Automotive Technology 5th Edition
Chapter 9 HAND TOOLS
Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This Automotive Technology 5th text provides complete coverage of automotive components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and NATEF and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Real World Fixes, Videos, Animations, and NATEF Task Sheet references.
Motivate Learners	Explain how the knowledge of how something works translates into the ability to use that knowledge to figure why the engine does not work correctly and how this saves diagnosis time, which translates into more money.
State the learning objectives for the chapter or course you are about to cover and explain this is what they should be able to do as a result of attending this session or class.	Explain the chapter learning objectives to the students as listed: 1. Compare the different types of wrenches. 2. Discuss the purpose of ratchets, sockets, and extensions, and screwdrivers. 3. Discuss the purpose of hammers, mallets, and pliers. 4. Explain the characteristics of cutters, punches, chisels, removers, and hacksaws. 5. Identify the different types of electrical hand tools. 6. Discuss the safety tips for using hand tools and hand tool maintenance.
Establish the Mood or Climate	Provide a ***WELCOME,*** Avoid put downs and bad jokes.
Complete Essentials	Restrooms, breaks, registration, tests, etc.
Clarify and Establish Knowledge Base	Do a round robin of the class by going around the room and having each student give their backgrounds, years of experience, family, hobbies, career goals, or anything they want to share.

NOTE: This lesson plan is based on the 5th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

LINK CHP 9: ATE5 Chapter Images

ICONS	Chapter 9 Hand Tools
	**1. SLIDE 1 CH9 HAND TOOLS**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** http://www.youtube.com/watch?v=oHXjWvmWiyc http://www.youtube.com/watch?v=kvOyPwKhKRc
	**2. SLIDE 2 EXPLAIN Figure 9-1** forged wrench after it has been forged but before the flashing, extra material around the wrench, has been removed. **3. SLIDE 3 EXPLAIN Figure 9-2** A typical open-end wrench. The size is different on each end and notice that the head is angled 15 degrees at each end. **4. SLIDE 4 EXPLAIN Figure 9-3** typical box-end wrench is able to grip the bolt or nut at points completely around the fastener. Each end is a different size. **5. SLIDE 5 EXPLAIN Figure 9-4** end of a box-end wrench is angled 15 degrees to allow clearance for nearby objects or other fasteners. **6. SLIDE 6 EXPLAIN Figure 9-5** combination wrench has an open end at one end and a box end at the other with the same size at each end.
	**DEMONSTRATION: open-end wrench is one of most basic tools. Show when and where open end wrenches are used in automotive service and repair**
	**Open End & Gear Wrench Use Animation** **Open End Wrench (View) (Download)** **Gear Wrench (View) (Download)**
	**DEMONSTRATION: Show examples of box-end, adjustable, & line wrenches, and discuss where each is used in automotive applications. Remind students of safety procedures they should follow when using wrenches.**

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	7. **SLIDE 7 EXPLAIN Figure 9-6** adjustable wrench. Adjustable wrenches are sized by the overall length of the wrench and not by how far the jaws open. Common sizes of adjustable wrenches include 8, 10, and 12 in. 8. **SLIDE 8 EXPLAIN Figure 9-7** end of a typical line wrench, which shows that it is capable of grasping most of the head of the fitting.
	9. **SLIDE 9 EXPLAIN Figure 9-8** 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. 10. **SLIDE 10 EXPLAIN Figure 9-9** typical flex handle used to rotate a socket, also called a breaker bar because it usually has a longer handle than a ratchet and, therefore, can be used to apply more torque to a fastener than a ratchet. 11. **SLIDE 11 EXPLAIN Figure 9-10** most commonly used socket drive sizes include 1/4, 3/8, and 1/2 in. drive.
	**DEMONSTRATION: Show students how to use a ratchet and socket set, and identify automotive applications where socket wrenches are best used. Explain relevance of drive size to application**
	**Show ANIMATION: Rounded bolts: www.jameshalderman.com 6 and 12 Point**
	**Student HANDS-ON Task: have students practice using sockets and wrenches**
	12. **SLIDE 12 EXPLAIN Figure 9-11 a** 6-point socket fits the head of the bolt or nut on all sides. A 12-point socket can round off the head of a bolt or nut if a lot of force is applied. 13. **SLIDE 13 EXPLAIN Figure 9-12** crowfoot socket is designed to reach fasteners using a ratchet or breaker bar with an extension. 14. **SLIDE 14 EXPLAIN Figure 9-13** Using a torque wench to tighten connecting rod nuts on an engine. 15. **SLIDE 15 EXPLAIN Figure 9-14** beam-type torque wrench that displays torque reading on face of dial. The

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	beam display is read as beam deflects, which is in proportion to amount of torque applied to fastener.
	**DEMONSTRATION: Show students clicker type and beam-type torque wrenches & demonstrate how to use them properly. Stress importance of resetting torque wrenches to lowest setting (lowest setting is not always "0")**
	**Show ANIMATION: Torque Wrench www.jameshalderman.com**
	Torque to Angle (View) (Download)
	Torquing Cylinder Head Bolts - Step 1 (View) (Download)
	Torquing Cylinder Head Bolts - Step 2 (View) (Download)
	Torquing Cylinder Head Bolts - Step 3 (View) (Download)
	**HANDS-ON Task: have students practice torquing a cylinder head.**
	16. **SLIDE 16 EXPLAIN Figure 9-15** Torque wrench calibration checker. 17. **SLIDE 17 EXPLAIN Figure 9-16** Deep sockets allow access to the nut that has a stud plus other locations needing great depth, such as spark plugs.
	**Advise students to check calibration of a torque wrench to ensure that fasteners are tightened to specifications and not beyond. Torque wrenches will stay in calibration longer if they are not used to loosen bolts.**
	DEMONSTRATION: IF AVAILBLE: Show students HOW a torque wrench is calibrated

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	18. **SLIDE 18 EXPLAIN Figure 9-17** flat-tip (straight blade) screwdriver. Width of blade should match width of the slot in the fastener being loosened or tightened. 19. **SLIDE 19 EXPLAIN Figure 9-18** Two stubby screwdrivers that are used to access screws that have limited space above. A straight blade is on top and a #2 Phillips screwdriver is on the bottom.
	**Show ANIMATION: Screw Driver Selection** **www.jameshalderman.com** **Screwdriver Selection (View) (Download)**
 	**DEMONSTRATION: Show students a variety of flat-tip and Phillips screwdrivers. Ask them which type is used more on automobiles and why. Show students how to use offset & impact Screwdrivers. For what type of application is each used?**
	20. **SLIDE 20 EXPLAIN Figure 9-19** offset screwdriver is used to install or remove fasteners that do not have enough space above to use a conventional screwdriver. 21. **SLIDE 21 EXPLAIN Figure 9-20** impact screwdriver used to remove slotted or Phillips head fasteners that cannot be broken loose using a standard screwdriver.
	**DEMONSTRATION: Show examples of hammers and mallets. Discuss the features of each hammer or mallet and describe where it is used.**
	22. **SLIDE 22 EXPLAIN Figure 9-21** typical ball-peen hammer. 23. **SLIDE 23 EXPLAIN Figure 9-22** rubber mallet used to deliver a force to an object without harming the surface. 24. **SLIDE 24 EXPLAIN Figure 9-23** dead-blow hammer that was left outside in freezing weather. Plastic covering was damaged, which destroyed this hammer. The lead shot is encased in the metal housing and then covered.
	25. **SLIDE 25 EXPLAIN Figure 9-24** Typical slip-joint pliers, which are also common household pliers. Slip joint allows jaws to be opened to two different settings.
	**Show Animation: Diagonal Pliers** **www.jameshalderman.com** **Slip Joint Pliers (View) (Download)**

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	**26. SLIDE 26 EXPLAIN Figure 9-25** Multigroove adjustable pliers are known by many names, including the trade name Channel Locks. **27. SLIDE 27 EXPLAIN Figure 9-26** linesman's pliers are very useful because they can help perform many automotive service jobs.
	**ANIMATION: Channel Lock & Lineman's** **www.jameshalderman.com** **Channel Lock Pliers (View) (Download)** **Linemans Pliers (View) (Download)**
	**DEMONSTRATION: Show examples of slip-joint & multigroove adjustable pliers and discuss how each is used.**
	**28. SLIDE EXPLAIN Figure 9-27** Diagonal-cut pliers are another common tool that has many names.
	**Show Animation: Diagonal Pliers** **www.jameshalderman.com** **Dikes (View) (Download)**
	**29. SLIDE 29 EXPLAIN Figure 9-28** Needle-nose pliers are used where there is limited access to a wire or pin that needs to be installed or removed. **30. SLIDE 30 EXPLAIN Figure 9-29** Locking pliers are best known by their trade name Vise-Grip®
	**Show Animation: Diagonal Pliers** **www.jameshalderman.com** **Vise Grips (View) (Download)**
	**HANDS-ON TASK: Have students use a pair of snap-ring pliers to remove and replace internal and external snap rings.**
	**31. SLIDE 31 EXPLAIN Figure 9-30** Snap-ring pliers are also called lock-ring pliers and are designed to remove internal and external snap rings (lock rings).

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	**Show Animation: Diagonal Pliers** **www.jameshalderman.com** **Snap Ring Pliers (View) (Download)**
	32. **SLIDE 32 EXPLAIN Figure 9-31** Files come in many different shapes and sizes. Never use a file without a handle.
	33. **SLIDE 33 EXPLAIN Figure 9-32** Tin snips are used to cut thin sheets of metal or carpet. 34. **SLIDE 34 EXPLAIN Figure 9-33** utility knife uses replaceable blades and is used to cut carpet and other materials.
	**DEMONSTRATION: Show examples of a variety of cutters, including tin snips and utility knives, and describe where each might be used in automotive**
	35. **SLIDE 35 EXPLAIN Figure 9-34** punch used to drive pins from assembled components. This type of punch is also called a pin punch. 36. **SLIDE 36 EXPLAIN Figure 9-35** Warning stamped in the side of a punch warning that goggles should be worn when using this tool. Always follow safety warnings
	**SAFETY NOTE: Stress importance of wear safety glasses with side shields when using punches, chisels, or especially any type of rotary grinding device**
	37. **SLIDE 37 EXPLAIN Figure 9-36** Use grinder or a file to remove mushroom material on end of punch or chisel.
	**DEMONSTRATION: Show examples of punches and chisels and describe intended purpose of each. Where are these tools be used in an automotive setting?**
	38. **SLIDE 38 EXPLAIN Figure 9-37** stud remover uses an offset serrated wheel to grasp stud so it will be rotated when a ratchet or breaker bar is used to rotate assembly. 39. **SLIDE 39 EXPLAIN Figure 9-38** nut splitter is used to split a nut that cannot be removed. After the nut has been split, a chisel is then used to remove the nut. 40. **SLIDE 106 EXPLAIN Figure 9-39** set of bolt

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	extractors, commonly called easy outs.
	**DEMONSTRATION: Show students how to use an easy-out extractor to remove a broken bolt.**
	41. **SLIDE 41 EXPLAIN Figure 9-40** Removing plugs or bolts is easier if the plug is first heated to cherry red color, using a torch, and then applying wax.
	**DEMONSTRATION: Show wax trick to help remove a rusted fastener. Make sure students understand paraffin wax is flammable: Figure 9-40**
	**HANDS-ON TASK: Have students perform wax trick to help remove a rusted fastener. Make sure students understand paraffin wax is flammable: Figure 9-40**
	42. **SLIDE 42 EXPLAIN Figure 9-41** typical hacksaw that is used to cut metal. If cutting sheet metal or thin objects, a blade with more teeth should be used.
	43. **SLIDE 43 EXPLAIN Figure 9-42** A typical beginning technician tool set that includes the basic tools to get started. 44. **SLIDE 44 EXPLAIN Figure 9-43** A typical large tool box, showing just one of many drawers.
	45. **SLIDE 45 EXPLAIN Figure 9-44** seal puller being used to remove a seal from a rear axle. 46. **SLIDE 46 EXPLAIN Figure 9-45** seal driver or installer is usually plastic and is designed to seat the seal.
	**Show Animation: Diagonal Pliers** **www.jameshalderman.com** **Seal Driver (View) (Download)**
	**DEMONSTRATION: Show seal puller and a seal driver and where they are used on an automobile.**
	**HANDS-ON TASK: Have students use a pair of snap-ring pliers to remove and replace internal and external snap rings.**

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	47. **SLIDE 47 EXPLAIN Figure 9-46** typical 12 volt test light. 48. **SLIDE 48 EXPLAIN Figure 9-47** An electric soldering gun used to make electrical repairs. Soldering guns are sold by the wattage rating. The higher the wattage, the greater amount of heat created. Most solder guns used for automotive electrical work usually fall within the 60 to 160 watt range.
	**There is a correct tool for every job. Tools are an expensive, life-long investment. If you are going to make a living with them, buy high-quality tools.**
	49. **SLIDE 49 EXPLAIN Figure 9-48** A binder clip being used to keep a fender cover from falling.
	**Stress the importance of using fender covers to protect the vehicle's exterior finish from harm.**
	**SAFETY Warn students to be careful not to overtighten bolts and nuts by using a cheater bar. Explain that they might break the wrench or cause themselves harm.**
	**HANDS-ON TASK** **Hand Tool Identification Task sheet PAGE 12**
	**DISCUSSION: Talk with your students about the maintenance procedures for hand tools. What are the benefits of proper maintenance?**