

FIGURE 11.1 A rule showing that the larger the division, the longer the line.

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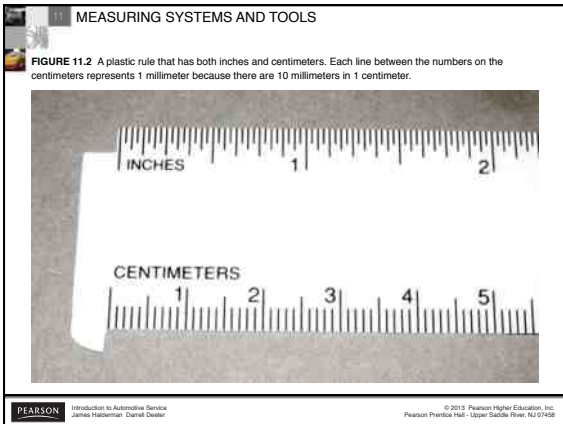
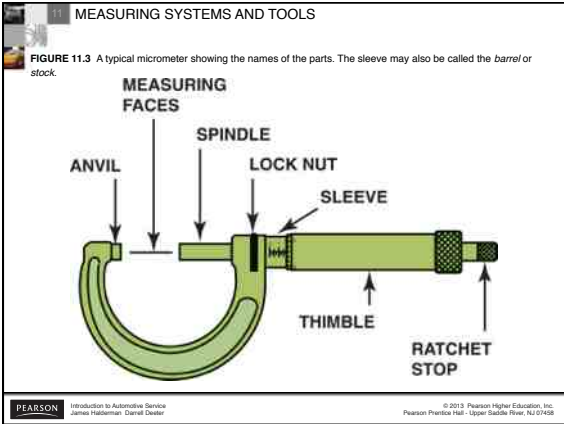
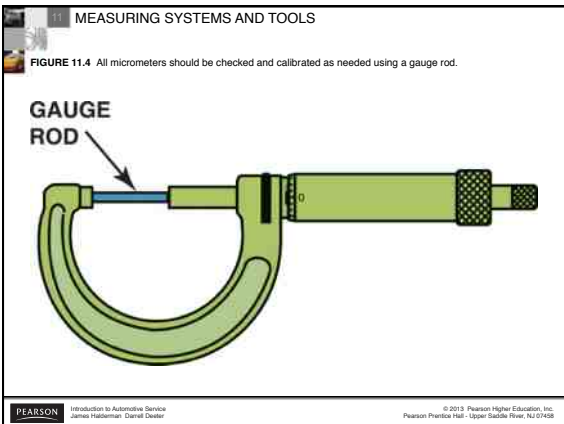
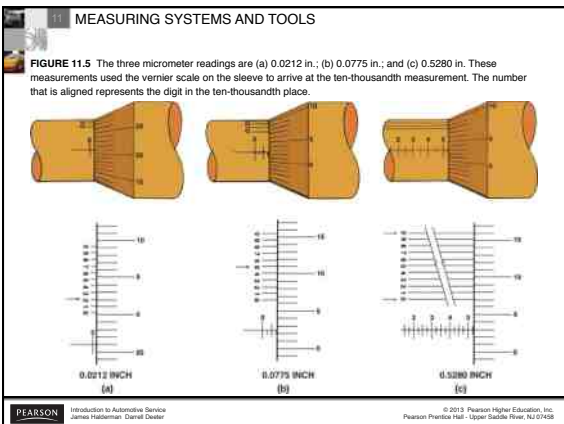


FIGURE 11.2 A plastic rule that has both inches and centimeters. Each line between the numbers on the centimeters represents 1 millimeter because there are 10 millimeters in 1 centimeter.

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FIGURE 11.6 Metric micrometer readings that use the 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.

(a) 0.187 MM (b) 3.001 MM (c) 6.33 MM

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FIGURE 11.7 Using a micrometer to measure the connecting rod journal for out-of-round and taper.

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FIGURE 11.8 Crankshaft journal measurements. Each journal should be measured in at least six locations, but also in position A and position B and at 120-degree intervals around the journal.

A B

2.0000" 1.9999" 1.9995" 1.9999"

120° 120° 120° 120°

A B

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FIGURE 11.9 Camshaft journals should be measured in three locations, 120 degrees apart, to check for out-of-round.

The diagram shows a circular cross-section of a camshaft journal. Three arrows originate from the center, pointing to the top, bottom-left, and bottom-right positions. Curved arrows between these points indicate the 120-degree angles between each measurement location.

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FIGURE 11.10 Checking a camshaft for wear by measuring the lobe height with a micrometer.

The illustration shows a hand holding a micrometer against the top of a camshaft lobe. The micrometer's spindle is in contact with the lobe's surface, and the thimble is being rotated to take a measurement.

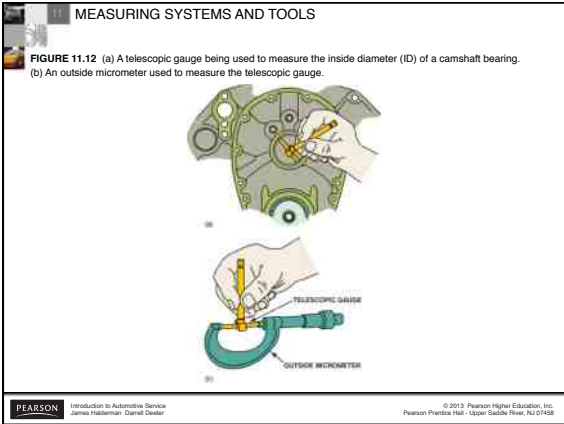
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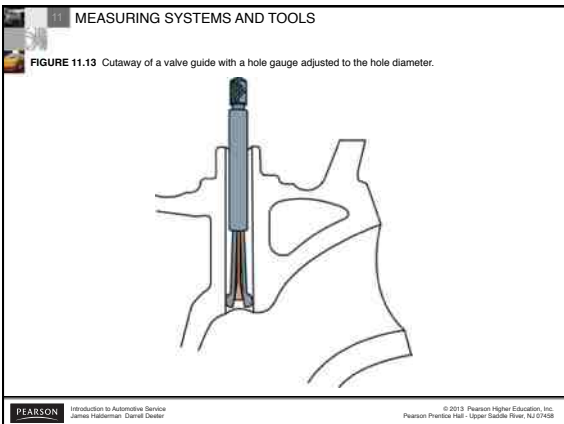
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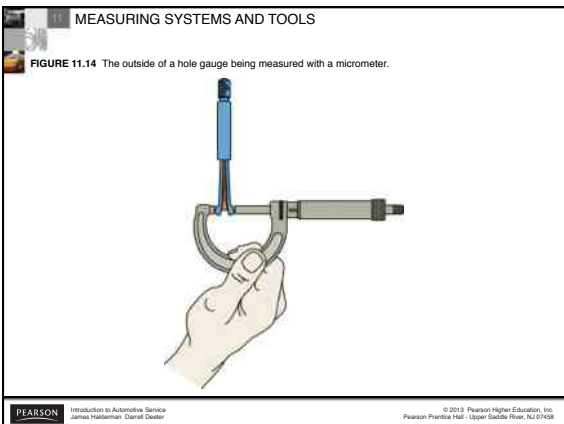
FIGURE 11.11 When the head is first removed, the cylinder taper and out-of-round should be checked below the ridge (a) and above the piston when it is at the bottom of the stroke (b).

The figure contains two photographs. Photograph (a) shows a cylinder with a measuring tool (likely a bore gauge) positioned below the ridge. Photograph (b) shows the same setup but with the piston at the bottom of the stroke, measuring the area above it.

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FIGURE 11.15 (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.

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FIGURE 11.16 A group of feeler gauges (also known as thickness gauges), used to measure between two parts. The long gauges on the bottom are used to measure the piston-to-cylinder wall clearance.

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FIGURE 11.17 A feeler gauge, also called a thickness gauge, is used to measure the small clearances such as the end gap of a piston ring.

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FIGURE 11.18 A straightedge is used with a feeler gauge to determine if a cylinder head is warped or twisted.



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FIGURE 11.19 A dial indicator is used to measure valve lift during flow testing of a high-performance cylinder head.

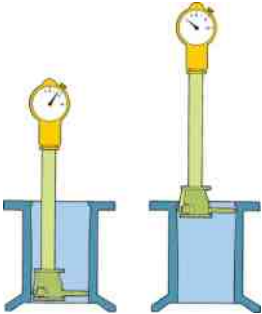


DIAL INDICATOR

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FIGURE 11.20 A dial bore gauge is used to measure cylinders and other engine parts for out-of-round and taper conditions.



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FIGURE 11.21 A depth micrometer being used to measure the height of the rotor of an oil pump from the surface of the housing.



The illustration shows a hand holding a depth micrometer against the top surface of a metal housing. The micrometer's base is in contact with the housing's surface, and its vertical stem extends down to touch the top of a rotor inside the housing. The rotor has a central rectangular cutout and several curved lobes around its perimeter. The housing is shown in a cross-sectional view.

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