Automotive Engines

Chapter 3 Fasteners & Thread Repair

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. Explain the terms used to identify bolts and other threaded fasteners. 2. Explain the strength ratings of threaded fasteners. 3. Describe the proper use of nonthreaded fasteners. 4. Discuss how snap rings are used.
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.

ICONS	Ch3 Fasteners & Thread Repair
	1. SLIDE 1 FASTENERS & THREAD REPAIR
	2. **SLIDES 2-3 READ CHAPTER OBJECTIVES & KEY TERMS**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/**
	WEB SITE REGULARLY UPDATED
	4. **SLIDE 4 Threaded Fasteners READ & EXPLAIN TEXT & FIGURE 3-1 dimensions of a typical bolt showing where sizes are measured. The major diameter is called the crest.**
	5. **SLIDE 5 Threaded Fasteners READ & EXPLAIN TEXT EXPLAIN FIGURE 3-2 Thread pitch gauge used to measure the pitch of the thread. This bolt has 13 threads to the inch.**
	6. **SLIDE 6 EXPLAIN FIGURE 3-3** Bolts and screws have many different heads which determine what tool must be used.
	7. **SLIDE 7 READ & EXPLAIN TEXT Chart 8-1** American National System is one method of sizing fasteners
	**DISCUSSION: ASK STUDENTS TO TALK ABOUT DIFFERENCES BETWEEN UNIFIED NATIONAL COARSE (UNC) & UNIFIED NATIONAL FINE (UNF) THREADS. WHERE MIGHT EACH BE FOUND IN USE ON AN AUTOMOBILE? ASK STUDENTS WHICH THEY THINK WOULD HAVE BETTER HOLDING POWER.**
	8. **SLIDES 8-9 Metric Bolts EXPLAIN TEXT & EXPLAIN FIGURE 3-4** Metric system specifies fasteners by diameter, length, and pitch.
	10. **SLIDE 10 Grades of Bolts EXPLAIN TEXT**
	11. **SLIDE 11 EXPLAIN FIGURE 3-5** Stronger threads are created by cold-rolling a heattreated bolt blank instead of cutting the threads using a die**.**
	12. **SLIDE 12 EXPLAIN TECH TIP**
	13. **SLIDE 13 EXPLAIN Tensile Strength**
	14. **SLIDE 14 EXPLAIN FIGURE 3-6** Metric bolt (cap screw) grade markings and approximate tensile strength.

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	**SHOW VIDEO FROM WWW.MYAUTOMOTIVELAB.COM ON BOLT MARKINGS** http://media.pearsoncmg.com/ph/chet/chet_mylabs/akamai/template/video640x480.php?title=Bolt%20Marking&clip=pandc/chet/2012/automotive/Auto_Shop_Safety/Clip24BoltMarkings1.mov&caption=chet/chet_mylabs/akamai/2012/automotive/Auto_Shop_Safety/xml/Clip24BoltMarkings1.xml
	**DEMONSTRATION: SHOW EXAMPLES OF A VARIETY OF GENERAL BOLTS & SCREWS. DISCUSS WHAT TYPE OF TOOL MUST BE USED WITH EACH. STUDENTS GUESS WHY EXAMPLES ARE, OR ARE NOT USED ON CARS.**
	**15. SLIDE 15 EXPLAIN TEXT**
	16. SLIDE 16 EXPLAIN FIGURE 3-7 types of lock nuts. On the left, a nylon ring; in the center, a distorted shape; and on the right, a castle for use with a cotter key
	**17. SLIDE 17 Taps and Dies EXPLAIN TEXT & FIGURE 3-8 typical bottoming tap used to create threads in holes that are not open, but stop in a casting, such as an engine block.**
	18. SLIDE 18 EXPLAIN TEXT
	19. SLIDE 19 EXPLAIN FIGURE 3-9 Many taps, especially larger ones, have the tap drill size printed on the top.
	20. SLIDE 20 EXPLAIN FIGURE 3-10 die is used to cut threads on a metal rod & EXPLAIN FIGURE 3-11 (a) T-handle is used to hold and rotate small taps. EXPLAIN FIGURE 3-11 (b) tap wrench is used to hold and drive larger taps.
	21. SLIDE 21 EXPLAIN FIGURE 3-12 die handle used to rotate a die while cutting threads on a metal rod.
	**DEMONSTRATION: SHOW STUDENTS A TAP AND DIE SET, AND DEMONSTRATE HOW IT IS USED. SHOW STUDENTS BOTH TAPERED AND BOTTOMING TAPS.**
	**HANDS-ON TASK: HAVE STUDENTS USE A TAP AND DIE SET TO PRACTICE BOTH CUTTING THREADS IN A HOLE WITH A TAP AND THREADING A ROD WITH A DIE.**
	**22. SLIDE 22 Thread Pitch Gauge EXPLAIN TEXT & FIGURE 3-13 typical metric thread pitch gauge**

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DEMONSTRATION: SHOW & DEMONSTRATE BOTH AN ENGLISH & METRIC THREAD PITCH GAUGE

There are many blades to check on a threadpitch gauge. To speed up process, check tap chart and see which thread pitches are available for that diameter bolt. Check those choices first.

23. **SLIDE 23** EXPLAIN FREQUENTLY ASKED QUESTION EXPLAIN
24. **SLIDE 24** EXPLAIN **FIGURE 3-14** thread chaser is shown at top compared to a tap on bottom. A thread chaser is used to clean threads without removing metal
25. **SLIDE 25 Sheet Metal Screws** READ & EXPLAIN TEXT & **FIGURE 3-15** Sheet metal screws come with many head types
26. **SLIDE 26 Washers** READ & EXPLAIN TEXT & EXPLAIN **FIGURE 3-16** Various types of nuts (top) & washers (bottom) serve different purposes & used to secure bolts or cap screws**.**
27. **SLIDE 27 Snap Rings and Clips** EXPLAIN TEXT
28. **SLIDE 28** EXPLAIN **FIGURE 3-17** Some different types of snap rings. An internal snap ring fits inside of a housing or bore, into groove. An external snap ring fits into a groove on outside of a shaft or axle. An E-clip fits into a groove in the outside of a shaft. A C-clip shown is used to retain a window regulator handle on its shaft

SHOW ANIMATION FROM WWW.MYAUTOMOTIVELAB.COM ON SNAP RING IDENTIFICATION

http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A1_Animation/Chapter3_Fig_3_18/index.htm

29. **SLIDE 29** EXPLAIN **FIGURE 3-18 typical door panel retaining clip. & FIGURE 3-19** Plastic or metal trim tools are available to help the technician remove interior door panels and other trim without causing harm.
30. **SLIDE 30** EXPLAIN **FIGURE 3–20** Pins come in various types
31. **SLIDE 31** EXPLAIN **FIGURE 3-21** Various types of rivets.
32. **SLIDE 32** EXPLAIN **FIGURE 3-22** All of the nuts shown are used by themselves except for the pal nut,

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	which is used to lock another nut to a threaded fastener so they will not be loosened by vibration. **33. SLIDE 33** EXPLAIN **FIGURE 3-23** castellated nut is locked in place with a cotter pin. **34. SLIDE 34** EXPLAIN **How to Avoid Broken Fasteners**
	
	**35. SLIDE 35** EXPLAIN **Thread Repair Inserts** **36. SLIDE 36** EXPLAIN **FIGURE 3-24** Helical inserts look like small, coiled springs. The outside is a thread to hold the coil in the hole, and the inside is threaded to fit the desired fastener. **37. SLIDE 37** EXPLAIN **FIGURE 3-25** insert provides new, stock-size threads inside an oversize hole so that the original fastener can be used. **38. SLIDE 38** EXPLAIN **FIGURE 3-26** Heli-Coil® kits, available in a wide variety of sizes, contain everything needed to repair damaged hole back to original size. **39. SLIDE 39** EXPLAIN **FIGURE 3-27** This solid-bushing insert is threaded on the outside, to grip the workpiece. The inner threads match the desired bolt size. **40. SLIDE 40** EXPLAIN **FIGURE 3-28** Timesert® kit includes drill (a), recess cutter (b), a special tap (c), installer (d), and Timesert® threaded bushing (e). **41. SLIDE 41** EXPLAIN **FIGURE 3-29** Drill out damaged threads with correct bit.
	**42. SLIDE 42** EXPLAIN **FIGURE 3-30** Use special tap for insert. **43. SLIDE 43** EXPLAIN **FIGURE 3-31** Put some thread-locking compound on the insert. **44. SLIDE 44** EXPLAIN **FIGURE 3-32** Use driver to drive the keys down flush with the surface of the workpiece. **45. SLIDE 45** EXPLAIN **FIGURE 3-33** insert and insert locks should be below the surface of the workpiece.
 	**NATEF TASK_COMPLETE TASK SHEET ON THREAD REPAIR perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert PAGE 4 & 13**

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	**Talk through SUMMARY and questions**
	**HOMEWORK: RESEARCH MANUFACTURING PROCESSES USED TO STRENGTHEN METAL IN GENERAL & BOLTS IN PARTICULAR. ASK THEM TO DESCRIBE HOW YOU CAN CHANGE STRENGTH OF A BOLT BY HEATING IT.**
	**HOMEWORK: COMPLETE CH3 CROSSWORD PUZZLE: HTTP://WWW.JAMESHALDERMAN.COM/LINKS/BOOK_ENGINE_THEORY_SERV_7/CW/CROSSWORD_CH_3.PDF**