Regular maintenance is required to keep engines in good operating condition. Once preventive maintenance practices are put into place, engine performance will increase and engines should last longer. Safety precautions should be used during engine maintenance.

Objective:

- Explain and identify maintenance practices on engines.

Key Terms:

- compression gage
- flooding
- preventive maintenance

Engine Maintenance

For agricultural equipment to operate efficiently, it must be maintained properly. Preventive maintenance is the performance of practices to keep equipment in good working condition, such as changing fluids, cleaning components, and replacing filters. Properly maintaining agricultural equipment requires skills, practice, and quality management.

Key preventive maintenance practices include the following points:

- Read the operator’s manual to be knowledgeable about the equipment.
- Follow the recommended maintenance schedule and all of the manufacturer’s recommendations.
- Keep a history record on the equipment.
- Keep equipment clean, especially in the case of internal combustion engines.
AMAZING ASPECTS: Be Safe

Operator safety is always the first concern when dealing with agricultural equipment. It is important to observe safety measures to avoid injuries. Whenever maintenance practices are undertaken, the guidelines below should be followed:

- Read and follow all instructions in the manual.
- Know all the safety emblems and warning signs used for agricultural equipment.
- Always use protective eyewear, clothing, and footwear.
- Use jackstands, engine stands, and other supports when working around raised or dismantled equipment.
- Observe caution around fuels and flammable materials while servicing equipment.
- Operate internal combustion engines only in well-ventilated areas.
- Place machines in park and lower implements before working on them.
- Work in bright and properly ventilated areas.
- Regularly clean the floor and remove obstacles and fluids.
- Handle batteries safely since they produce hydrogen gas, which is very explosive.
- Keep fire extinguishers and smoke detectors in shop work areas.
- Use caution when working around high pressure.
- Use protective hearing devices when working in loud areas for extended periods.
- Safely dispose of used fluids to protect people, animals, and the environment.

Use only fluids, filters, and products that meet or exceed the manufacturer’s recommendations.

Be careful to measure the correct amount of fluids being added to engines.

COMMON MAINTENANCE PRACTICES

Even with proper preventive maintenance, engines will periodically experience problems and need repairs. Locating the problem is obviously necessary in order to correct it. Usually,
the problem can be traced to the ignition, fuel, or compression system. If one of these three systems is not functioning properly, the engine will run poorly or not at all.

**Ignition System**

The ignition system provides the spark for spark ignition engines. The electrical spark may be generated from a magnetic field created by magnets in a magneto ignition system. A battery ignition system’s spark is generated by the battery or charging system. Because several problems can be traced to the ignition system, it is important to check it in a logical sequence, such as the following:

1. Inspect the spark plug to insure that the correct plug is being used. Make sure the gap is set according to the specifications.
2. Inspect the spark plug wire to determine if it is in place.
3. Use a spark tester to check the spark output by connecting the tester between the spark plug and the spark plug wire. If there is a weak spark or no spark, it could indicate a bad armature, or the wire may be grounded. Inspect the wire for bare spots. Also, insure that the wire is not grounded. Lack of a spark on magneto ignition systems can be caused by corrosion on the flywheel or armature legs.
4. If a strong spark is occurring, it could indicate that the timing of the spark is off, which could mean that there is a problem with the flywheel. The flywheel is held in correct position with the crankshaft by a soft metal key. If the engine is subjected to an abrupt stop, the key may be sheared off. The shearing of a key decreases the chances that the crankshaft will break. However, if the key is partially sheared, the timing will be off.

The following is a list of steps in checking the key:

1. Remove the shroud from the engine.
2. Take off the screen and remove the flywheel nut using the correct tools. Some of the flywheel nuts will have left-hand threads.
3. Inspect the flywheel. A sheared or partially sheared key should be apparent. To replace the key, the flywheel will have to be removed by using special pullers that will not
cause the flywheel to break. To pull the flywheel, remove the crankshaft nut, install and tighten the puller, and tap the center bolt of the puller with a light blow. The impact of the blow should cause the wheel to pop off of the tapered shaft.

4. Replace the defective key in the key way and reassemble the unit.

**Fuel System**

Once problems with the ignition system have been ruled out, check the fuel system. The fuel system’s function is to deliver the correct amount of clean fuel to the combustion chamber. When checking for fuel system problems, the following items should be inspected:

1. A simple first step is to insure that there is gas in the gas tank. Although this is a very basic factor, it is often overlooked.

2. If the engine fails to start, remove the spark plug and check it for gasoline. If the odor of gasoline is present on the plug or in the cylinder, the fuel system is probably working correctly. If the spark plug is wet and shows signs of moisture, it could be fouled and should be dried or replaced.

3. If the spark plug does not smell of gasoline, the flow of gas from the fuel tank to the carburetor should be checked. Inspect it for blockages in the fuel line or carburetor. The diaphragm of the carburetor may be torn. This prevents the gas from being transferred from the fuel line to the carburetor.

4. Flooding might be the cause of the problem. Flooding is an excessive amount of gasoline in the carburetor. It may be caused by applying the choke for too long. Allowing the engine to sit for a few minutes permits the excess gasoline to be dispersed.

**Compression System**

The compression system is the most difficult to repair. It contains many parts. Most are located within the engine, so repairs require engine disassembly. Compression of an internal combustion engine can be measured by performing compression tests. A compression gage is a tool used to determine compression pressure of the cylinder as recommended by the manufacturer. A common procedure for checking compression is to remove all spark plugs, install the compression gage in a spark plug port, and turn the engine over. The compression gage should be used to check each cylinder. If the compression system is weak or defective, a decision has to be made whether to replace or overhaul the engine. The decision to rebuild an engine should not be taken lightly. It involves a great deal of disassembly and reassembly work.

**Engine Cooling System**

The engine cooling system is designed to manage the heat produced by the combustion of the air and fuel. There are two basic kinds of cooling systems: liquid cooling and air cooling.
**TABLE 1. Common Maintenance Practices**

<table>
<thead>
<tr>
<th>Liquid Cooling Systems</th>
<th>Air Cooling Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visually check the hoses and belts for leaks and cracks.</td>
<td>Keep the system clean by removing dirt that can clog air passages.</td>
</tr>
<tr>
<td>Maintain the proper coolant level in the system.</td>
<td>Make sure the precleaner, which is usually a screen, is in place.</td>
</tr>
<tr>
<td>Keep the system clean.</td>
<td>Check the fan to make sure it is operating properly and can move air freely.</td>
</tr>
<tr>
<td>Use the recommended coolant in the required mixture.</td>
<td>All shrouds and engine shields are in place to allow for proper air circulation.</td>
</tr>
<tr>
<td>Use a pressure tester to pressurize the system and check for leaks.</td>
<td></td>
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<tr>
<td>Use a coolant hydrometer to check the specific gravity of the coolant.</td>
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<tr>
<td>Check the condition of the system’s fan.</td>
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</tbody>
</table>

**Lubrication System**

Proper maintenance of the lubrication system of an internal combustion engine is critical. General maintenance practices include checking the engine oil level regularly and changing the oil and filters according to the manufacturer’s recommendations.

**TABLE 2. General Procedure for Changing Oil and Filter**

<table>
<thead>
<tr>
<th>Changing Oil and Filter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Make sure the machine or engine is in a safe and level position.</td>
</tr>
<tr>
<td>2. Operate the engine until it has warmed up.</td>
</tr>
<tr>
<td>3. Shut off the engine, and remove the drain plug.</td>
</tr>
<tr>
<td>4. Allow the oil to drain for several minutes.</td>
</tr>
<tr>
<td>5. Clean dirt from the oil filter area, and remove the filter.</td>
</tr>
<tr>
<td>6. Install a new filter; make sure the filter gasket is oiled and properly installed.</td>
</tr>
<tr>
<td>7. Fill the crankcase with the recommended amount of oil.</td>
</tr>
<tr>
<td>8. Start the engine, and allow it to run for about two minutes.</td>
</tr>
<tr>
<td>9. Check to make sure the system has the correct operating pressure and check for any leaks.</td>
</tr>
<tr>
<td>10. After shutting the engine off and waiting several minutes, recheck the engine oil level.</td>
</tr>
</tbody>
</table>
Air Intake System

The air intake system cleans dirt and other particles from the air and brings it into the combustion chamber. This should occur without severe restrictions to the free flow of the air, which would decrease the engine output.

The following are general procedures for testing the air intake system:

1. Connect a vacuum gage to the intake manifold.
2. Allow the engine to run for a few minutes.
3. Record the gage reading with the engine operating at fast-idle speed.
4. Compare the readings with the manufacturer’s specifications.
5. Inspect the intake system for possible restrictions and leaks.

Summary:

A dependable engine requires regular maintenance. Operator’s manuals provide information pertaining to specific information on engines. It is essential for the manufacturer’s specifications to be read and followed. General engine maintenance and attention to all engine systems will keep engines running properly. When working with internal combustion engines, safety precautions must be used.

Checking Your Knowledge:

1. Why are preventive maintenance practices important on engines and equipment?
2. What are the nine safety colors, and what do they represent?
3. What should be inspected on the ignition system?
4. What is flooding?
5. What are the general maintenance practices for liquid cooling systems?
Expanding Your Knowledge:

Locate a small engine that has been used recently (e.g., lawnmower, weed eater, tiller, or chainsaw). Perform preventive maintenance practices, and make a diagnosis of your findings. Fix or repair problems. Be sure to change the oil, clean the air filter, check the cleanliness of the fuel system, and check the performance of the spark plug.

Web Links:

Engines
http://www briggsandstratton com/engines/support/how-to-articles.aspx

Small Engine Advisor
http://smallengineadvisor.com/maintenance2.htm

Small Engine Repair
http://www small-engines com/

Agricultural Career Profiles
http://www mycaert com/career-profiles