Automotive Engines

Chapter 4 HAND TOOLS

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This engine systems course or class provides complete coverage of the 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 on the second SLIDE. 1. Describe what tool is the best to use for each job. 2. Discuss how to safely use hand tools. 3. Explain the difference between the brand name (trade name) and the proper name for tools. 4. Explain how to maintain hand tools.
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.

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     	**1. SLIDE 1 CH9 HAND TOOLS** **2. SLIDES 2-3 EXPLAIN Objectives & KEY TERMS** **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE REGULARLY UPDATED** **4. SLIDE 4 EXPLAIN Wrenches EXPLAIN FIGURE 4-1** A forged wrench after it has been forged but before the flashing, extra material around the wrench, has been removed. **5. SLIDE 5 EXPLAIN** Wrenches **6. SLIDE 6 EXPLAIN FIGURE 4-2** typical open-end wrench. The size is different on each end and notice that head is angled 15 degrees at each end. **7. SLIDE 7 EXPLAIN FIGURE 4-3** typical box-end wrench is able to grip the bolt or nut at points completely around the fastener. Each end is a different size. **8. SLIDE 8 EXPLAIN FIGURE 4-4** end of a box-end wrench is angled 15 degrees to allow clearance for nearby objects or other fasteners. **9. SLIDE 9 EXPLAIN FIGURE 4-5** combination wrench has an open end at one end and a box end at the other with the same size at each end. **DEMONSTRATION: An open-end wrench is one of the most basic tools. Show students when and where open end wrenches are used in automotive service and repair** **DEMONSTRATION: Show students examples of box-end, adjustable, & line wrenches, and discuss where each is used in automotive applications. Remind students of the safety procedures they should follow when using all types of wrenches.** **SHOW ANIMATION OPEN-END WRENCH** **http://www.jameshalderman.com/animations.html#a0**

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	**SHOW ANIMATION GEAR WRENCH** http://www.jameshalderman.com/animations.html#a0
	**10. SLIDE 10** EXPLAIN **FIGURE 4-6** 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. **11. SLIDE 11** EXPLAIN **FIGURE 4-7** end of a typical line wrench, which shows that it is capable of grasping most of the head of the fitting
	**12. SLIDE 12** EXPLAIN Ratchets, Sockets, and Extensions **13. SLIDE 12** EXPLAIN **FIGURE 4-8** 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.
	14. SLIDE 14 EXPLAIN **FIGURE 4-9** A 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. **15. SLIDE 15** EXPLAIN **FIGURE 4-10** most commonly used socket drive sizes include 1/4 in., 3/8 in., 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.myautomotivelab.com** http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A1_Animation/Chapter4_Fig_4_11c/index.htm
	**Show ANIMATION: 6/12 Point Sockets www.myautomotivelab.com** http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A1_Animation/Chapter04_Fig_04_11/index.htm
	**16. SLIDE 16** EXPLAIN **FIGURE 4-11 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. **17. SLIDE 17** EXPLAIN **FIGURE 4-12** crowfoot socket is designed to reach fasteners using a ratchet or breaker bar

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	with an extension. 18. **SLIDE 18** EXPLAIN **FIGURE 4-13** Using a torque wench to tighten connecting rod nuts on an engine. 19. **SLIDE 19** EXPLAIN **FIGURE 4-14** beam-type torque wrench that displays the torque reading on the face of the dial. The beam display is read as the beam deflects, which is in proportion to the amount of torque applied to the fastener.
	20. **SLIDES 20-21** EXPLAIN TECH TIP 22. **SLIDE 22** EXPLAIN **FIGURE 4-15** Torque wrench calibration checker
	**DEMONSTRATION: Show students clicker type and beam-type torque wrenches & demonstrate how to use them properly. Stress importance of resetting torque wrenches to the lowest setting (lowest setting is not always "0")**
	23. **SLIDE 23** EXPLAIN **FIGURE 4-16** Deep sockets allow access to the nut that has a stud plus other locations needing great depth, such as spark plugs.
	24. **SLIDE 24** EXPLAIN FREQUENTLY ASKED QUESTION
	25. **SLIDE 25** EXPLAIN TECH TIP 26. **SLIDE 26** EXPLAIN TECH TIP 27. **SLIDE 27** EXPLAIN TECH TIP
	28. **SLIDE 28** EXPLAIN Screwdrivers 29. **SLIDE 29** EXPLAIN **FIGURE 4-17** flat-tip (straight blade) screwdriver. The width of blade should match width of slot in fastener being loosened or tightened. 30. **SLIDE 30** EXPLAIN **FIGURE 4-18** 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.
 	**DEMONSTRATION: Show students a variety of flat-tip & 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?**

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	**31. SLIDE 31 EXPLAIN FIGURE 4-19** An offset screwdriver is used to install or remove fasteners that do not have enough space above to use a conventional screwdriver. **32. SLIDE 32 EXPLAIN FIGURE 4-20** An impact screwdriver used to remove slotted or Phillips head fasteners that cannot be broken loose using a standard screwdriver.
	**33. SLIDE 33 EXPLAIN FREQUENTLY ASKED QUESTION**
	**DEMONSTRATION: Show examples of hammers and mallets. Discuss the features of each hammer or mallet and describe where it is used.**
	**34. SLIDE 34 EXPLAIN FIGURE 4-21** typical ball-peen hammer. **35. SLIDE 35 EXPLAIN FIGURE 4-22** rubber mallet used to deliver a force to an object without harming surface. **36. SLIDE 36 EXPLAIN FIGURE 4-23** dead-blow hammer that was left outside in freezing weather. The plastic covering was damaged, which destroyed this hammer. The lead shot is encased in the metal housing and then covered
	**37. SLIDE 37 EXPLAIN** Pliers **38. SLIDE 38 EXPLAIN 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. **39. SLIDE 39 EXPLAIN FIGURE 4-25** Multigroove adjustable pliers are known by many names, including the trade name Channel Locks. **40. SLIDE 40 EXPLAIN FIGURE 4-26** A linesman's pliers are very useful because they can help perform many automotive service jobs.
	**DEMONSTRATION: Show examples of slip-joint & multigroove adjustable pliers and discuss how each is used.**
	**41. SLIDE 41 EXPLAIN FIGURE 4-27** Diagonal-cut pliers are another common tool that has many names.

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	**42. SLIDE 42** EXPLAIN TECH TIP
	**43. SLIDE 43** EXPLAIN **FIGURE 4-28** Needle-nose pliers are used where there is limited access to a wire or pin that needs to be installed or removed & EXPLAIN **FIGURE 4-29** Locking pliers are best known by their trade name Vise-Grip®
	**44. SLIDE 44** EXPLAIN TECH TIP
	**45. SLIDE 45** EXPLAIN **FIGURE 4-30** Snap-ring pliers are also called lock-ring pliers and are designed to remove internal and external snap rings (lock rings)
	**HANDS-ON TASK: Have students' use a pair of snap-ring pliers to remove and replace internal and external snap rings.**
	**46. SLIDE 46** EXPLAIN **FIGURE 4-31** Files come in many different shapes and sizes. Never use a file without a handle
	**47. SLIDE 47** EXPLAIN Cutters & EXPLAIN **FIGURE 4-32** Tin snips are used to cut thin sheets of metal or carpet.
	48. SLIDE 48 EXPLAIN **FIGURE 4-33** A 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**
	**49. SLIDE 49** EXPLAIN **Punches and Chisels &** EXPLAIN **FIGURE 4-34** punch used to drive pins from assembled components. This type of punch is also called a pin punch.
	50. SLIDE 50 EXPLAIN **FIGURE 4-35** Warning stamped in the side of a punch warning that goggles should be worn when using this tool. Always follow safety warnings.
	51. SLIDE 51 EXPLAIN **FIGURE 4-36** Use a grinder or a file to remove the mushroom material on the end of a punch or chisel.

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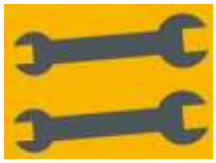
	**DEMONSTRATION: Show examples of punches and chisels and describe the intended purpose of each. Where are these tools be used in an automotive setting?**
	**52. SLIDE 52** EXPLAIN Removers **53. SLIDE 53** EXPLAIN **FIGURE 4-37** stud remover uses an offset serrated wheel to grasp stud so it will be rotated when a ratchet or breaker bar is used to rotate assembly. **54. SLIDE 54** EXPLAIN **FIGURE 4-38** 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. **55. SLIDE 55** EXPLAIN **FIGURE 4-39** set of bolt extractors, commonly called easy outs.
	**DEMONSTRATION: Show students how to use an easy-out extractor to remove a broken bolt.**
	**56. SLIDE 56** EXPLAIN TECH TIP ON USING WAX **57. SLIDE 57** EXPLAIN **FIGURE 4–40** Removing plugs or bolts is easier if the plug is first heated to cherry red color, using a torch, and then applying wax. During cooling, the wax flows in between the threads, making it easier to remove
	**DEMONSTRATION: Show wax trick to help remove a rusted fastener. Make sure students understand paraffin wax is flammable:**
	**HANDS-ON TASK: Have students perform wax trick to help remove a rusted fastener. Make sure students understand paraffin wax is flammable:**
	**58. SLIDE 58** EXPLAIN FREQUENTLY ASKED QUESTION
	**59. SLIDE 59 EXPLAIN Hacksaws &** EXPLAIN **FIGURE 4-41** typical hacksaw that is used to cut metal. If cutting sheet metal or thin objects, a blade with more teeth should be used.
	**60. SLIDE 60** EXPLAIN TECH TIP **61. SLIDE 61** EXPLAIN TECH TIP

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	**62. SLIDE 62** EXPLAIN Tool Sets and Accessories & EXPLAIN **FIGURE 4-42** typical beginning technician tool set that includes the basic tools to get started. **63. SLIDE 63** EXPLAIN **FIGURE 4-43** typical large tool box, showing just one of many drawers.
	**64. SLIDE 64** EXPLAIN TECH TIP
	**65. SLIDE 65** EXPLAIN Seal Pullers and Drivers & EXPLAIN **FIGURE 4-44** seal puller being used to remove a seal from a rear axle. **66. SLIDE 66** EXPLAIN **FIGURE 4-45** seal driver or installer is usually plastic and is designed to seat the seal.
	**DEMONSTRATION: Show seal puller and a seal driver and where they are used on an automobile.**
	**67. SLIDE 67** EXPLAIN **Electrical Hand Tools** **68. SLIDE 68** EXPLAIN **FIGURE 4-46** typical 12 volt test light. **69. SLIDE 69** EXPLAIN **FIGURE 4-47** 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.**
	**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.**
	**70. SLIDE 70** EXPLAIN TECH TIP
	**71. SLIDES 71-72** EXPLAIN Safety Tips for Using Hand Tools

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	**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. **DISCUSSION:** Talk with your students about the maintenance procedures for hand tools. What are the benefits of proper maintenance? 73. **SLIDE 73** EXPLAIN TECH TIP 74. **SLIDE 74** EXPLAIN **FIGURE 4–48** A binder clip being used to keep a fender cover from falling 75. **SLIDE 75** EXPLAIN Hand Tool Maintenance **Talk through SUMMARY and questions** **HOMEWORK:** complete Ch4 crossword puzzle: http://www.jameshalderman.com/links/book_engine_theory_serv_7/cw/crossword_ch_4.pdf