Lesson A6–3

Measuring Engine Components and Specifications

Unit A. Mechanical Systems and Technology

Problem Area 6. Agricultural Power Systems

Lesson 3. Measuring Engine Components and Specifications

New Mexico Content Standard:

Pathway Strand: Power, Structural and Technical Systems

Standard: **III:** Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

Benchmark: **III-A:** Troubleshoot problems and evaluate performance to service and repair the components of internal combustion engines.

Performance Standard: **1.** Describe principles of operation. **2.** Identify engine systems and components. **3.** Analyze and troubleshoot engine.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Identify measuring and testing equipment for internal combustion engines.
2. Identify the specifications of an internal combustion engine.
3. Explain four major specifications to be checked on small engines.

List of Resources. The following resources may be useful in teaching this lesson:

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Briggs & Stratton. *Single Cylinder "L" Head Repair Manual.* 1999.

Hoerner, Harry J., et al. *Small Gasoline Engines, Operation, Repair, and Maintenance*. Minneapolis, Minnesota: Hobar Publications, 1992.

List of Equipment, Tools, Supplies, and Facilities

Writing surface
Overhead projector
Transparencies from attached masters
Microcomputer
Presentation software
TV converter hardware
Small gasoline engine
Small gasoline engine tools and instruments

Terms. The following terms are presented in this lesson (shown in bold italics):

Compression gage
Dial indicator
Flat feeler gage
Inside micrometer set
Micrometer caliper
Plastigage
Round-wire gage
Tachometers
Telescoping gage
Torque wrench

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Display a specification chart of an internal combustion engine. Ask the students if they know how the specifications are determined.

Summary of Content and Teaching Strategies

Objective 1: Identify measuring and testing equipment for internal combustion engines.

Anticipated Problem: What are some of the instruments used for measuring internal combustion engines?

I. Proper selection and use of tools is an important asset to successful engine repair. The following tools are commonly used in measuring engine components.

   A. The ***micrometer caliper*** is a precision measuring tool for taking outside measurements. It has accuracy to the nearest ten-thousandth of an inch.

      1. A ***inside micrometer*** may be used to determine the inside of the cylinder. It is a one piece micrometer with a handle that allows it to be inserted into the cylinder bore.

      2. Often, a ***flat feeler gage*** is used to recognize the spacing between two surfaces. They measure in increments of .001 inch. Another tool performing the same type of measurements is the ***dial indicator***, which is made up of a movable tip that records the readings of the dial needle on a circular scale.

      3. The ***round-wire gage*** is used in measuring the electrode gap of spark plugs. It typically measures in .001 inch.

      4. ***Plastigage*** is a thin, plastic, threadlike material which is used to measure the clearance between the bearing journal on a crankshaft and the bearing rod cap.

   B. It is important to follow the manufacturers specifications for the torque which bolts and nuts must be tightened to, depending on their size and grade. Every bolt has a torque specification. A ***torque wrench*** is the hand tool used for this purpose and will be one of three different designs; click-type, torsion-bar type, or flexible-beam type.

      1. A ***compression gage*** is a rubber tipped or threaded dial instrument that helps in determining if there is a problem with the cylinder, piston rings, valves, or gaskets. It measures the compression pressure of the engine in pounds per square foot. In testing, one cylinder engines have normal readings between 60–150 pounds per square inch (psi).

      2. The ***telescoping gage*** is a tool used for measuring inside diameter.

      3. There are three common types of tachometers used with internal combustion engines. ***Tachometers*** are used for reading revolutions per minute (RPM). The speedometer-type, vibration-type, and electronic-type are used to accurately check engine revolutions per minute.

Assign students to read the suggested chapters in the recommended resource texts. Follow the reading up by displaying TM: A6–3A through TM: A6–3C. They will provide good illustrations of various measuring instruments. A good application would be to have students practice using the instruments on an engine in your shop or lab.

Objective 2: Identify the specifications of an internal combustion engine.

Anticipated Problem: What are the specifications of an internal combustion engine?

II. Charts are provided by engine manufacturers detailing the exact specifications to increase performance and prolong service life.

   A. Specifications are related to engine size and work requirements.

      1. The model number must be observed before determining the correct settings for any engine.
      2. Torque specifications are listed in foot-pounds or inch-pounds. The flywheel nut, cylinder head, connecting rod cap, and crankcase cover are examples of items on a small engine chart.

   B. Clearances of the intake and exhaust valves are critical to the operation of four-stroke engines.

      1. The cylinder bore requirements may be found in the column listing standard measurements in inches.
      2. All other specifications center around the crankshaft and the areas it affects inside the engine.

Have students read the suggested chapters in the recommended resource texts. Obtain a copy of the manufacturer's specifications for an engine. Review the specifications with the class. Use classroom discussion to identify any concepts that need to be covered in more detail.

Objective 3: Explain four major specifications to be checked on small engines

Anticipated Problem: What are four major specifications that are commonly checked on small engines?

III. Every engine requires four basic elements to run. The specifications on these elements should be routinely checked in order to maintain engines in good running order.

   A. Fuel—engine owners should use only the fuel recommended by the manufacturer. Using improper types of fuel will lead to major engine problems. If fuel type is correct and the engine does not run properly, the carburetor may need to be adjusted. General guidelines for carburetor adjustments are as follows:

      1. Turning the needle valve clockwise will create a leaner fuel mixture.
      2. Turning the needle counter clockwise will create a richer fuel mixture.

   B. Oxygen—engines need to take in clean air in order for combustion to occur. Air filters should routinely be checked and cleaned to insure that the engine is supplied with the proper amounts of oxygen.

   C. Compression—if the engine does not have compression, it can be indicative of more serious problems. A quick way to check if a small engine has compression is to pull the

starter rope. If, when pulled, there is no resistance against the starter rope, the engine lacks compression.

D. Ignition—spark plugs should be routinely checked. This can be done by removing the plug. If the plug's electrode is covered with carbon deposits it may be cleaned with a wire brush or simply replaced. When the spark plug is reinstalled, the plug gap should be adjusted properly as recommended by the manufacturer.

Have students read the suggested chapters in the recommended resource texts. They contain good basic information on the topic. TM: A6–3D will provide a good example of using a plug gap tool to set the gap in a spark plug.

Review/Summary. The review and summary of the lesson may be accomplished by viewing the transparency masters with the students. A discussion should be performed with the students before proceeding with the laboratory activity and testing.

Evaluation. Objectives should be reviewed by the students. A laboratory activity should be performed before the written test is given to students.

Answers to Sample Test:

Part One: Matching

1 = e, 2 = a, 3 = h, 4 = g, 5 = c, 6 = f, 7 = b, 8 = d

Part Two: Completion

1. foot-pounds
2. needle valve
3. cylinder
4. .001

Part Three: Short Answer

1. Fuel, oxygen, compression, and ignition.
2. Speedometer-type, vibration-type, and electronic-type.

Sample Test Name_____

Test

Lesson A6–3: Measuring Engine Components and Specifications

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

a. Compression gage
b. Dial indicator
c. Flat feeler gage
d. Micrometer caliper
e. Plastigage
f. Telescoping gage
g. Torque wrench
h. Tachometer

_____ 1. Thread-like plastic material used to measure between parts.

_____ 2. A tool screwed or held to a spark plug opening measuring pounds per square inch.

_____ 3. Testing tool used for reading revolutions per minute (RPM).

_____ 4. Used for tightening parts by determining the rotary efforts placed upon a fastener.

_____ 5. Pieces of flat metal manufactured to predetermined thicknesses.

_____ 6. Tool having two movable spring loaded parts allowing for expanded measurements.

_____ 7. Displays a needle on a circular scale showing differences in dimensions.

_____ 8. Measuring tool for taking outside linear measurements.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. Torque specifications are listed in _____ _____ or inch-pounds.
2. A rich carburetor mixture may be corrected by adjusting the _____ _____ clockwise.
3. The _____ bore requirements may be found in the column listing standard measures in inches.
4. The electrode gap of spark plugs is typically measured in _____ inch.

Part Three: Short Answer

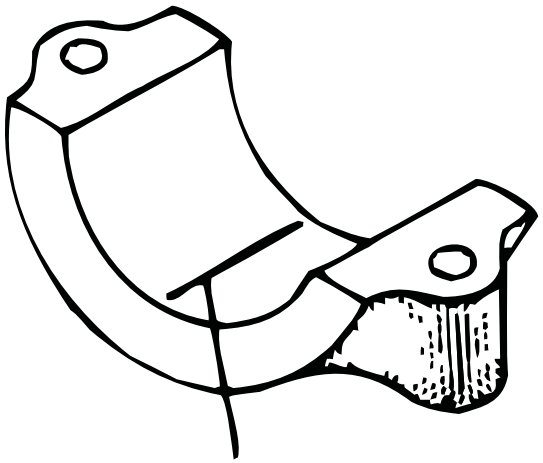
Instructions. Provide information to answer the following questions.

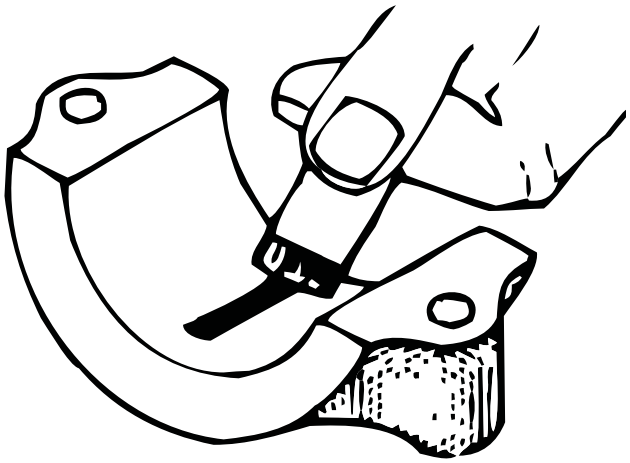
1. Name four basic elements engines require in order to run.

2. What are the three types of tachometers?

TM: A6–3A

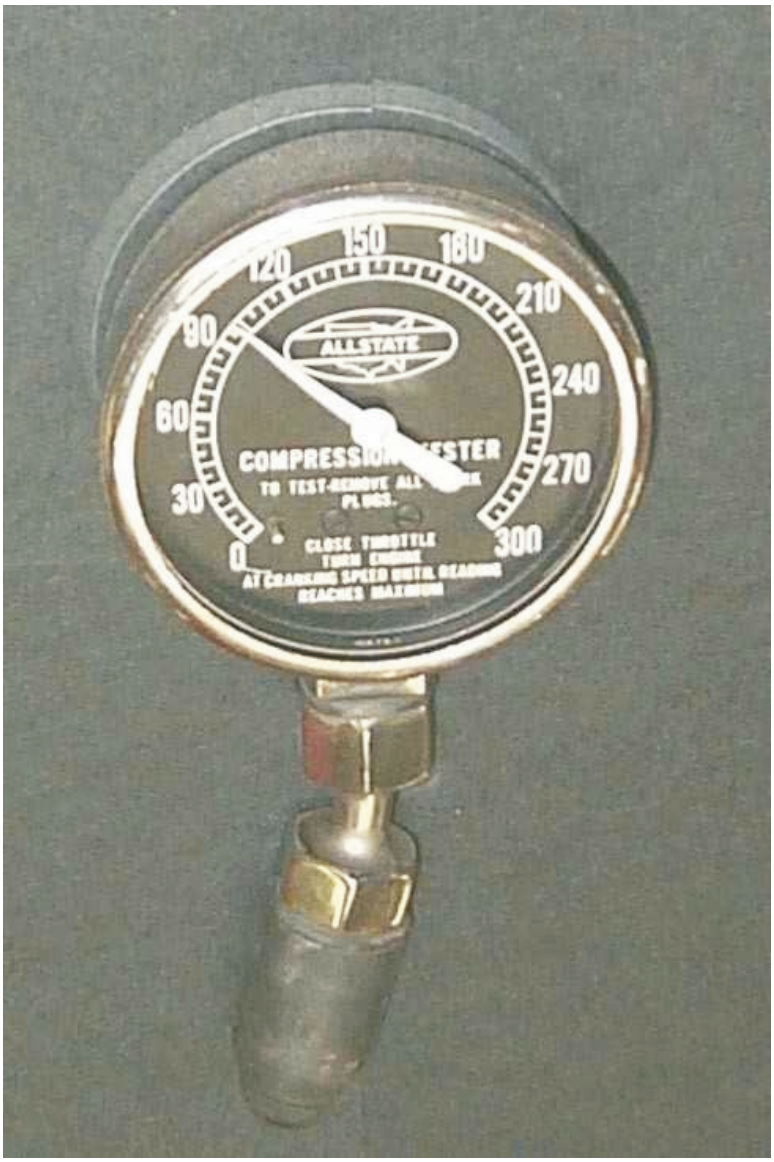
PLASTIGAGE





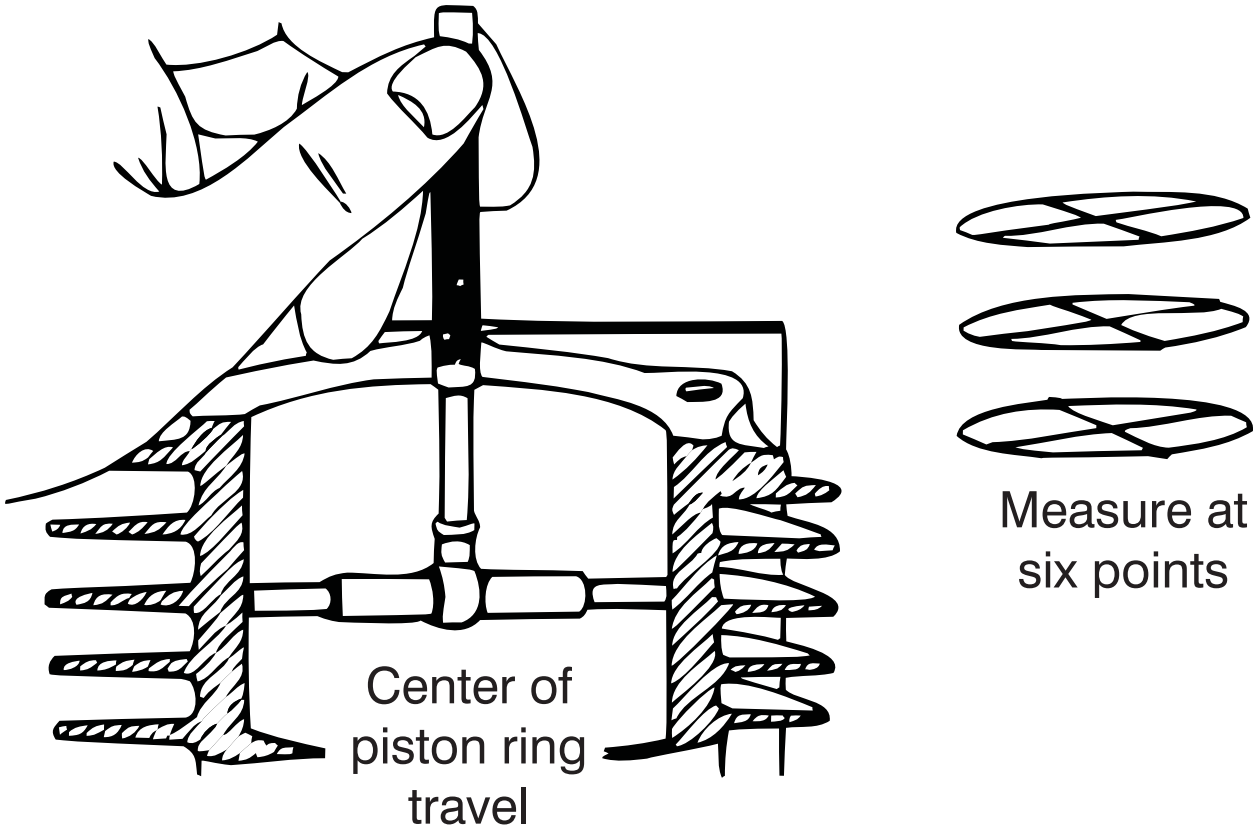
TM: A6–3B

COMPRESSION GAGE



TM: A6–3C

TELESCOPING GAGE



TM: A6–3D

SETTING THE GAP ON A SPARK PLUG

(Courtesy, Interstate Publishers, Inc.)