

Automotive Engines Theory and Servicing
Ninth Edition

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Chapter 4
Hand Tools



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OBJECTIVES (1 OF 2)

4.1 Compare the different types of wrenches.

4.2 Discuss the purpose of ratchets, sockets, and extensions, and screwdrivers.

4.3 Discuss the purpose of hammers, mallets, and pliers.

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OBJECTIVES (2 OF 2)

4.4 Explain the characteristics of cutters, punches, chisels, removers, and hacksaws.

4.5 Identify the different types of electrical hand tools.

4.6 Discuss the safety tips for using hand tools and hand tool maintenance.

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WRENCHES (1 OF 3)

- Wrenches are the most used hand tool by service technicians.
- Most wrenches are constructed of forged alloy steel, usually chrome-vanadium steel.



FIGURE 4-1 A forged wrench after it has been forged but before the flashing, extra material around the wrench, has been removed.

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WRENCHES (2 OF 3)

- Open-end Wrench: used to loosen or tighten bolts or nuts that do not require a lot of torque
- Box-end Wrench: placed on top of the fastener and grips the points of the fastener
- Combination Wrench: allows technicians to loosen or tighten a fastener, with the open end to increase the speed of rotating the fastener

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WRENCHES (3 OF 3)

- Adjustable Wrench: used when the exact size wrench is not available or when a large nut needs to be rotated
- Line Wrenches: used to grip all the way around a nut for a fuel or refrigerant line

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RATCHETS, SOCKETS, AND EXTENSIONS (1 OF 2)

- A socket fits over the fastener and grips the points and/or flats of the bolt or nut.
- The socket is rotated (driven) using either a long bar called a breaker bar (flex handle) or a ratchet.

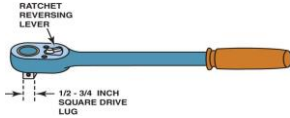


FIGURE 4-8 A typical ratchet used to rotate a socket. A ratchet makes a ratcheting noise when it is being rotated in the opposite direction from loosening or tightening. A knob or lever on the ratchet allows the user to switch directions.

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RATCHETS, SOCKETS, AND EXTENSIONS (2 OF 2)

- Crowfoot Sockets
- Torque Wrenches
 - A clicker-type torque wrench
 - A beam- or dial-type torque wrench

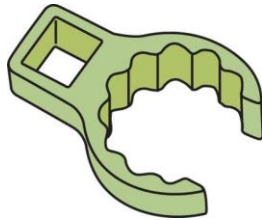


FIGURE 4-12 A crowfoot socket is designed to reach fasteners using a ratchet or breaker bar with an extension.

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FIGURE 4-13 Using a torque wrench to tighten connecting rod nuts on an engine.



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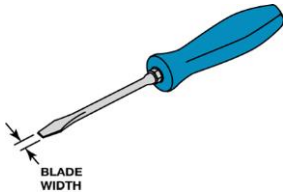
SCREWDRIVERS (1 OF 2)

- Many smaller fasteners are removed and installed by using a screwdriver.
- Screwdrivers are available in many sizes and tip shapes.
- The most commonly used screwdriver is called a flat tip or straight blade.

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FIGURE 4-17 A flat-tip (straight blade) screwdriver. The width of the blade should match the width of the slot in the fastener being loosened or tightened.



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SCREWDRIVERS (2 OF 2)

- Flat-tip screwdrivers are sized by the width of the blade and this width should match the width of the slot in the screw.
- Offset Screwdrivers
- Impact Screwdriver

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HAMMERS AND MALLETS

- Hammers and mallets are used to force objects together or apart



FIGURE 4-21 A typical ball-peen hammer.

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FIGURE 4-22 A rubber mallet used to deliver a force to an object without harming the surface.



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PLIERS (1 OF 2)

- Pliers are used to hold, twist, bend, and cut objects
 - Slip-joint Pliers
 - Multigroove Adjustable Pliers
 - Linesman's Pliers
 - Diagonal Pliers

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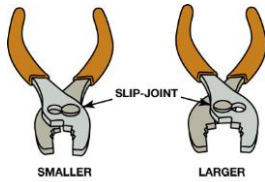
PLIERS (2 OF 2)

- Needle-nose Pliers
- Locking Pliers
- Snap-ring Pliers
- Files

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FIGURE 4-24 Typical slip-joint pliers, which are also common household pliers. The slip joint allows the jaws to be opened to two different settings.



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CUTTERS

- Snips
- Utility Knife
 - Safe Use of Cutters

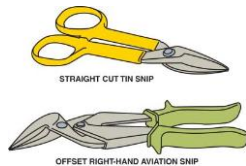


FIGURE 4-32 Tin snips are used to cut thin sheets of metal or carpet.

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PUNCHES AND CHISELS

- Punches
- Chisels



FIGURE 4-34 A punch used to drive pins from assembled components. This type of punch is also called a pin punch.

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REMOVERS (1 OF 2)

- Removers are tools used to remove damaged fasteners.
 - A remover tool is not normally needed during routine service unless the fastener is corroded or has been broken or damaged by a previous attempt to remove the bolt or nut.

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REMOVERS (2 OF 2)

- Damaged Heads
- Broken Bolts, Studs, or Screws

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FIGURE 4-37 A stud remover uses an offset serrated wheel to grasp the stud so it will be rotated when a ratchet or breaker bar is used to rotate the assembly.



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HACKSAWS

- A hacksaw is used to cut metals, such as steel, aluminum, brass, or copper.

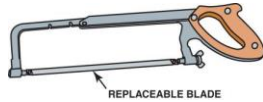


FIGURE 4-41 A typical hacksaw that is used to cut metal. If cutting sheet metal or thin objects, a blade with more teeth should be used.

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BASIC HAND TOOL LIST

- How many items can you name from the list?

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TOOL SETS AND ACCESSORIES

- A beginning service technician may wish to start with a small set of tools before spending a lot of money on an expensive, extensive tool box.

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FIGURE 4-42 A typical beginning technician tool set that includes the basic tools to get started.



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SEAL PULLERS AND DRIVERS

- What is the difference between seal pullers and seal drivers?

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FIGURE 4-44 A seal puller being used to remove a seal from a rear axle.



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ELECTRICAL HAND TOOLS

- Test Lights
- Soldering Guns
 - Electric soldering gun
 - Electric soldering pencil
 - Butane-powered soldering iron

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FIGURE 4-46 A typical 12 volt test light.



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SAFETY TIPS FOR USING HAND TOOLS (1 OF 3)

- Always pull a wrench toward you for best control and safety. Never push a wrench.
- Keep wrenches and all hand tools clean to help prevent rust and to allow for a better, firmer grip.
- Always use a 6-point socket or a box-end wrench to break loose a tight bolt or nut.

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SAFETY TIPS FOR USING HAND TOOLS (2 OF 3)

- Use a box-end wrench for torque and an open-end wrench for speed.
- Never use a pipe extension or other type of "cheater bar" on a wrench or ratchet handle.
- Always use the proper tool for the job. If a specialized tool is required, use the proper tool and do not try to use another tool improperly.

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SAFETY TIPS FOR USING HAND TOOLS (3 OF 3)

- Never expose any tool to excessive heat.
- Never use a hammer on any wrench or socket handle unless you are using a special "staking face" wrench designed to be used with a hammer.
- Replace any tools that are damaged or worn.

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HAND TOOL MAINTENANCE (1 OF 2)

- Clean each tool before placing it back into the tool box.
- Keep tools separated.
- Line the drawers of the tool box with a material that will prevent the tools from moving as the drawers are opened and closed.

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HAND TOOL MAINTENANCE (2 OF 2)

- Release the tension on all "clicker-type" torque wrenches after use.
- Keep the tool box secure.

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SUMMARY (1 OF 3)

- Wrenches are available in open end, box end, and combination open and box end.
- An adjustable wrench should only be used where the proper size is not available.
- Line wrenches are used to remove fuel or refrigerant lines.

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SUMMARY (2 OF 3)

- Sockets are rotated by a ratchet or breaker bar, also called a flex handle.
- Torque wrenches measure the amount of torque applied to a fastener.
- Screwdriver types include straight blade (flat tip) Torx, and Phillips.
- Hammers and mallets come in a variety of sizes and weights.

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SUMMARY (3 OF 3)

- Pliers are a useful tool and are available in many different types, including slip-joint, multigroove, linesman's, diagonal, needle-nose, and locking pliers.
- Other common hand tools include snap-ring pliers, files, cutters, punches, chisels, and hacksaws.

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