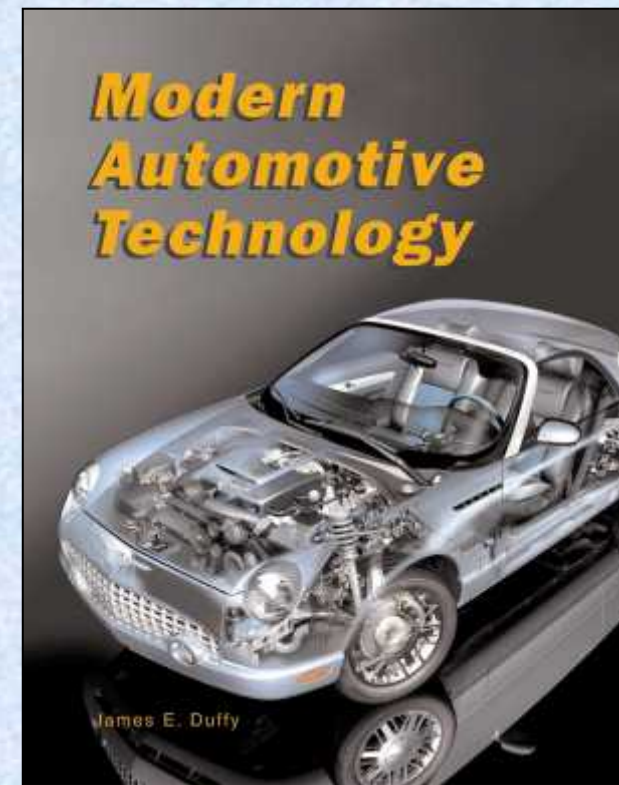


powerpoint for
**Modern Automotive
Technology**

by
Russell Krick



Publisher
The Goodheart-Willcox Co., Inc.
Tinley Park, Illinois

Chapter 3

Basic Hand Tools

Contents

(13 Topics)

- Tool rules
- Tool storage
- Wrenches
- Screwdrivers
- Pliers
- Hammers
- Chisels and punches

Contents

- Files
- Saws
- Holding tools
- Cleaning tools
- Probe and pickup tools
- Pry bars

Tool Rules

There are several basic tool rules that should be remembered

Purchase Quality Tools

- ❑ With tools, you usually get what you pay for
- ❑ Quality tools are lighter, stronger, easier to use, and are usually covered by a warranty

Keep Tools Organized

- ❑ For each tool to be located quickly, the tools should be neatly arranged
- ❑ There should be a place for every tool, and every tool should be in its place

Keep Tools Clean

- ❑ Wipe tools clean and dry after each use
- ❑ Greasy or oily tools can be dangerous!
 - it is easy to lose your grip on a dirty tool
- ❑ Cleaning also prevents corrosion from forming on the tools

Use the Right Tool for the Job

- ❑ Even though several different tools may be used to loosen a bolt, usually one will do a better job
- ❑ One tool may be faster, grip the bolt better, be less likely to break, or require less physical effort

Tool Storage

☐ Toolbox

- stores and protects a technician's tools when not in use

☐ Toolbox Parts

- lower roll-around cabinet holds bulky, heavy tools
- upper tool chest holds commonly used tools in easy reach
- small carrying tray is placed in the upper tool chest and allows tools to be taken to the vehicle more easily

Toolbox

Never open more than one drawer at a time



Toolbox Organization

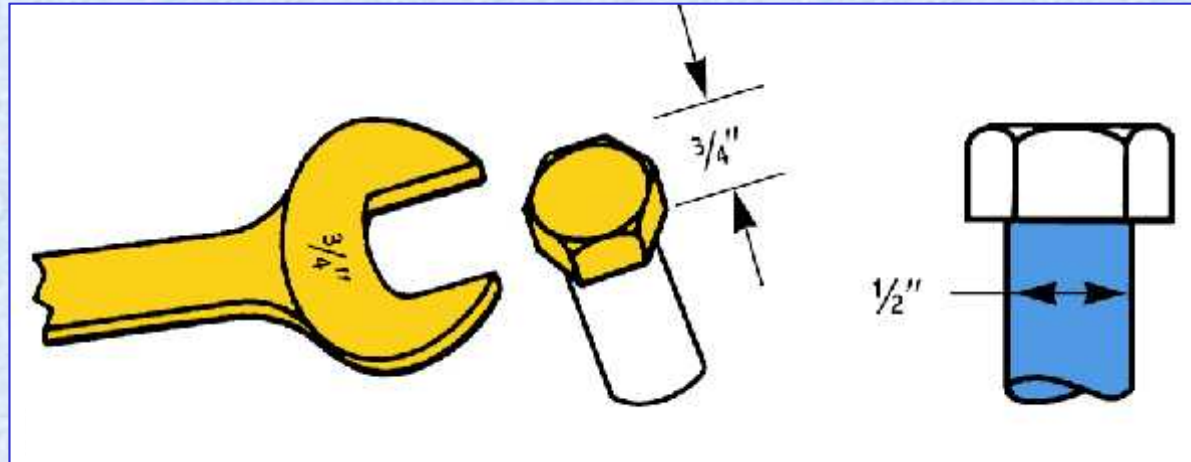
- ❑ Related tools are usually kept in the same drawer
 - various types of hammers may be stored in one drawer and all screwdrivers in another
- ❑ Small or delicate tools should not be kept with large, heavy tools to prevent damage
- ❑ Tool holders help organize small tools

Wrenches

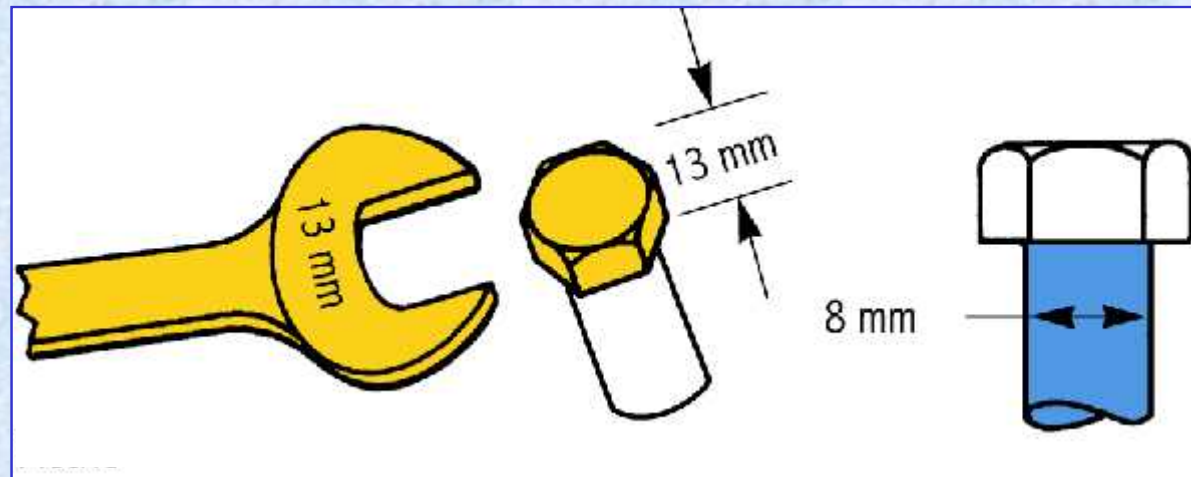
- ❑ Used to install and remove nuts and bolts
- ❑ Available in both conventional (inch) and metric (millimeter) sizes
 - size is stamped on the side of the wrench
- ❑ Wrench size is determined by measuring across the wrench jaws

Wrench Sizes

Customary



Metric



Rules for Wrench Use

- ❑ Always select the right size wrench
 - wrench must fit the bolt head snugly
- ❑ Never hammer on a standard wrench
 - use a longer wrench with more leverage or a special slug wrench, which is designed to be used with a hammer

Rules for Wrench Use

- ❑ When possible, pull on the wrench
 - if the wrench slips, you are less likely to hurt your hand
- ❑ Never use a steel bar or pipe to increase the length of a wrench
 - excess force can bend or break the wrench

Open-End Wrench

- ❑ Has an open jaw on both ends
- ❑ Each end is a different size and set at an angle
- ❑ Angle allows the open-end wrench to turn bolts and nuts with little wrench swing space
- ❑ Wrench can be turned over between each swing to get a new “bite” on the bolt head

Box-End Wrench

- Completely closed on both ends
- Will not round off bolt heads as easily as an open-end wrench
- Available with either 6- or 12-point openings

Combination Wrench

- ❑ Has a box-end jaw on one end and an open end on the other
- ❑ Both ends are usually the same size
- ❑ Provides the advantage of two types of wrenches for the price of one

Line Wrench

- ❑ Also called a tubing wrench or flare nut wrench
- ❑ Box-end wrench with a small opening or split in the jaw
- ❑ Opening allows the wrench to be slipped over fuel lines, brake lines, or power steering lines
- ❑ Prevents damage to soft fittings

Hand Wrenches



A. Open-end

B. Box-end

C. Combination

D. Tubing or line wrench

Socket Wrench (Socket)

- ❑ Cylinder-shaped, box-end tool
- ❑ One end fits over the fastener, while the other end has a square hole that fits on a handle used for turning



Socket Terms

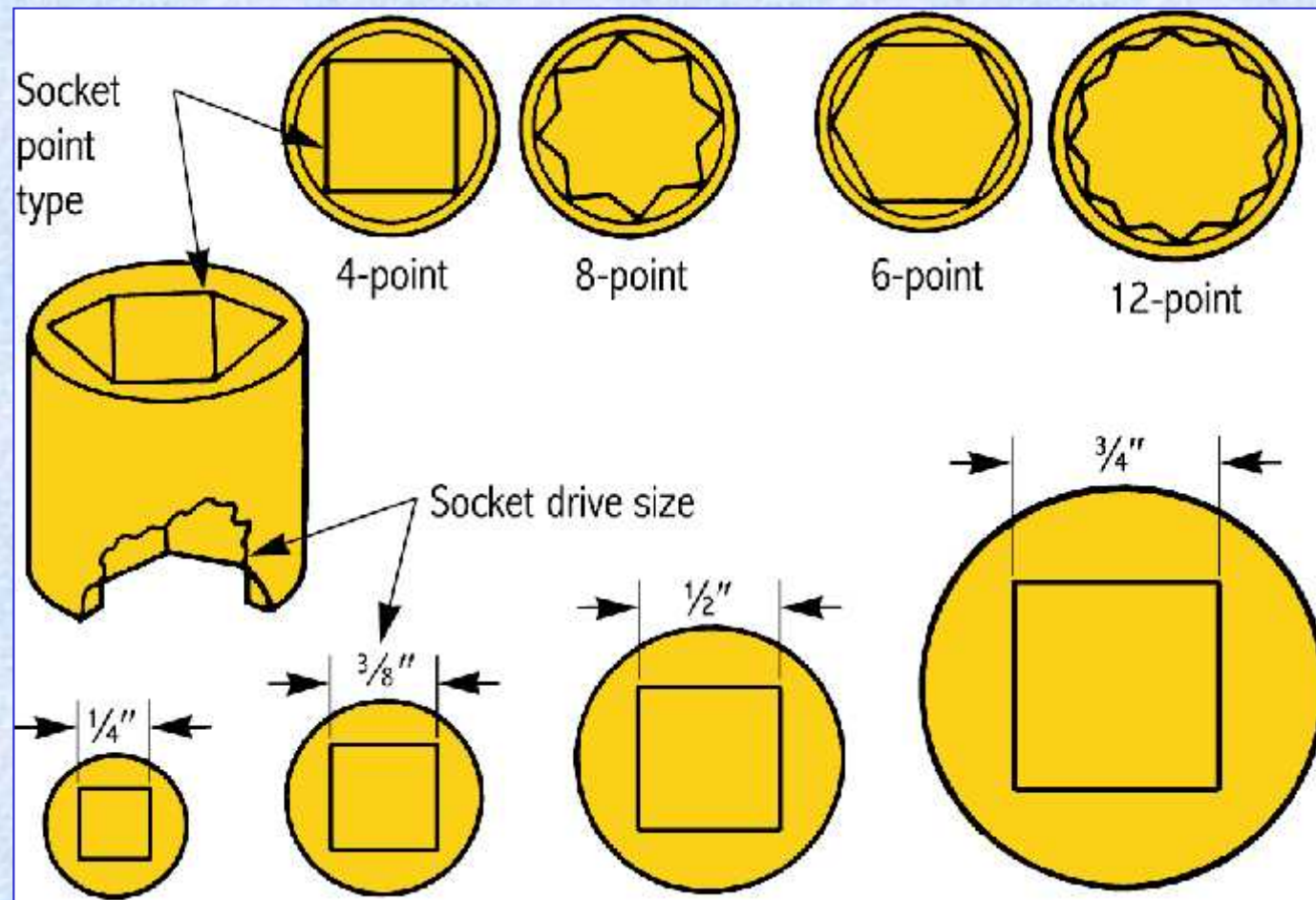
□ Drive size

- size of the square opening for the handle
- common drive sizes are 1/4", 3/8", 1/2", and 3/4"

□ Points

- configuration of the box for the bolt head
- 4-point, 6-point, 8-point, and 12-point sockets are available

Socket Terms

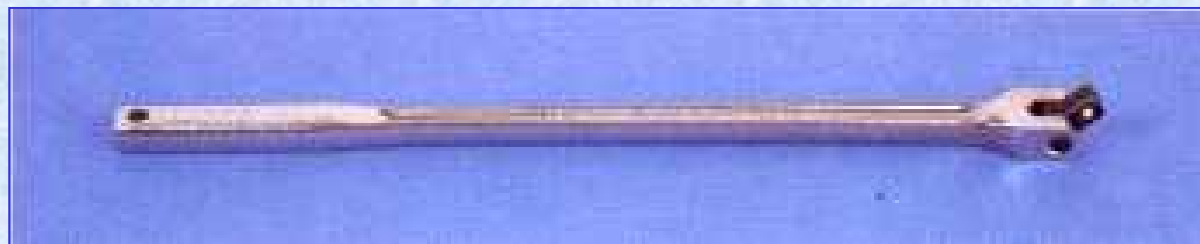


Socket Handles

- Ratchet



- Breaker bar or flex handle

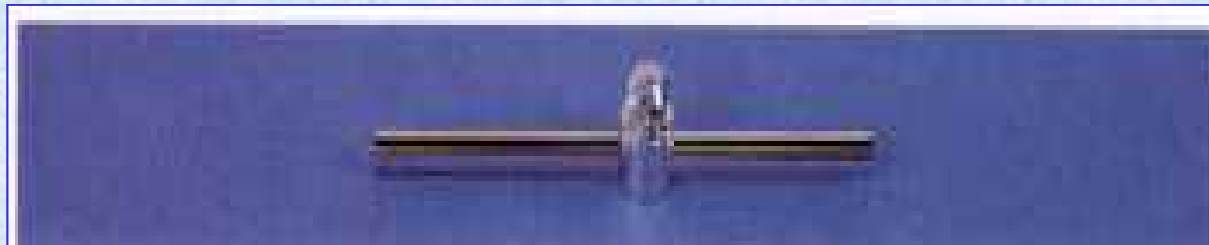


Socket Handles

- Speed handle



- T-handle

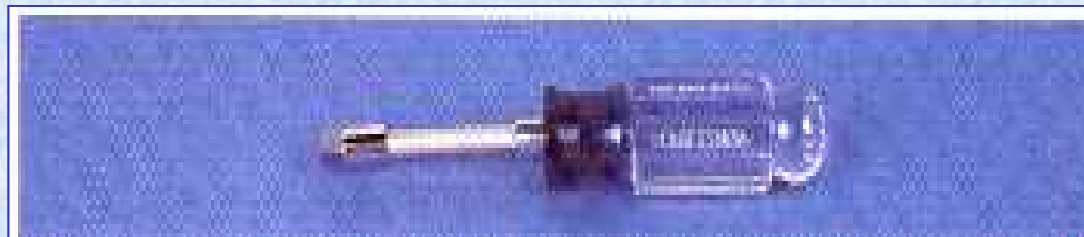


Socket Handles

- Torque wrench



- Flexible driver



Extensions



Used between a socket and its handle

Universal Joint



Swivel that lets the socket wrench reach around obstructions

Adjustable (Crescent) Wrench

- ❑ Has jaws that can be adjusted to fit different size bolt and nut heads
- ❑ Used only when other type wrenches will not fit



Pipe Wrench

- ❑ Adjustable wrench used to grasp cylindrical objects
- ❑ Toothed jaws actually dig into the object



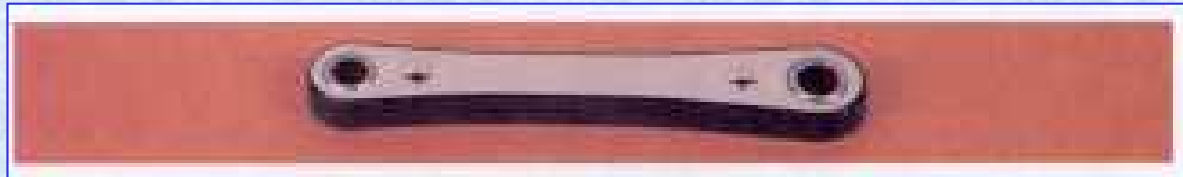
Allen Wrench

- ❑ Hexagonal shaft-type wrench
- ❑ Used to turn set screws on pulleys, gears, and knobs

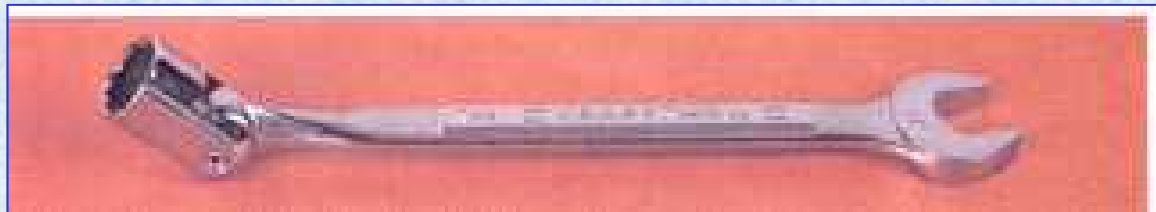


Specialty Wrenches

- Ratchet wrench



- Flex-combination



- Half-moon

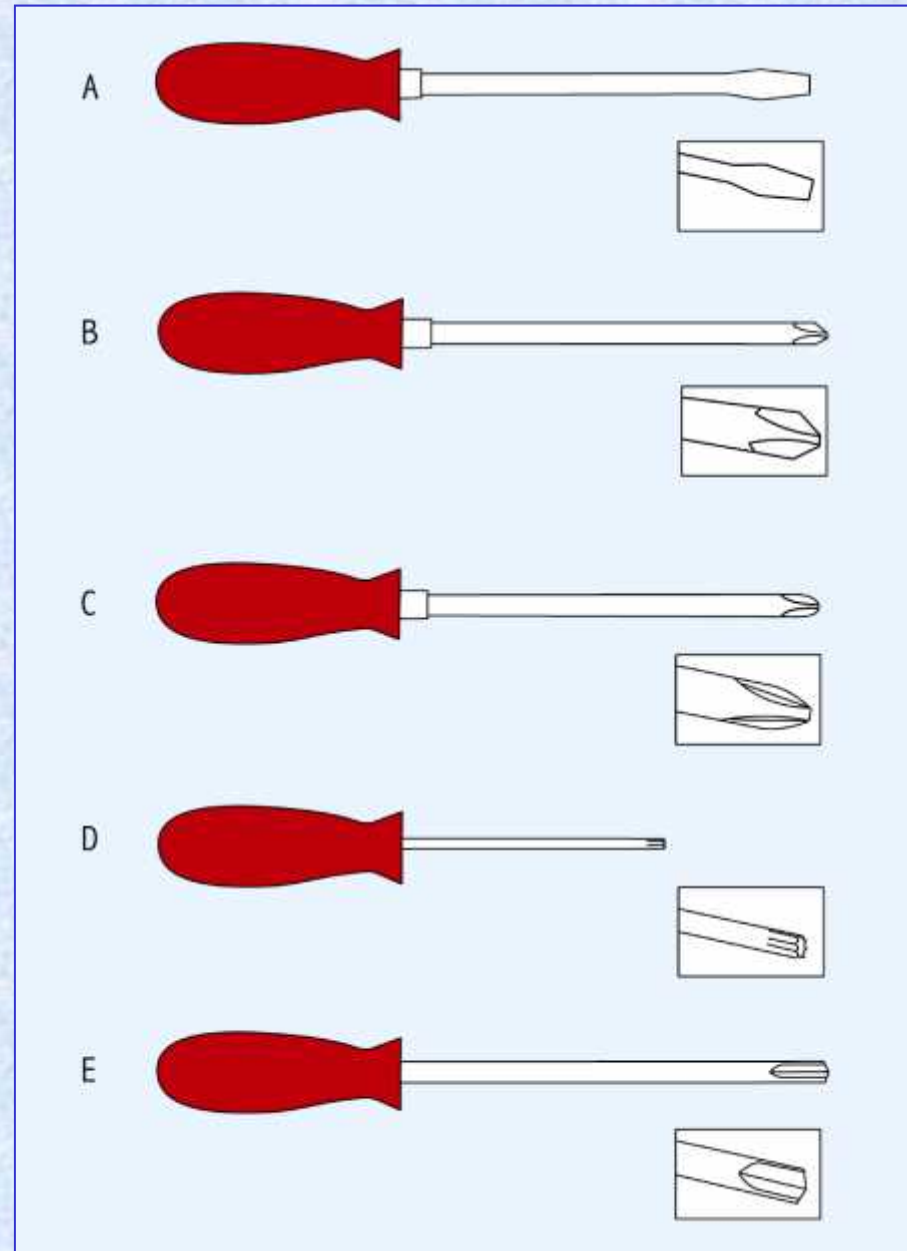


Screwdrivers

- ❑ Used to remove or install screws
- ❑ Available in many shapes and sizes

Screwdriver Types

- A. Standard
- B. Phillips
- C. Reed and Prince
- D. Torx
- E. Clutch



Screwdriver Types

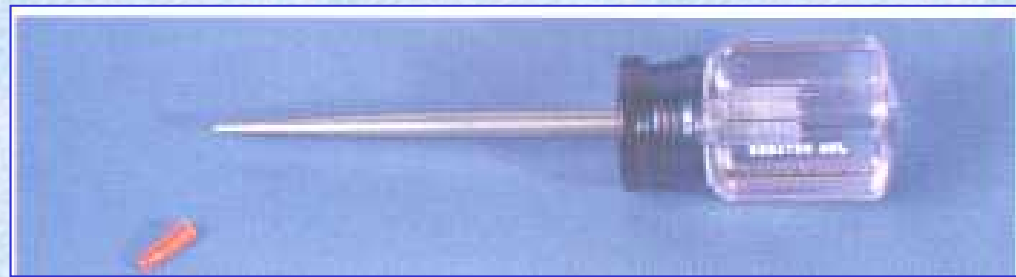
- Offset



- Stubby



Screwdriver Types



○ Awl

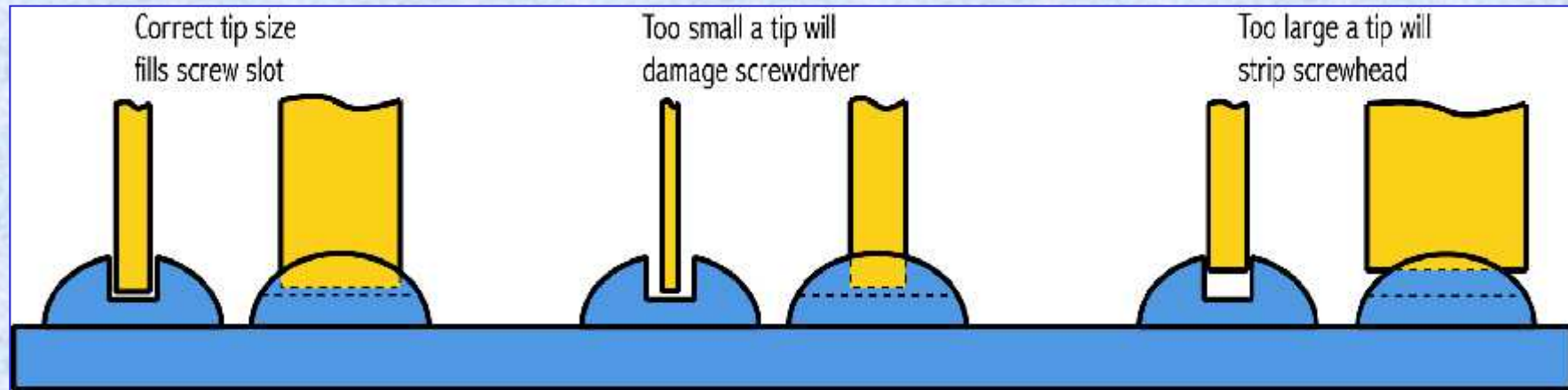
○ Starting screwdriver

Impact Driver

Used to loosen stubborn fasteners. When struck with a hammer, the driver exerts powerful turning and downward forces.



Selecting a Screwdriver



Screwdriver tip must fit in the slot perfectly

Pliers

- Used to grip, cut, crimp, hold, and bend various parts
- Never use pliers when another type tool will work
- Pliers can nick and scar a part

Combination (Slip Joint) Pliers



Slip joint allows the jaws to be adjusted to grasp different size parts

Rib Joint Pliers



Also called channel lock pliers or water pump pliers. Open extra wide for holding very large objects.

Needle Nose Pliers



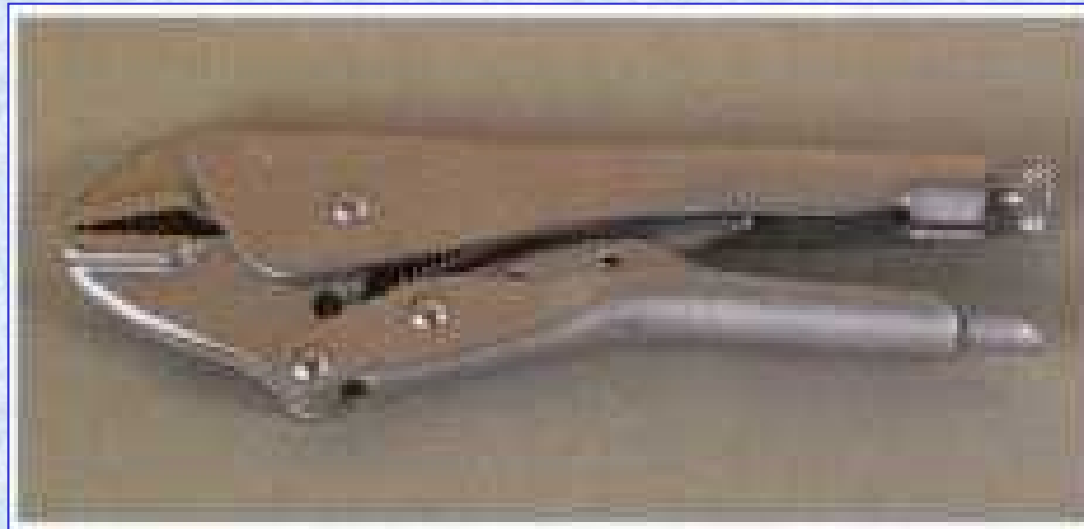
Excellent for handling extremely small parts or reaching into highly restricted areas

Diagonal Cutting Pliers



Jaw shape allows these pliers to cut items flush with an adjacent surface

Locking Pliers (Vise Grips)



Clamp onto and hold a part. Sometimes used to unscrew fasteners with stripped or rounded heads.

Snap Ring Pliers



Sharp, pointed tips are useful for installing and removing special clips called snap rings

Hammers

Various types of hammers are used for operations that involve striking a tool or part

Rules for Hammer Use

- Select the right size hammer
- Always check that the hammer head is tight on the handle
- Use a brass, plastic, or dead blow hammer on parts and tools that can be damaged by a steel hammer
- Grasp the hammer near the end of the handle and strike the part or tool squarely

Ball Peen Hammer



Flat surface is for general striking. Round end is for shaping metal parts, such as sheet metal or rivet heads

Sledge Hammer



Heavy hammer that produces powerful blows

Brass Hammer



Provides a soft, heavy head. Head deforms to protect the part surface from damage.

Plastic (Rawhide) Hammer



Light hammer with a soft head. Used where light blows are needed to prevent part breakage or damage.

Rubber Mallet



Recommended on many sheet metal or plastic parts, such as moldings and wheel covers

Dead Blow Hammer

- ❑ Features a plastic-coated, metal face
- ❑ Filled with small metal balls (lead shot)
- ❑ Extra weight prevents a rebound of the hammer when striking
- ❑ Plastic coating prevents surface damage

Chisels and Punches

□ Chisels

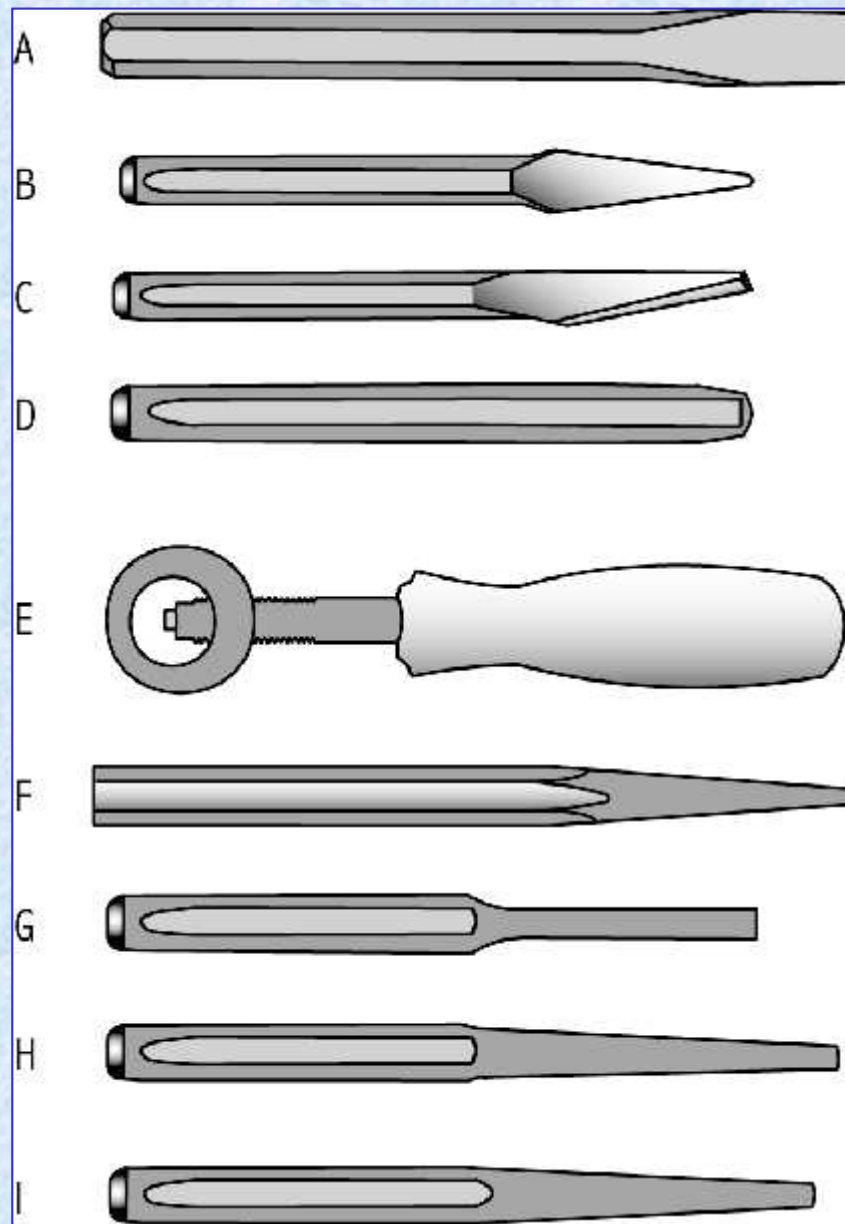
- used for cutting off rivet heads and damaged or badly rusted nuts and bolts

□ Punches

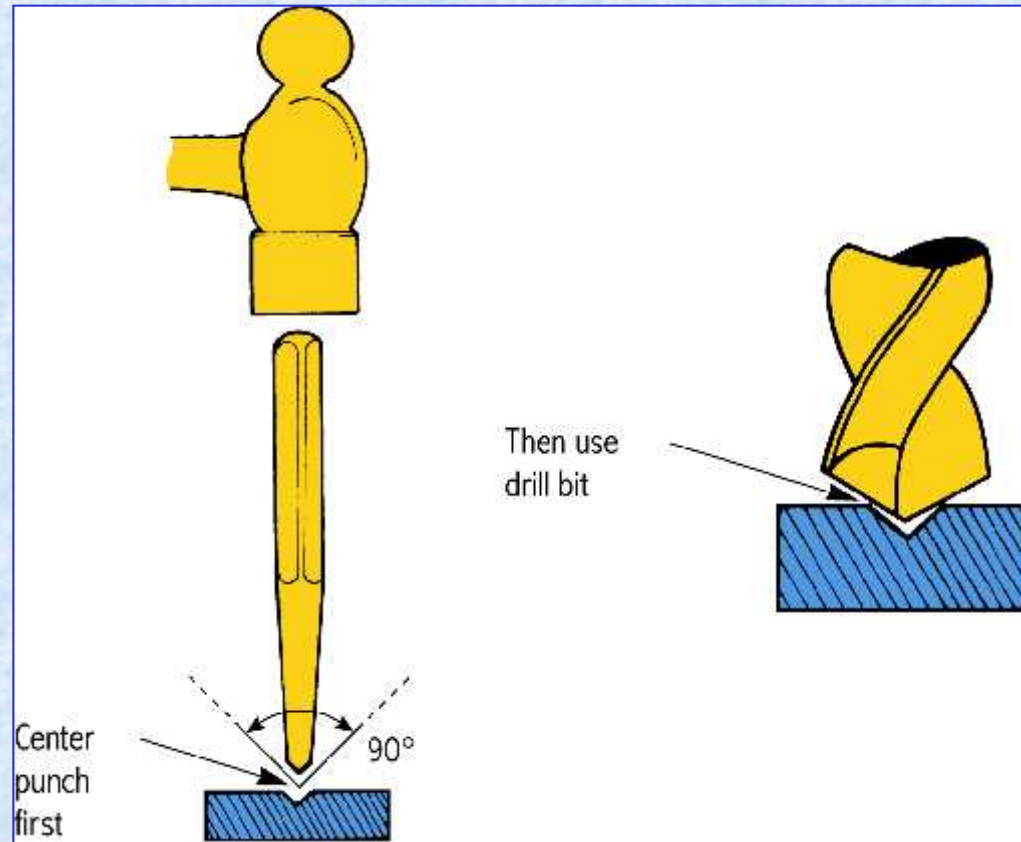
- used to mark or make an indentation in metal or to drive parts like pins or bolts out of holes

Chisels and Punches

- A. Flat chisel
- B. Cape chisel
- C. Round-nose chisel
- D. Diamond-point chisel
- E. Holder
- F. Center punch
- G. Pin punch
- H. Long, tapered punch
- I. Starting punch



Center Punch



Used to mark parts for reassembly and to start a hole before drilling

Starting (Drift) Punch

- ❑ Has a strong, tapered shank that can withstand moderate blows
- ❑ Used to drive pins, shafts, and metal rods part of the way out of a hole

Pin Punch

- ❑ Used after the starting punch to push a pin, shaft, or rod out of a hole
- ❑ Has a straight shank that can fit into the bore as the part is driven out

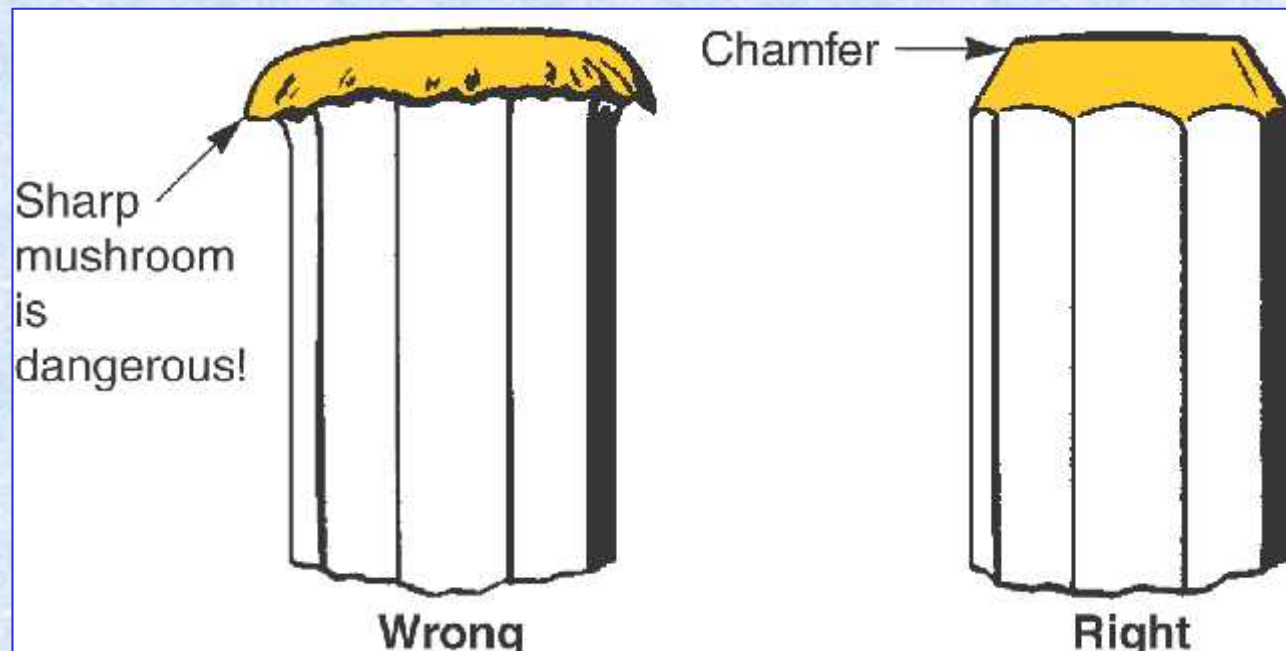
Aligning Punch

- ❑ Has a long, tapered shape
- ❑ Handy for lining up parts during assembly
- ❑ Punch is inserted into holes in mating parts and then wiggled to match up the holes

Chisel and Punch Rules

- ❑ Use the largest punch or chisel that will work
- ❑ Keep both ends of a chisel or punch properly ground and shaped
 - after prolonged hammering, the top of a chisel or punch can become deformed and enlarged (mushroomed)

Chisel and Punch Rules



Grind off the mushroom and
form a chamfer

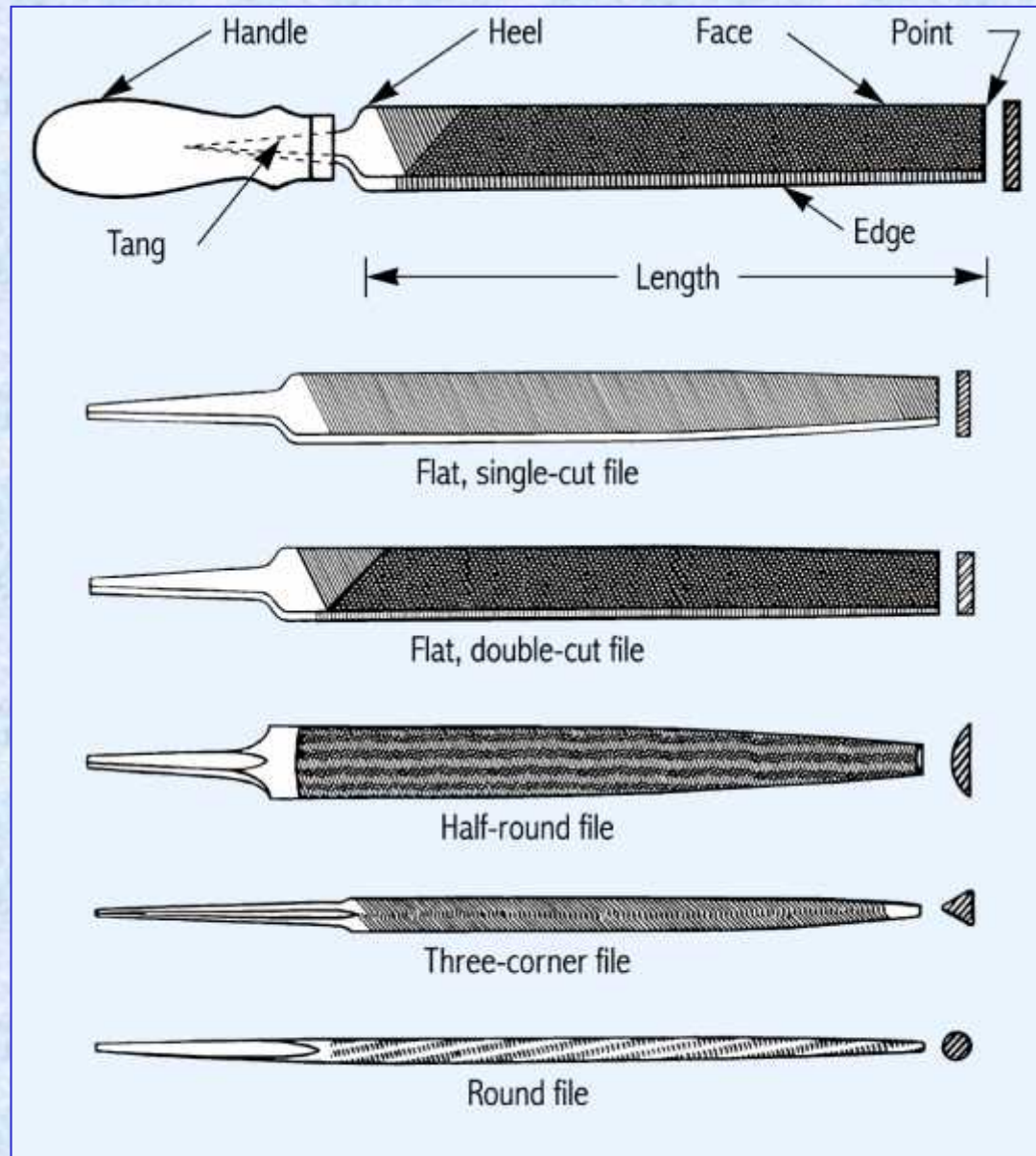
Chisel and Punch Rules

- ❑ When grinding a chisel or punch, grind slowly to avoid overheating the tool
 - overheating can cause the tool to become soft
- ❑ Wear eye protection when using or grinding a chisel or punch

Files

- ❑ Remove burrs, nicks, and sharp edges and perform other smoothing operations
- ❑ Useful when only a small amount of material must be removed

Files



File Grades

❑ Coarse file

- provides large cutting edges
- used on soft materials, such as plastic, brass, and aluminum

❑ Fine file

- provides small cutting edges
- produces a smoother surface
- used on harder materials, like cast iron or steel

File Safety Rules

- Never use a file without a handle securely attached
- To prevent undue file wear, apply pressure only on the forward stroke
- When filing, place one hand on the handle and the other on the file tip

File Safety Rules

- ❑ Do not file too rapidly
 - one file stroke every second is fast enough
- ❑ If a file becomes clogged, clean it with a file card
- ❑ Never hammer or pry with a file

Saws

- ❑ A hacksaw is the saw most frequently used by a technician
- ❑ Various blade lengths can be mounted in an adjustable frame
 - blade teeth should point away from the handle
- ❑ Select the appropriate blade for the job
 - at least two saw teeth should contact the material being cut

Using a Hacksaw



Press down lightly on the forward stroke.
Use 50-60 strokes per minute.

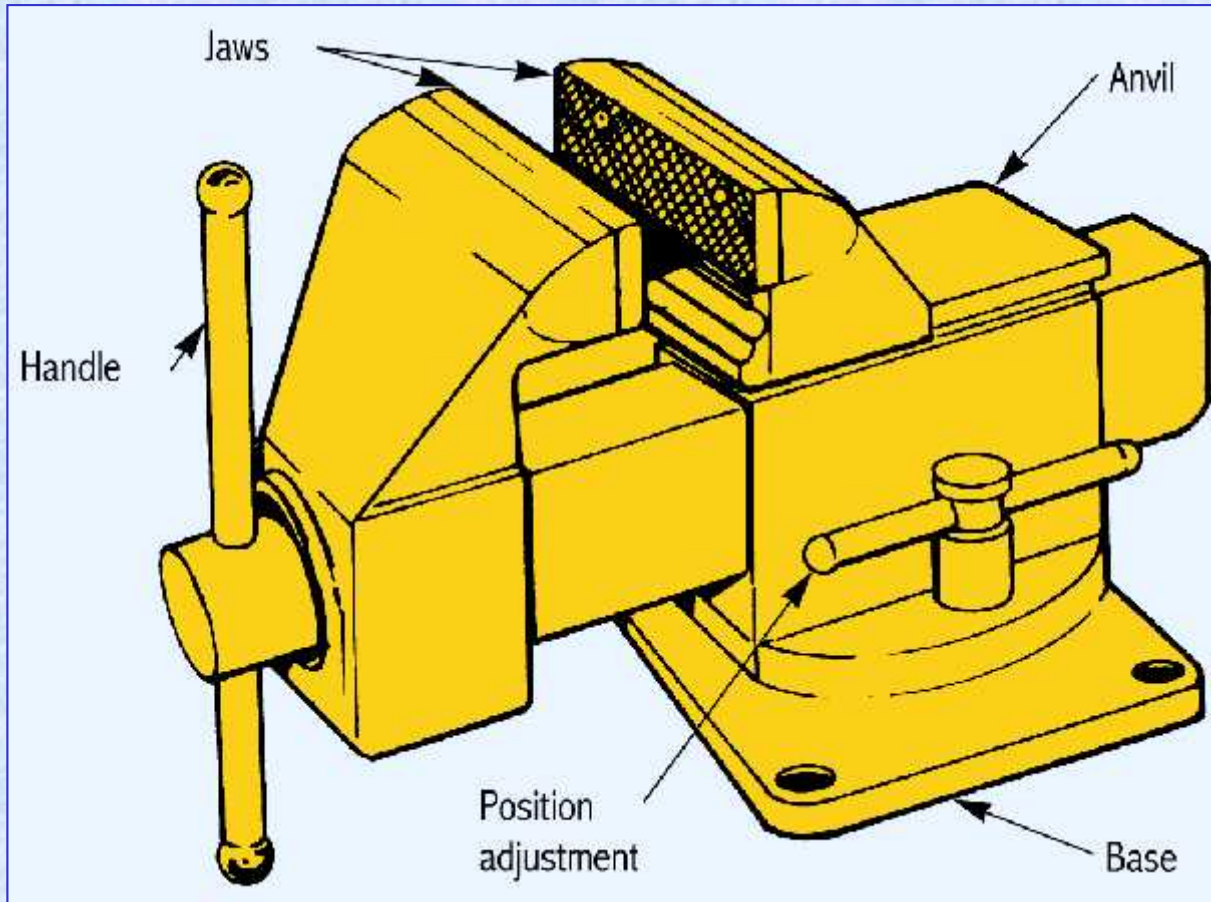
Holding Tools

- ❑ There are several different types of tools used for holding objects in the automotive shop
- ❑ These tools include:
 - vise
 - C-clamp
 - stand
 - holding fixture

Vise

- ❑ Mounted on a workbench
- ❑ Used to hold parts during cutting, drilling, hammering, and pressing operations
- ❑ Vise caps or wood blocks should be used when mounting precision parts in a vise
 - vise caps are soft metal jaw covers

Vise

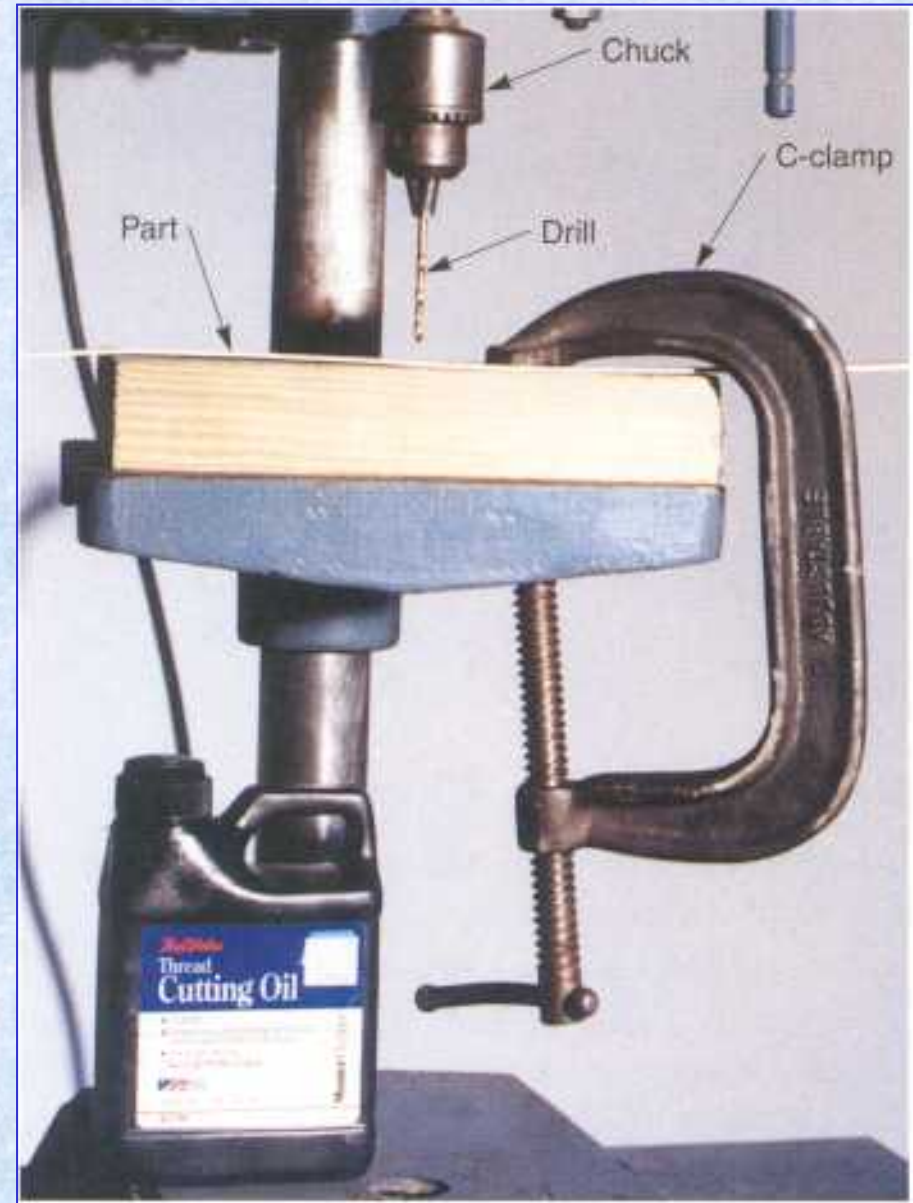


Rules for Vise Use

- Never hammer on a vise handle to tighten or loosen the vise
- Keep the moving parts of the vise clean and oiled
- Wear safety glasses when using a vise
- Be careful not to damage parts in the jaws of a vise

C-Clamp

Holds parts on a work surface when drilling, filing, cutting, or welding



Stands and Holding Fixtures

- ❑ Used to secure heavy or clumsy parts while working
- ❑ Cylinder head stands, transmission fixtures, rear axle holding stands, and others all make your work safer and easier

Cylinder Head Stand



Holds the head in position during valve
and seat work

Cleaning Tools

- ❑ There is an old saying, “if you do the job right, you will spend most of your time cleaning parts”
- ❑ Dirt is a major enemy of a vehicle
 - one grain of sand can cause a major breakdown by clogging a passage or scarring a part

Cleaning Tools

❑ Scrapers

- remove grease, gaskets, sludge, dried oil, and carbon on parts
- used on flat surfaces
- when using a scraper, never scrape toward your body and keep your free hand out of the way

❑ Brushes

- used to remove light rust and dirt on parts

Probe and Pickup Tools

- Pickup tools are needed when bolts, nuts, or other small parts are dropped and cannot be reached by hand
- A mirror probe can be helpful during inspection of hard-to-reach areas

Magnetic Pickup Tool



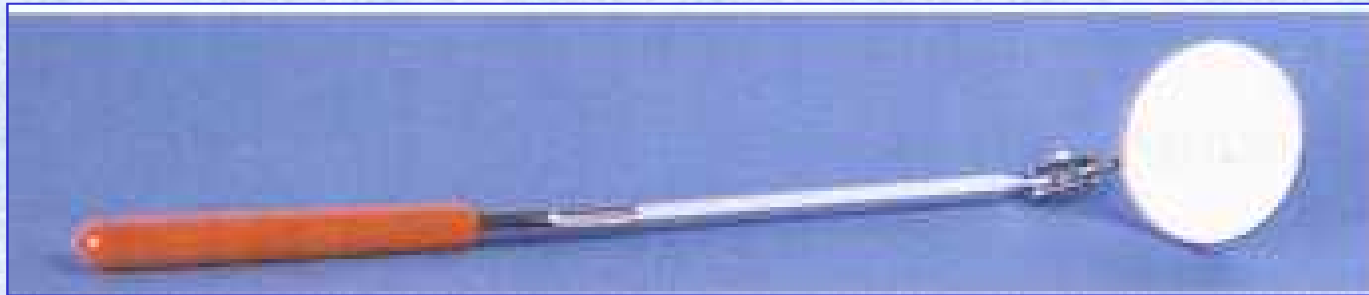
Magnet hinged to the end of a rod

Finger Pickup Tool



Grasps nonmagnetic parts that will not stick to a magnet

Mirror Probe



Allows you to look around corners or
behind parts

Pry Bars

- ❑ Strong steel bars that are helpful during numerous assembly, disassembly, and adjustment operations
- ❑ Commonly used when adjusting the tension of engine belts
- ❑ When prying, always be careful to not damage any part of the vehicle