










Automotive Maintenance and Light Repair, 1ST Edition

Chapter 12 Measuring Systems and Tools

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers Automotive Maintenance and Light Repair . It correlates material to task lists specified by ASE and NATEF.
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. <ul style="list-style-type: none">• Describe how to read a ruler.• Explain how to use a micrometer and vernier dial caliper.• Describe how to use a telescopic gauge and a micrometer to measure cylinder and lifter bores.• Discuss how to measure valve guides using a small-hole gauge.
Establish the Mood or Climate	Provide a <i>WELCOME</i> , 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	Ch12 Measuring Systems and Tools
        	<p>1. SLIDE 1 CH12 Measuring Systems & Tools</p> <p>2. SLIDE 2 EXPLAIN OBJECTIVES</p> <p>Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE REGULARLY UPDATED</p> <p>DISCUSSION: ASK STUDENTS TO DISCUSS DIFFERENCES BETWEEN METRIC AND ENGLISH MEASUREMENT SYSTEMS. HAVE STUDENTS CONJECTURE ABOUT WHY METRIC SYSTEM HAS NOT BEEN TOTALLY ADOPTED IN THE UNITED STATES.</p> <p>Be sure to check specifications to verify unit of measurement used.</p> <p>3. SLIDE 3 EXPLAIN English Customary Measuring System</p> <p>4. SLIDE 4 EXPLAIN Metric System of Measure:</p> <p>5. SLIDE 5 EXPLAIN Linear Measurements (Tape Measure / Rule)</p> <p>6. SLIDE 6 EXPLAIN FIGURE 12–1 A rule showing that the larger the division, the longer the line.</p> <p>7. SLIDE 7 EXPLAIN FIGURE 12–2 A plastic rule that has both inches and centimeters. Each line between the numbers on the centimeters represents 1 millimeter because there are 10 millimeters in 1 centimeter.</p> <p>READING AN INCH RULE http://www.jameshalderman.com/animations.html#a0</p> <p>READING METRIC RULE http://www.jameshalderman.com/animations.html#a0</p> <p>DEMONSTRATION: SHOW METRIC EQUIVALENTS OF COMMON UNITS OF MEASURE: LINEAR, VOLUMETRIC, & WEIGHT. DISCUSS HOW TO CONVERT BETWEEN ENGLISH AND METRIC.</p>

ICONS



Ch12 Measuring Systems and Tools

CONVERTING ENGLISH TO METRIC

<http://www.jameshalderman.com/animations.html#a0>





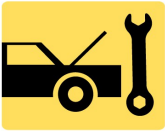

8. **SLIDE 8 EXPLAIN Micrometer,**
9. **SLIDE 9 EXPLAIN FIGURE 11–3** micrometer showing names of the parts. Sleeve may also be called the barrel or stock.
10. **SLIDE 10 EXPLAIN FIGURE 12–4** All micrometers should be checked and calibrated using gauge rod.
11. **SLIDE 11 EXPLAIN FIGURE 12–5** Three micrometer readings are (a) 0.0212 in.; (b) 0.0775 in.; (c) 0.5280 in. These measurements used Vernier scale to arrive at ten-thousandth measurement. Number that is aligned represents digit in ten-thousandth place.
12. **SLIDE 12 EXPLAIN FIGURE 12–6** Metric micrometer readings that use Vernier scale on the sleeve to read to the nearest 0.001 millimeter. The arrows point to the final reading for each of the three examples

SHOW MICROMETER PARTS ANIMATION: WWW.MYAUTOMOTIVELAB.COM

http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A1_Animation/Chapter7_Fig_7_3/index.htm

SHOW MICROMETER PARTS ANIMATION: HTTP://WWW.JAMESHALDERMAN.COM/ANIMATIONS.HTML#A0

13. **SLIDE 13 EXPLAIN FIGURE 12–7** Using micrometer to measure connecting rod journal: out-of-round & taper.
14. **SLIDE 14 EXPLAIN FIGURE 12–8** Crankshaft journal measurements. Each journal measured in at least 6 locations, but also in position A & B and at 120° intervals around journal.
15. **SLIDE 15 EXPLAIN FIGURE 12–9** Camshaft journals measured in 3 places 120° apart: check for out-of-round.
16. **SLIDE 16 EXPLAIN FIGURE 12–10** Checking camshaft for wear by measuring lobe height with micrometer.

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	<p><u>DEMONSTRATION:</u> SHOW STUDENTS HOW TO USE A MICROMETER (ENGLISH/METRIC) TO TAKE OUT-OF-ROUND & TAPER MEASUREMENTS OF CONNECTING ROD & MAIN BEARING JOURNALS ON A CAMSHAFT. SHOW HOW TO USE A MICROMETER, USING VERNIER SCALE.</p>
	<p><u>HANDS-ON TASK SHEET:</u> HAVE STUDENTS USE A GAUGE ROD TO CALIBRATE A MICROMETER. HAVE STUDENTS PRACTICE USING A MICROMETER BY <u>COMPLETING TASK SHEET ON MIC USE.</u></p>
	<p>17. SLIDE 17 EXPLAIN Telescopic Gauge</p> <p>18. SLIDE 18 EXPLAIN FIGURE 12–11 When head is first removed, cylinder taper & out-of-round should be checked below ridge (a) and above piston when it is at bottom of stroke (b).</p> <p>19. SLIDE 19 EXPLAIN FIGURE 12–12 (a) A telescopic gauge being used to measure the inside diameter (ID) of a camshaft bearing. (b) An outside micrometer used to measure telescopic gauge.</p>
	<p>20. SLIDE 20 EXPLAIN Small-hole Gauge</p> <p>21. SLIDE 21 EXPLAIN FIGURE 12–13 Cutaway of a valve guide with a hole gauge adjusted to hole diameter.</p> <p>22. SLIDE 22 EXPLAIN FIGURE 12–14 outside of a hole gauge being measured with a micrometer.</p>
	<p><u>DEMONSTRATION:</u> SHOW STUDENTS HOW TO THE USE A TELESCOPIC GAUGE AND MICROMETER TO MEASURE A PISTON BORE. NEXT DEMO USING A SMALL-HOLE GAUGE TOGETHER WITH A MICROMETER TO MEASURE A VALVE GUIDE BORE.</p>
	<p><u>HANDS-ON TASK SHEET:</u> USE TELESCOPING GAUGE TOGETHER WITH A MICROMETER TO MEASURE A PISTON BORE BY <u>COMPLETING PAGE TASK SHEET ON MEASURING BORE</u></p>
	<p>23. SLIDE 23 EXPLAIN FIGURE 12–15 (a) A typical Vernier dial caliper. This is a very useful measuring tool for automotive engine work because it is capable of measuring inside, outside, and depth measurements. (b) To read a Vernier dial caliper, simply add the reading on the blade to the reading on the dial.</p>

ICONS



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SHOW VERNIER CALIPER ANIMATION [WWW.MYAUTOMOTIVELAB.COM](http://www.myautomotivelab.com)

[http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A1_Animation/Chapter7_Fig_7_15\(a\)/index.htm](http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A1_Animation/Chapter7_Fig_7_15(a)/index.htm)

SHOW VERNIER DIAL CALIPER ANIMATION [HTTP://WWW.JAMESHALDERMAN.COM/ANIMATIONS.HTML#A0](http://www.jameshalderman.com/animations.html#a0)

DEMONSTRATION: SHOW STUDENTS HOW TO USE A VERNIER DIAL CALIPER TO MEASURE OUTSIDE DIAMETER OR LENGTH OF AN OBJECT, AND DISCUSS ITS AUTOMOTIVE SERVICE OR REPAIR APPLICATIONS. SHOW STUDENTS HOW TO MEASURE DEPTH WITH A VERNIER DIAL CALIPER. PASS THE TOOL AROUND

HANDS-ON TASK: HAVE STUDENTS MEASURE A PISTON WITH A VERNIER CALIPER

24. SLIDE 24 EXPLAIN Feeler Gauge (thickness gauge)
25. SLIDE 25 EXPLAIN FIGURE 12–16 A group of feeler gauges (also known as thickness gauges), used to measure between two parts. The long gauges on bottom are used to measure the piston-to-cylinder wall clearance.
26. SLIDE 26 EXPLAIN FIGURE 12–17 A feeler gauge, also called a thickness gauge, is used to measure the small clearances such as the end gap of a piston ring.
27. SLIDE 27 EXPLAIN Straightedge
28. SLIDE 28 EXPLAIN FIGURE 12–18 straightedge is used with a feeler gauge to determine if a cylinder head is warped or twisted.
29. SLIDE 29 EXPLAIN Dial Indicator
30. SLIDE 30 EXPLAIN FIGURE 12–19 dial indicator is used to measure valve lift during flow testing of a high-performance cylinder head.

SHOW DIAL INDICATOR ANIMATION: [WWW.MYAUTOMOTIVELAB.COM](http://www.myautomotivelab.com)

[HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A1_ANIMATION/CHAPTER7_FIG_7_19/INDEX.HTM](http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A1_Animation/Chapter7_Fig_7_19/index.htm)

SHOW DIAL INDICATOR ANIMATION: [HTTP://WWW.JAMESHALDERMAN.COM/ANIMATIONS.HTML#A0](http://www.jameshalderman.com/animations.html#a0)

ICONS



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31. **SLIDE 31 EXPLAIN** Dial Bore Gauge & Depth Micrometer
32. **SLIDE 32 EXPLAIN FIGURE 12–20** dial bore gauge is used to measure cylinders and other engine parts for out-of-round and taper conditions.
33. **SLIDE 33 EXPLAIN FIGURE 12–21** A depth micrometer being used to measure the height of the rotor of an oil pump from the surface of the housing.

DISCUSSION: HOST A DISCUSSION ON WHAT A DIAL BORE GAUGE IS USED TO MEASURE AND WHAT OTHER TOOLS CAN BE USED IN ITS PLACE WHEN ONE IS NOT AVAILABLE

SHOW DIAL BORE INDICATOR

ANIMATION:

WWW.MYAUTOMOTIVELAB.COM

[HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A1_ANIMATION/CHAPTER30 FIG 30 23/INDEX.HTM](http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A1_animation/chapter30_fig_30_23/index.htm)

HOMEWORK: COMPLETE CH12 CROSSWORD

PUZZLE: [HTTP://WWW.JAMESHALDERMAN.COM](http://www.jameshalderman.com)

NATEF MLR TASK SUPP B5 DEMONSTRATE PROPER USE OF PRECISION MEASURING TOOLS (I.E. MICROMETER, DIAL-INDICATOR, DIAL-CALIPER).