

Appendix A

Topic 1: Introduction to Engine Systems

Read through the information to learn about small gas engines. An assignment follows to test your knowledge from the readings.

A gasoline-fueled engine is an internal combustion engine designed to transform the chemical energy of burning fuel (gasoline that is combined with air) into mechanical energy that will turn the crankshaft allowing a mower's blade to cut or a tractor's wheels to turn.

You will learn in the pages that follow that there are four strokes that the piston must make in a four stroke engine to complete a cycle: **Intake, Compression, Power and Exhaust.**

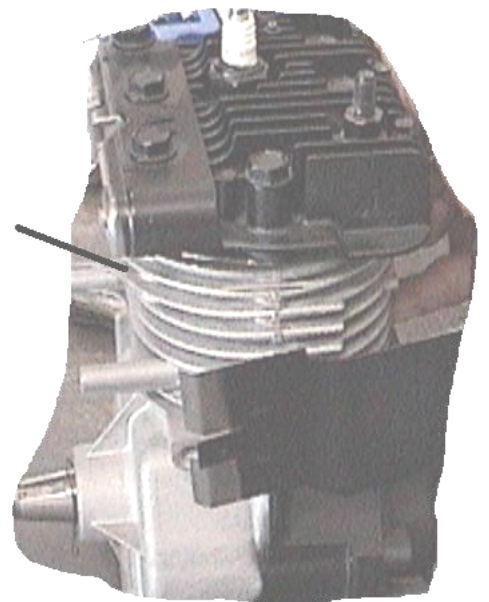
There are five basic systems that make up a small gas engine that we will look at during this module:

1. **Mechanical** – the design and construction of the engine
2. **Carburetion** – the mixing of the air with the gas and admitting it to the cylinder
3. **Ignition** – firing of the fuel charge in the combustion chamber
4. **Cooling** – a method of removing the heat from the engine
5. **Lubrication** – the ability to get the oil to all of the moving parts

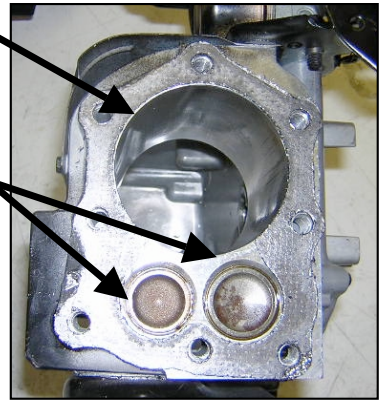
Mechanical

Take out the engine to identify each part as you are reading the information below. The important parts of any internal combustion engine are:

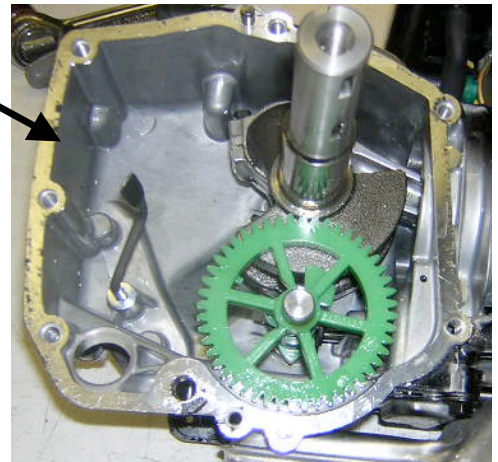
Cylinder Block – the cylinder block is usually cast from either iron or aluminum alloy. The cylinder block is what keeps all of the engine parts in alignment. The cylinder itself can either be bored directly into the cast iron or sometimes a steel sleeve will be inserted into an oversized hole (that is the case in the aluminum cylinders). Aluminum is a soft metal and the movements of the piston would wear out the cylinder walls very quickly without the steel sleeve. Aluminum is used because of the ability to dissipate (move away) heat quickly and it is very lightweight. The fins, called **cooling fins** that you see around the outside of the cylinder block direct the air around the engine to help keep it cool.



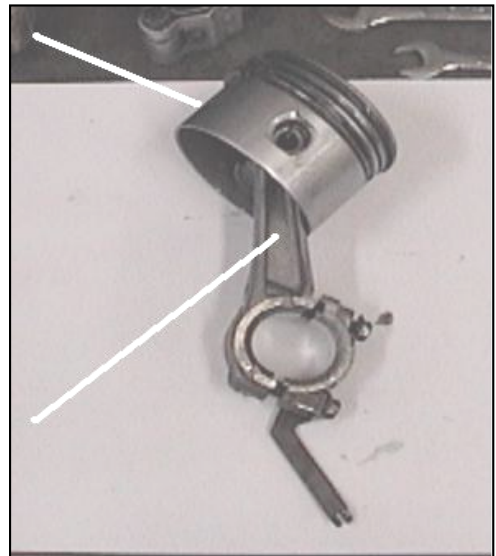
- **Cylinder** – This is the large hole in the center of the engine where the piston travels up and down. You can only see this when the engine is disassembled (remove the cylinder head). The gasoline-air mixture enters and exits the cylinder through the ports or **valves** in the cylinder. The ported cylinder can also be referred to as the combustion chamber. When combustion takes place, all ports or valves must be closed.



- **Crankcase** – the crankcase is designed to be rigid and strong to withstand the rotational forces (spinning) of the crankshaft as well as to protect the internal parts of the engine. In four-stroke engines, oil for the lubrication of the engine is contained in the crankcase, in two-stroke engines oil and gas are passed through the crankcase before entering the combustion chamber. Oil and gasket seals are used to keep out dirt and keep the oil clean. The oil dip stick measures the amount of oil in the crankcase.

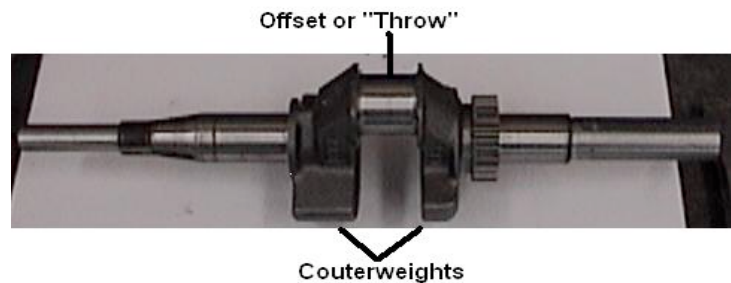


- **Piston** – the piston is what transfers the energy of the combustion into the output energy of the crankshaft. The piston is exposed to the extreme heat of the combustion and will expand in diameter, therefore, it is slightly smaller than the inside diameter of the cylinder. There are rings around the outside of the piston that make contact with the cylinder. The piston rings provide a seal between the combustion chamber and the crankcase keeping the exhaust gases above the piston and not allowing the lubricating oil to leak into the combustion chamber. The cylinder walls are lubricated with oil from the crankcase and allow the piston to move freely within the cylinder.



- **Connecting rod** – The piston is connected to the crankshaft by the connecting rod. The connecting rod is connected on one end to the piston and on the other to a journal (that is offset) on the crankshaft. By being offset, the motion of the piston allows the crankshaft to be rotated in a circular direction.

- **Crankshaft** – the crankshaft is made from either cast steel or forged steel and it is the major rotating part of the engine. The surfaces of the crankshaft are precisely machined and ground to specific dimensions. The crankpin or connecting rod journal is offset from the center of the crankshaft to allow the piston to move up and down in the cylinder. This offset is called the **throw** of the crankshaft. **Counterweights** are used on the opposite side of the crankshaft as the offset to balance the weight of the connecting rod. The tapered end of the crankshaft always fits into the flywheel that has a tapered hole that matches. Together this taper provides very good holding power. The crankshaft is held in an exact position within the cylinder block by **roller bearings**. Roller bearings are used with highly polished bearing races that are pressed into the crankcase. Together, the roller bearing and the bearing race provide very little friction and a very good resistance to wear.



A key (piece of square metal) is also used to make sure the flywheel is placed in the correct position on the crankshaft. This is so the magnets in the flywheel approach the ignition coil at the exact same time as the piston approaches top dead center in the cylinder.