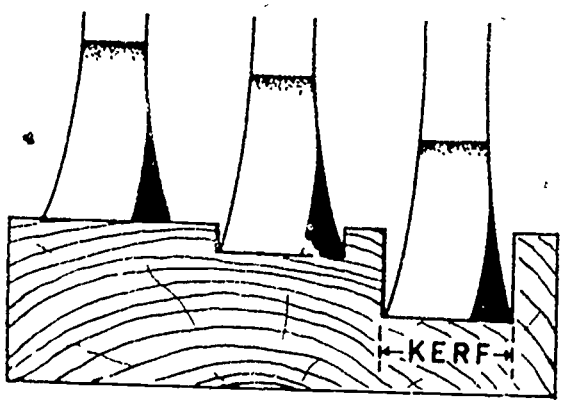
THE FRONT FACE OF A CROSSCUT SAW TOOTH HAS AN ANGLE OF 15°. THE BACK ANGLE IS 45°, AND THE TOOTH EDGES ARE BEVELED ABOUT 24°. THE TEETH THUS HAVE THE APPEARANCE OF A SERIES OF KNIFE POINTS.



THE FRONT FACE OF A RIPSAW TOOTH HAS AN ANGLE OF 8°. THE BACK ANGLE IS 52°. THE TEETH ARE FILED STRAIGHT ACROSS THE FACE, AND THUS HAVE THE APPEARANCE OF A SERIES OF CHISEL EDGES.



A CROSS-SECTION VIEW OF THE PROGRESS OF A CROSSCUT SAW TEETH THROUGH WOOD SHOWS THE KNIFE-LIKE SCORING ACTION, THE PARING ACTION, AND THE FREE CUT.



A CROSS-SECTION VIEW OF THE PROGRESS OF RIPSAW TEETH THROUGH WOOD SHOWS THE CHISEL-LIKE ACTION OF THE TEETH.

Fig. E-42. The crosscut saw

Fig. E-43. The ripsaw

HACKSAWS

The hacksaw is designed for cutting metals of all kinds other than hardened steel. Most hacksaw frames are adjustable to take 8-, 10-, or 12-in. blades. Blades are made with 14, 18, 24 and 32 teeth per inch to suit various metals and metal shapes; the right blade must be selected for the job. (See Fig. E-44.) Two or more teeth of the hacksaw blade should be in contact with the work at all times. If the material to be cut is too thin to allow this, the piece should be clamped between two pieces of wood and the cut then made through the wood and the metal at the same time.

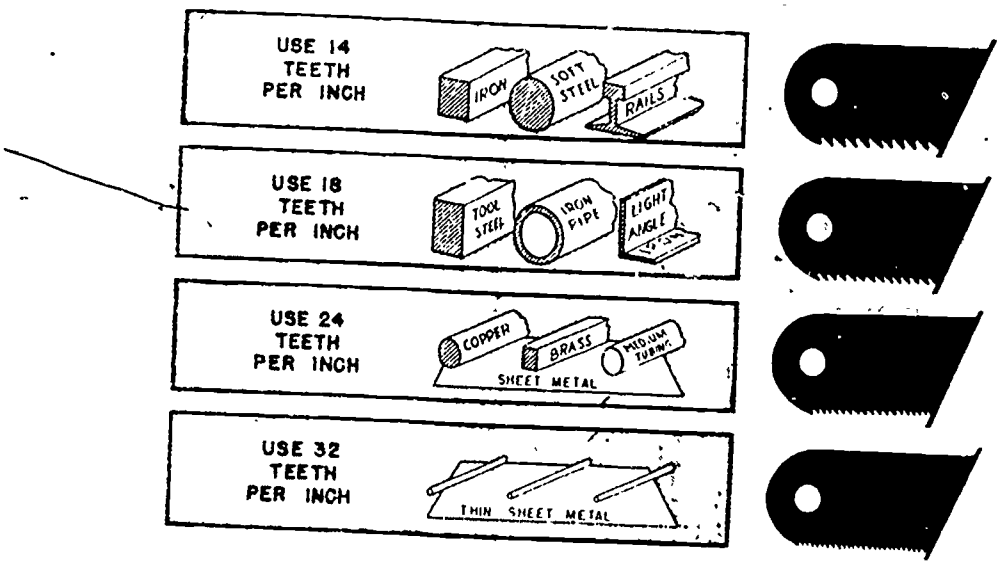


Fig. E-44. Choosing the right hacksaw blade

A hacksaw blade is placed on the frame with its teeth pointing away from the handle so that they cut on the push stroke. The blade must be kept under proper tension in the frame; twisting or bending the blade will break it. Work to be sawed should be securely held in a vise or with clamps. The hacksaw should be held with the right hand on the handle and the left hand on the front end of the frame, then moved evenly and with uniform pressure through the cut. On the return stroke, the blade should be lifted slightly. Cutting should be done at a moderate rate (less than one stroke per second); too fast a rate will cause the blade to overheat and rapidly become dull, with a consequent loss of its cutting effectiveness and speed.

FILES

Files are made in a wide variety of styles and sizes. They are used in all the skilled trades for cutting and smoothing metals and other materials and for

sharpening those tools that do not have hardened or tempered cutting edges.

TYPES OF FILES

Files differ in length, shape and style and in the size, spacing and angle of their teeth. Lengths of files range from 4 to 18 in., the length being measured from the squared-off end to the shoulder. The pointed end of the file that fits into the handle is called the tang. Common shapes of files are round (rat-tail), half-round, flat, square and triangular. The general contour of a file may be tapered or blunt.

Files are specified according to type and coarseness of cut as well as length and shape. Standard cuts are single cut, double cut and rasp cut. Files with curved teeth are used for some special purposes. Single-cut files have one unbroken course of teeth or chisel cuts across the surface, parallel with each other but at an oblique angle to the length of the file. Double-cut files have two courses of teeth crossing each other, one course being finer than the other. In rasps, the teeth are not in parallel rows; each tooth is separate and has the appearance of having been raised by a pointed punch. Rasps are used by plumbers, woodworkers and others for rapid removal of material where finish is not especially important. (See Figs. E-45 and E-46.)

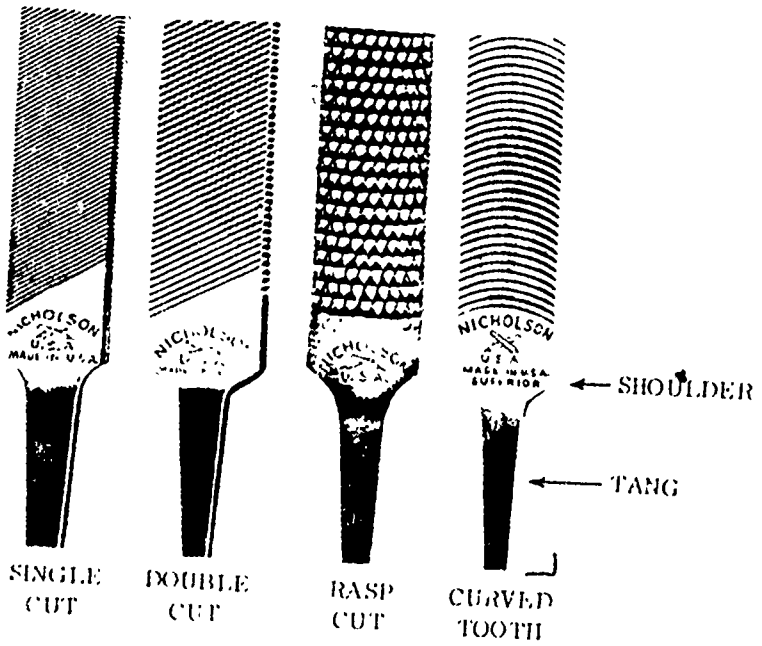


Fig. E-45. Various cuts of files

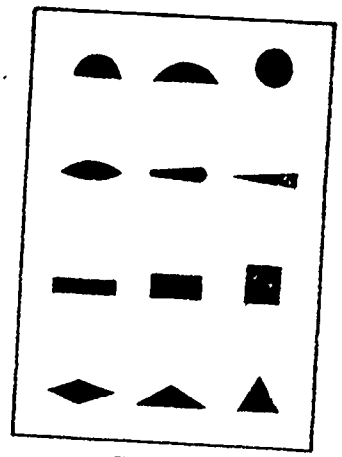


Fig. E-46
Cross sections of files

Terms employed to indicate the coarseness of a file are bastard, second-cut and smooth, with the bastard file being the coarsest type. The coarser the file, the more material it will remove with each file stroke. The longer the file, the coarser are its cuts or teeth; that is to say, a 12-in. smooth file is coarser than an 8-in. smooth file.

CORRECT USE AND CARE OF FILES

The apprentice should observe the following rules for the correct use and care of files:

- Never use a file without a handle; the bare tang of a file is sharp enough to inflict a painful wound if your hand should slip.
- Do not use a handle that is the wrong size for the file. Tighten the file in the handle by holding it with the square end up and striking the butt end against the bench as shown in Fig. E-47. To remove the handle, hold the file blade with the handle up and with the ferrule against the edge of a board; then move the file up and down so that the ferrule will tap against the board and the handle will work loose.
- Ensure that the material to be filed is held securely in a vise or with clamps. Hold the file with both hands and file in the forward direction only, exerting firm but not heavy pressure. (See Fig. E-48.) Raise the file on the return stroke to clear the material. In the case of soft metals such as lead or aluminum, however, draw the file back along the material on the return stroke to clean the soft metal cuttings from the teeth. For fine finishing, rub some chalk on the file; this will act as a lubricant.
- Clean loose material from the file teeth by tapping the end of the file lightly with or against a piece of wood. Do not strike the file with great force; this may damage the teeth or even break the file. Use a file card or brush for more thorough cleaning; brush in the direction of the slant of the teeth. If the teeth become clogged with resinous materials, clean them with a solvent such as turpentine. If oil accumulates on a file, the teeth will become clogged; to remove accumulated oil, rub the file with chalk, then clean it with a file card.
- Never throw a file down on the bench when the job is finished. Keep files separate in storage by standing them upright in a rack having a hole for each file tang; or, if the handles are kept on the tangs between jobs, hang the files by their handles in a rack.

- Files must not be used as hammers, chisels, punches, or prybars; they are made of high-quality, hardened steel to hold good cutting edges and are therefore brittle. The flying pieces of a shattered file can inflict serious injury.

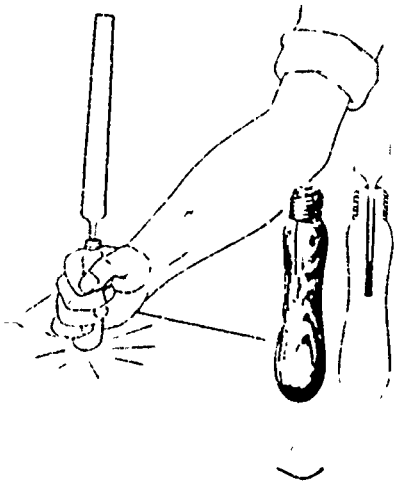


Fig. E-47. Fitting a file handle

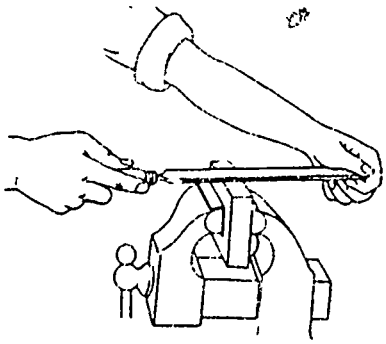


Fig. E-48. Filing in a vise

ABRASIVES

Abrasives are sharp, hard materials that cut or wear away softer materials. Emery, flint and garnet are natural abrasives; aluminum oxide and silicon carbide are artificial or man-made abrasives. Abrasives of many kinds are used in the form of grinding wheels, oilstones and coated abrasives. A coated abrasive is an abrasive sheet (sandpaper, for example) made by bonding small abrasive particles on a paper or cloth backing. Abrasive cloths are not only for hand work but also in place of solid abrasive wheels in certain kinds of grinding and polishing machines.

WHETSTONES

Abrasive stones made for manual sharpening, polishing or rubbing are variously known as whetstones, hones, oilstones, emery stones and slipstones (the latter

are small, wedge-shaped stones with rounded edges).

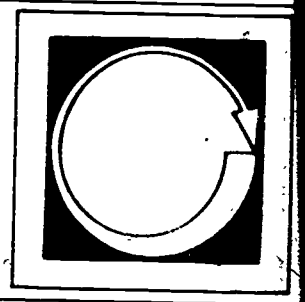
Whetstones are used for putting a sharp edge on cutting tools. Silicon carbide (carborundum) is commonly used in the manufacture of these stones. A whetstone should be treated with light oil to keep it from clogging and thus losing its cutting effectiveness. A badly clogged stone should be flushed with cleaning solvent or, if necessary, rubbed on an abrasive cloth on a flat surface, then flushed clean, dried and reoiled.

GRINDING WHEELS

The grinding wheel should be used to restore the working edges of cold chisels, punches, screwdrivers and drills. Goggles should be worn when a grinding wheel is used, even if the wheel itself has a safety shield. When a grinding wheel is used to sharpen a tool, great care should be taken to keep the tool from overheating; this will ruin the temper of the tool edge, which will then not retain its sharpness. The method most commonly used for cooling the tool during the grinding operation is dipping it frequently in water.

In general, the grinding wheel is not used on tools that require a thin, knifelike edge, such as wood chisels, unless they are in very poor condition and require squaring off or reshaping prior to hand sharpening; the whetstone is the correct sharpening device for such tools. In other tools where the cutting angle and bevel are very important, such as saws and snips, the sharpening should be done by a specialist.

Self Assessment



Read each statement and decide whether it is true or false. Write T if the statement is true; write F if the statement is false.

1. ____ A knife may be used for light prying.
2. ____ For some jobs, a dull hatchet is safer than a sharp one.
3. ____ The side of a hatchet may be used as a mallet.
4. ____ Both hands may be used to operate a hand snip if the material to be cut is unusually thick or hard.
5. ____ Pliers should be held close to the joint.
6. ____ Wood chisels are sized by length.
7. ____ Cold chisels are sized by length.
8. ____ A crosscut saw cuts on both the backward and the forward stroke.
9. ____ In ordering a handsaw, one must specify the number of teeth per inch of the saw.
10. ____ Handsaw teeth should occasionally be touched up with a file.
11. ____ Handsaw teeth are set to cut a kerf wider than the thickness of the blade.
12. ____ A hacksaw blade must have two or more teeth in contact with the work at all times.
13. ____ A mushroom head is acceptable on a small cold chisel.
14. ____ Bastard files are not as coarse as second-cut files.
15. ____ The longer the file, the coarser it is.
16. ____ Files should be oiled.
17. ____ Emery, flint and garnet are natural abrasives.
18. ____ Aluminum oxide and silicon carbide are artificial abrasives.

19. ____ A slipstone is a grinding wheel with a wedge-shaped edge.

20. ____ A wood chisel may be honed on a grinding wheel.

SELF ASSESSMENT ANSWER SHEET

1. F
2. T
3. F
4. F
5. F
6. T
7. F
8. T
9. F
10. T
11. T
12. T
13. F
14. F
15. T
16. F
17. T
18. T
19. F
20. F

Post Assessment

Listed below each numbered item are four possible answers or completing phrases. Decide which of the four is correct, or most nearly correct; then write the corresponding number in the blank space to the left of that item.

1. ____ The tool illustrated below is a:

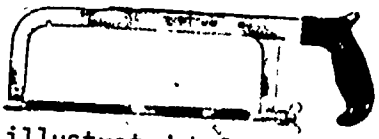
   a. single-cut file
   b. rasp
   c. curved-tooth file
   d. double-cut file

2. ____ The tool illustrated below is a:

   a. utility knife
   b. linoleum knife
   c. smoothing knife
   d. putty knife

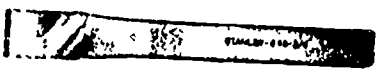
3. ____ The tool illustrated below is a:

   a. hacksaw
   b. compass saw
   c. ripsaw
   d. handsaw



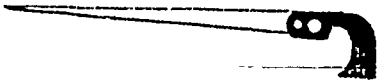
4. ____ The tool illustrated below is a:

   a. punch
   b. butt chisel
   c. cold chisel
   d. paring chisel



5. ____ The tool illustrated below is a:

   a. hacksaw
   b. compass saw
   c. bandsaw
   d. ripsaw



6. ___ The tool illustrated below is a:

a. wood rasp
b. crosscut file
c. single-cut file
d. double-cut file

7. ___ Wood chisels are sized by:

a. overall length
b. thickness of blade
c. width of blade
d. length of blade

8. ___ Both hands are on the saw when a worker uses a:

a. ripsaw
b. handsaw
c. hacksaw
d. keyhole saw

9. ___ Which of the following rules does not apply to a hacksaw?

a. Do not twist the blade.
b. Hold the work securely in a vise.
c. Insert blade so that teeth point away from the handle.
d. Do not saw metal.

10. ___ Which one of the following tools can be used to chip, carve and pare material?

a. draw knife
b. chisel
c. saw
d. rasp

11. ___ Which one of the following saws should not be used to cut across the grain?

a. crosscut saw
b. ripsaw
c. keyhole saw
d. compass saw

12. ___ Which one of the following tools can be used for cutting, ripping and hammering?

a. hatchet
b. claw hammer
c. chisel
d. file

13. ___ The terms "cape," "diamond-point," "round nose," and "flat" apply to:

a. snips
b. files
c. wood chisels
d. cold chisels

14. ___ A file is sized by:

a. blade length to shoulder
b. width and breadth of blade
c. width of cutting edge
d. diameter

15. ___ When a steel tool is being ground, the temper can be preserved by:

a. keeping the metal hot
b. dipping the tool in water
c. rubbing the tool with oil
d. using chalk on the grinder