FIGURE 12.1 A rule showing that the larger the division, the longer the line.

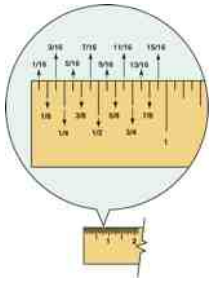

FIGURE 12.2 A plastic rule that has both inches and centimeters. Each line between the numbers on the centimeters represents 1 millimeter because there are 10 millimeters in 1 centimeter.

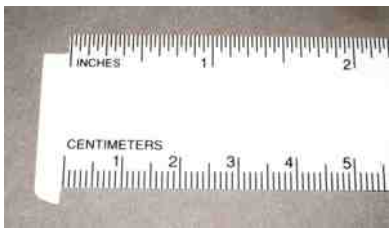

FIGURE 12.3 A typical micrometer showing the names of the parts. The sleeve may also be called the *barrel* or stock.

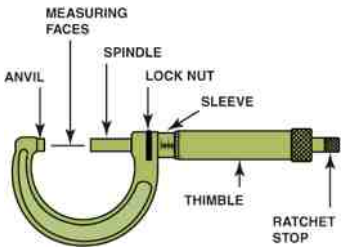

FIGURE 12.4 All micrometers should be checked and calibrated as needed using a gauge rod.

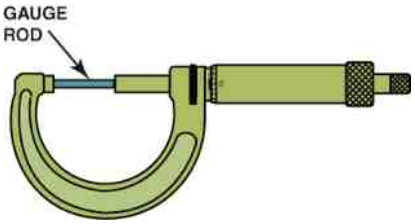

FIGURE 12.5 The three micrometer readings are (a) 0.0212 in.; (b) 0.0775 in.; and (c) 0.5280 in. These measurements used the vernier scale on the sleeve to arrive at the ten-thousandth measurement. The number that is aligned represents the digit in the ten-thousandth place.

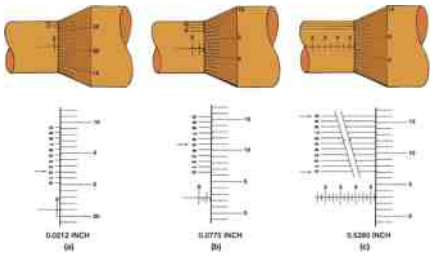

FIGURE 12.6 Metric micrometer readings that use the vernier scale on the sleeve to read to the nearest 0.001 millimeter. The arrows point to the final reading for each of the three examples.

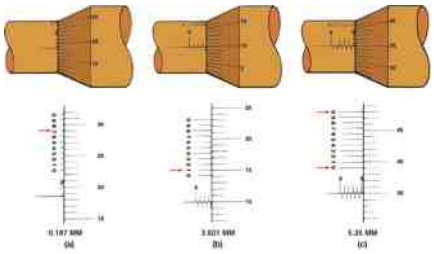

FIGURE 12.7 Using a micrometer to measure the connecting rod journal for out-of-round and taper.

FIGURE 12.8 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.

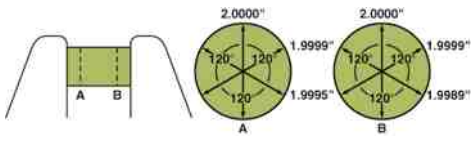

FIGURE 12.9 Camshaft journals should be measured in three locations, 120 degrees apart, to check for out-of-round.

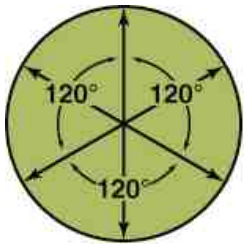

FIGURE 12.10 Checking a camshaft for wear by measuring the lobe height with a micrometer.

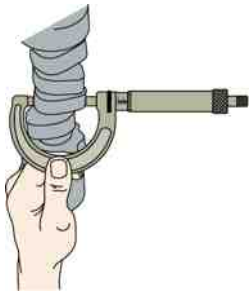

FIGURE 12.11 When the head is first removed, the cylinder taper and out-of-round should be checked below the ridge (a) and above the piston when it is at the bottom of the stroke (b).

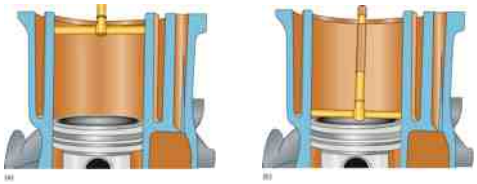

FIGURE 12.12 (a) A telescopic gauge being used to measure the inside diameter (ID) of a camshaft bearing. (b) An outside micrometer used to measure the telescopic gauge.

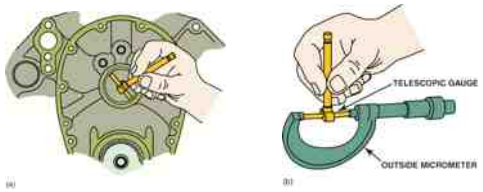

FIGURE 12.13 Cutaway of a valve guide with a hole gauge adjusted to the hole diameter.

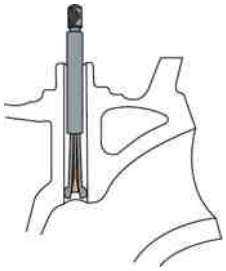

FIGURE 12.14 The outside of a hole gauge being measured with a micrometer.

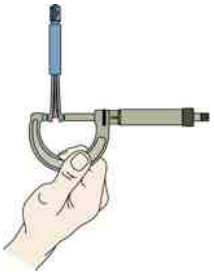

FIGURE 12.15 (a) A typical vernier dial caliper. This is a very useful measuring tool for automotive engine work because it is capable of measuring inside, outside, and depth measurements. (b) To read a vernier dial caliper, simply add the reading on the blade to the reading on the dial.

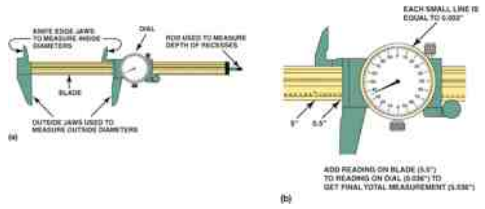

FIGURE 12.16 A group of feeler gauges (also known as thickness gauges), used to measure between two parts. The long gauges on the bottom are used to measure the piston-to-cylinder wall clearance.

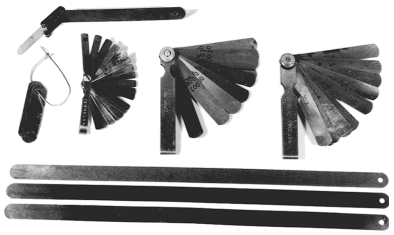

FIGURE 12.17 A feeler gauge, also called a thickness gauge, is used to measure the small clearances such as the end gap of a piston ring.

FIGURE 12.18 A straightedge is used with a feeler gauge to determine if a cylinder head is warped or twisted.

FIGURE 12.19 A dial indicator is used to measure valve lift during flow testing of a high-performance cylinder head.

FIGURE 12.20 A dial bore gauge is used to measure cylinders and other engine parts for out-of round and taper conditions.

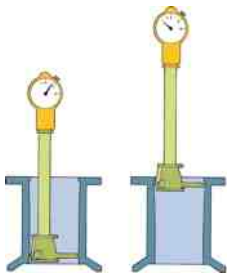

FIGURE 12.21 A depth micrometer being used to measure the height of the rotor of an oil pump from the surface of the housing.