

A EN 201 - Agricultural Power Units

Measuring Engine Wear

Objectives:

The Student Will Be Able To:

1. Describe the importance of measuring engine wear;
2. Describe how to measure cylinder wear;
3. Describe how to measure piston ring gap;
4. Describe how to measure the crankshaft;
5. Describe how to measure the cam shaft;
6. Describe how to measure valve wear; and
7. Appraise wear measurements and make repair judgments according to wear.

Required Reading For Quiz:

1. This laboratory chapter

I. Introduction:

Even though the internal working parts of an engine are not seen, they are the most important. These parts are so very important because of the jobs that they perform, and because of the intense work pressure that they endure. For these reasons, the internal moving parts of an engine must be made of high quality materials and they must be precise. Throughout this laboratory, the precision of these parts will be checked. Even though the parts are made of high quality materials, they are still subject to wear.

II. Measuring Cylinder Wear:

The cylinder wall of an internal combustion engine does not wear uniformly from top to bottom. The only area of severe wear is the part of the cylinder wall where the rings move from top to bottom. The wear is usually greater just below the top of the ring travel and decreases as the piston travels toward the bottom of its stroke.

To get an accurate measurement on the cylinder, it is recommended that six different measurements be taken. Measurements should be taken in pairs - two at the upper area of ring wear, two at the middle of ring wear, and the last two at the lower end of ring wear, (Figure, 4.1). At each of these positions one measurement should be taken parallel to the crankshaft and one taken perpendicular to the crankshaft. By using this method, any out-of-roundness and/or taper can be determined.

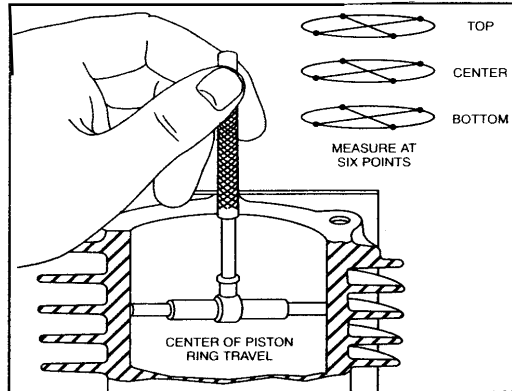


Fig. 4.1, Measuring Cylinder Bore
 Courtesy of Briggs & Stratton Corp.

Check the manufacturer's recommendation for allowable oversizing (wear), out-of-round, and cylinder taper. If any one dimension in the cylinder exceeds the factory allowance, the cylinder will require reboring to .010", .020", or .030" oversize replacement of the cylinder if the engine is to be put back into full service.

III. Measuring Piston Ring Gap:

When the piston is operating in a cylinder, the ends of each piston ring are separated by a slight gap referred to as the piston ring-gap, or end-clearance. This gap permits the ring to exert pressure on the cylinder wall for a tight seal, yet allows expansion when the ring becomes hot. Measurement of the piston ring-gap, (Figure, 4.2), is used to determine the amount of wear that has taken place on the piston rings themselves.

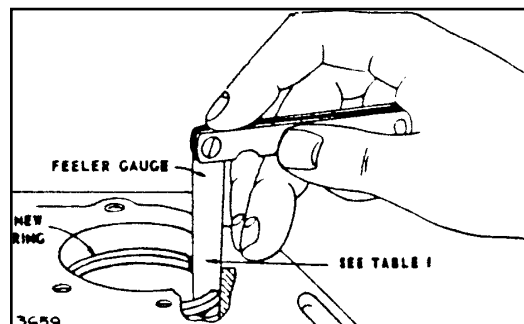


Fig. 4.2, Measuring Piston Ring Gap
 Courtesy of Briggs & Stratton Corp.

First, remove the rings from the piston. Using the top of the piston, push the compression ring into the cylinder until it is about one inch below the very top of the cylinder. With a standard flat feeler gauge, measure the distance between the ends of each ring. Compare your measurement with the manufacturer's specifications. If the ring gap is greater than the manufacturer's specifications, the entire ring set should be discarded and new rings installed. Too great a ring gap indicates that there is not enough spring tension in the rings to form a tight seal between the rings and the cylinder wall.

The gap will also cause combustion gases to leak past the rings resulting in lost engine power. Oil from the crankcase will also leak past the rings causing excessive oil consumption and smoking. If excessive end-clearance exists after a new ring is installed, this clearance is often used as criteria for cylinder resizing.

IV. Measuring the Crankshaft:

The bearing surfaces on a crankshaft are known as bearing journals. Each journal should be cleaned, and then measured with a micrometer or a caliper, (Figure, 4.3), at three or four points around the circumference to determine the size and to check for out-of-roundness. Compare the measurements obtained with the manufacturer's specifications or reject sizes.

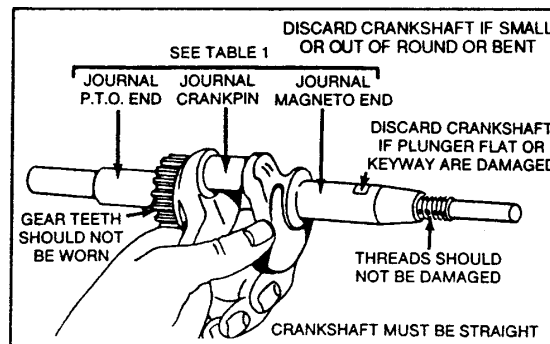


Fig. 4.3, Crankshaft Measurement Points
Courtesy of Briggs & Stratton Corp.

To measure the amount of clearance between the crankpin journal and the connecting rod bearing, plastigage can be used. It consists of a thin plastic material which is placed between the shaft and rod cap, as shown in Figure, 4.4. The rod cap is tightened to a recommended torque measurement, flattening the plastic. Extreme care must be taken to avoid turning the connecting rod on the crank pin since this would cause an incorrect reading. The rod cap is then removed, and the flattened plastic is measured for width by comparing it to a scale supplied by the manufacturer.

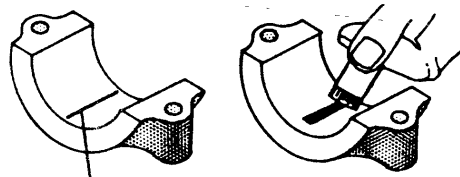


Fig. 4.4, Crankpin Journal and Connecting Rod Cap Clearance

The amount of clearance is specified by the manufacturer. These dimensions should be followed. In the absence of specific instructions, it is customary to use a minimum of .0005", to .0001" for small shafts. Any clearance in excess of .005" on either main or rod is usually regarded as reason for adjustment or the installation of new bearings.

V. Measuring the Camshaft:

The camshaft has two primary areas of wear, (Figure, 4.5). The first area of wear is the lobes, which are responsible for lifting the tappets. The lobes are subjected to large amounts of wear because of their scraping or rubbing action against the face of the tappet. The manufacturer's specifications should be checked and decisions made according to the micrometer readings of lobe wear. The second area of wear is the camshaft journal. The journal stabilizes the camshaft in the crankcase, and is not exposed to the same amount of wear as the lobes. Nevertheless, the journal is to be measured and decisions made according to wear in relation to manufacturer specifications.

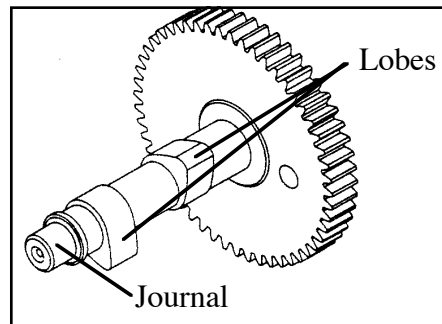


Fig. 4.5, Measuring the Camshaft.
Courtesy of Briggs & Stratton Corp.

VI. Measuring Valve Wear:

The important parts of the valve are the head, margin, face, and stem, as shown in Figure, 4.6-4.8. A valve is opened by its valve tappet as the tappet rides over the lobe of the camshaft. The valve is closed by a spring that acts against the tappet.

Tappet clearance, (valve clearance), should be checked by placing a flat feeler gauge between the valve tappet and the valve stem. Operator's manuals list the recommended clearances. When checking tappet clearance, turn the crankshaft until one of the valves is at its highest position; then, turn the crankshaft one revolution or until the tappet clears the valve stem, hold the valve down firmly with your thumb, and insert a feeler gauge. Repeat this procedure for the other valve. Grind or file off the end of the valve stem if necessary to obtain the desired clearance. If the tappet clearance is too great, the valve will not be open long enough. To change this, it is necessary to re-face the valve, its seat, or both. After a valve has gone through several grindings or re-facings the thickness of its margin may have grown too small. If the valve margin is $1/2$ its original thickness, it has worn too thin, and should be replaced.

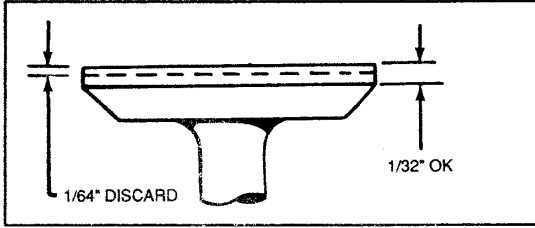


Fig. 4.6, Valve Margin
 Courtesy of Briggs & Stratton Corp.

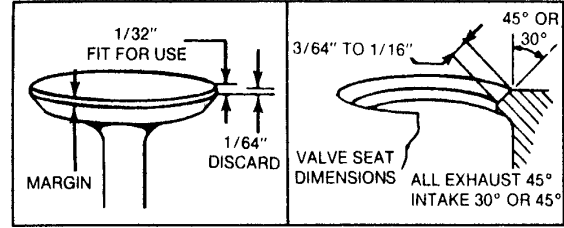


Fig. 4.7, Valve and Seat Margin
 Courtesy of Briggs & Stratton Corp.

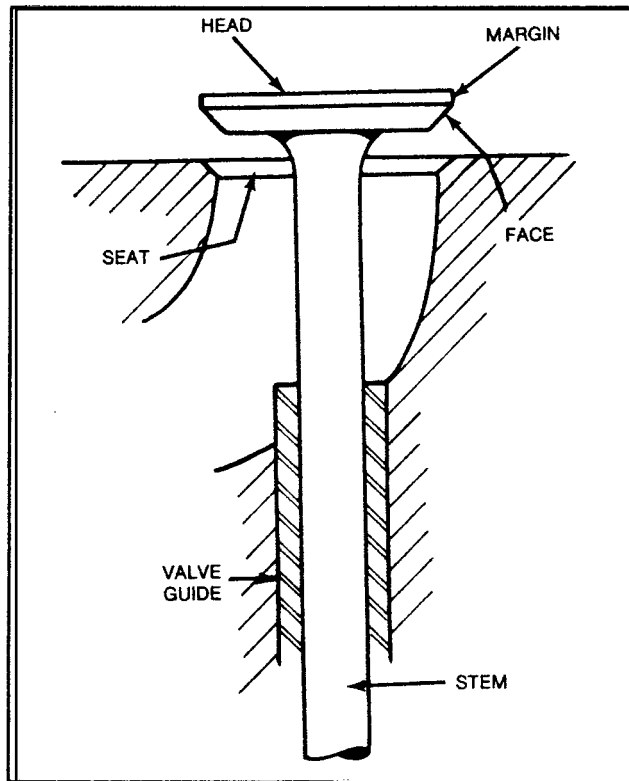


Fig. 4.8, Parts of the Valve.
 Courtesy of Briggs & Stratton Corp.

Note: Tappet clearance will be checked at the beginning of Laboratory V after the valves are reassembled.