MOTIVE POWER

ESSENTIAL MATH SKILLS FOR THE APPRENTICE

Dual Credit
School College Work Initiative

Student Handbook

Note of understanding

- This activity requires a specific skill set that should be familiar to the Instructor.
- It is designed to be a 6 – 8 hour activity.
- Although generic in nature, this activity has been designed around a specific Briggs & Stratton Engine:
  Model # 80202 Type # 4016 01 Code # 92072103
- Alternate engines can be utilized but it is intended that all the engines used in the activity are all the same model and type.
- This activity is designed to have no more than 2 students per engine.

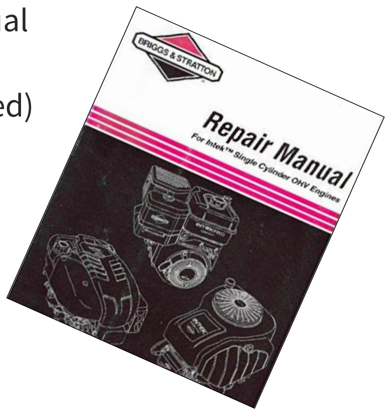
Objectives

In this project the student will

- Identify the major components of a four stroke engine.
- Understand engine operation using the four-stroke cycle principles.
- Develop knowledge of proper and safe tool usage.
- Interact with the mechanical components of a small gas engine.
- Complete the disassembly, measurement and reassembly of a small gas engine.

Support Material & Safety Equipment

- Small gas engine textbook/service manual (as deemed required by Instructor)
- Computer with internet access (if required)
- Shop coat and required PPE (personal protective equipment)



Required Tools & Equipment

The required tools and equipment you will need to complete this assignment are available from your teacher.

Socket Set

A Basic Socket Set consisting of both Metric and Standard sizes will be required.

Wrench Set

A set of small wrenches containing both Metric and Standard sizes.

Hammer

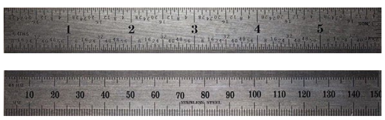
The hammer is made of plastic or rubber. It is used for gently tapping a part to help it break free or move.

Required Tools & Equipment

You will also require some specialized measuring tools that can be obtained from your teacher when you need them.

Pocket Slide Caliper: 0 – 5” (130mm)

This tool is used to measure the cylinder bore very precisely (this precision measuring instrument will measure to 1/64” or ½ mm)



Machinist Ruler and Straight Edge

This measuring instrument will measure to 1/64” or ½ mm. It will be used to measure engine stroke.

Compression Testing Gauge

This testing equipment will indicate the compression pressure of the piston and rings before disassembly. After reassembly compression pressure will be taken again to evaluate the condition of the reassembly.

Torque Wrench

This is an important tool for ensuring that fasteners are tightened properly.

Piston Ring Compressor

This tool compresses the piston rings so the piston can be re-inserted into the cylinder.

Support Material and Safety Equipment

- Small gas engine textbook/service manual (as deemed required by Instructor)
- Computer with internet access (if required)
- Shop coat and required PPE (personal protective equipment)

Engine Terminology

Four Cycle or Four Stroke Engines

When speaking of engines, they can be referred to as four cycle or four stroke. Both terms (cycle and stroke) refer to the same thing. The stroke is the movement of the piston from BDC (bottom dead center) to TDC (top dead center) or from TDC (top dead center) to BDC (bottom dead center) depending on the direction that the piston is moving in the cylinder.

In a four-cycle engine, each stage has its own stroke of the piston.

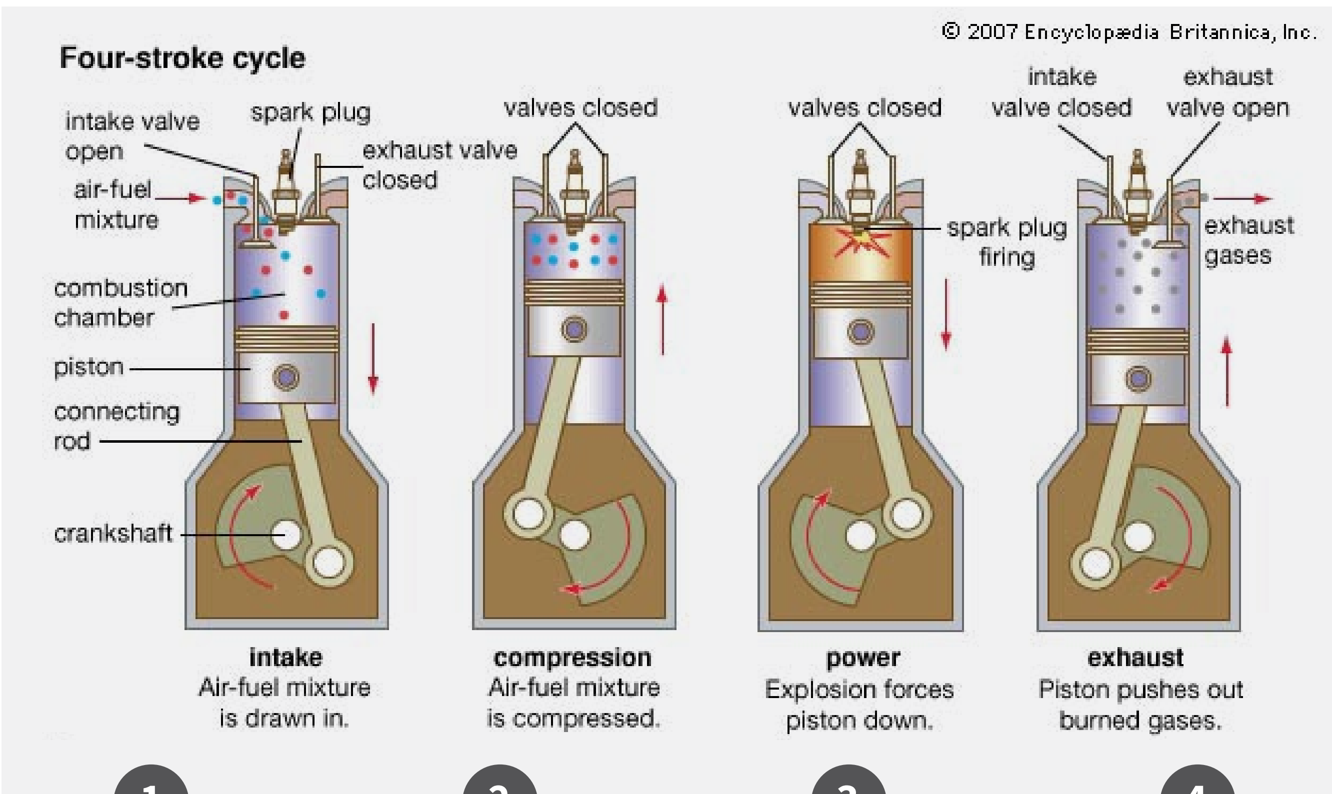
1. As the piston moves from TDC (top dead center), to BDC (bottom dead center) the intake stroke occurs.
2. As the piston moves from BDC (bottom dead center), to TDC (top dead center) the compression stroke occurs.
3. As the piston then moves again from TDC (top dead center), to BDC (bottom dead center) the power stroke occurs.
4. Finally as the piston moves from BDC (bottom dead center) to TDC (top dead center), the exhaust stroke occurs.

Then the process starts all over again. It takes two full rotations of the crankshaft for everything to happen in the four-cycle engine.

Small Four Stroke Gasoline Engine

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.

Below are the four strokes that the piston must make in a four stroke engine to complete **One Operational Cycle: Intake, Compression, Power, and Exhaust.**



1

Intake Stroke

Piston moving down creates a vacuum in the cylinder drawing in the air/fuel mixture

The intake valve is open and exhaust valve is closed

2

Compression Stroke

Piston moving up compresses the air/fuel mixture

The intake and exhaust valves are both closed

3

Power Stroke

Air/Fuel mixture ignited by spark plug

Piston moves down

The intake and exhaust valves are both closed

4

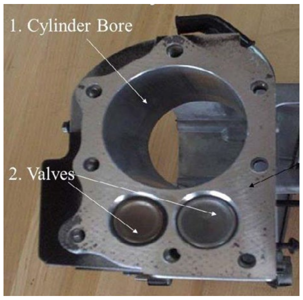
Exhaust Stroke

Piston moves up pushing burnt gases out exhaust passage past open exhaust valve

Intake valve closed

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 sometimes 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 the cylinder walls very quickly without the strength steel sleeve. Aluminum is used because of the ability to dissipate (transfer) 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 remove excess heat keep the engine cool.



Cylinder

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

Crankcase

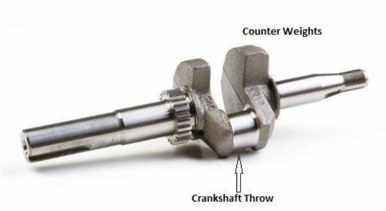
The crankcase is designed to be rigid and strong to withstand the rotational forces (spinning) of the crankshaft as well as to protect the internal parts of the engine. In four-stroke engines, oil for the lubrication of the engine is contained in the crankcase. Oil and gasket seals are used to keep dirt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

Piston and Rings

The piston is what receives the energy of the combustion (explosion), transfers it to the connecting rod which transfers it to the crankshaft throw. This causes the crankshaft to rotate. 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 bore. There are rings around the outside of the piston that make contact with the cylinder. The piston compression rings provide a seal between the piston and cylinder bore. They keep the exhaust gases above the piston while the oil control rings keep the lubricating oil out of the combustion chamber and in the crankcase. 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 (small hole end) and on the other (large hole end) 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 bearings. Roller bearings are sometimes used with highly polished bearing races that are pressed into the crankcase. Sometimes the bearing is machined into engine material. Regardless of the style, when lubricated with oil both provide very little friction and a very good wear resistance.

Gaskets and Seals

Due to the importance of air pressures inside a for stroke engine, it is essential that all seals and gaskets are in good shape so they can do their job. If an engine is being repaired to be put back into a running situation, many gaskets and seals would be replaced and not reused.

Safety First!

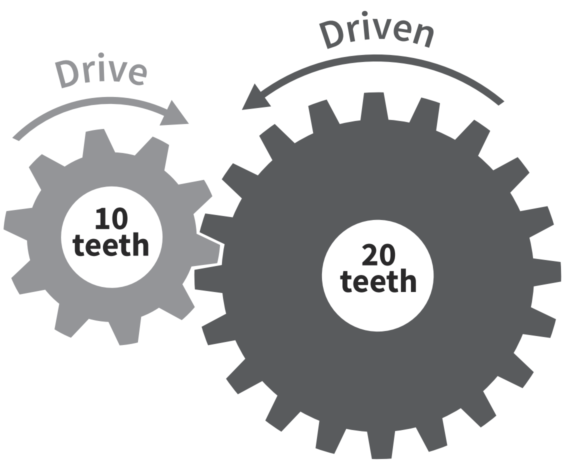
Read the following safety guidelines before starting the assignment.

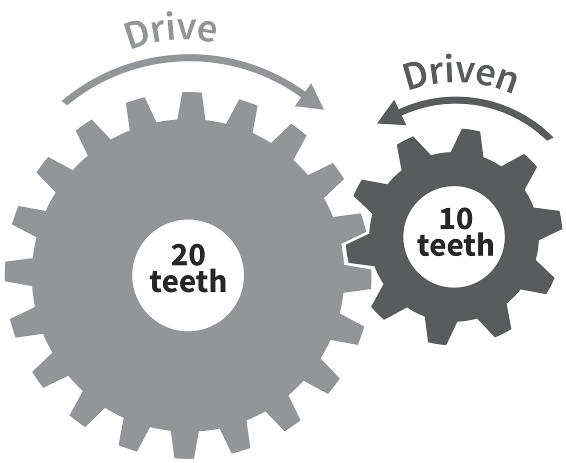
General Safety Considerations

- Wear proper eye protection and protective clothing AT ALL TIMES while working on the engine.
- Secure hair and loose clothing.
- Make sure all other students are at a safe distance before using the tool.
- Use the tool for its designed use.
- Report any and all injuries to the teacher.
- Never use a hammer on another hammer. The impact of the hardened surfaces may cause the heads to shatter.
- Remove fasteners by pulling the tool towards the body. NEVER pull towards your face.
- Follow all manufacturer's recommended operating instructions.

Gear Reduction
occurs when the drive gear is smaller or has fewer teeth than the driven gear.

Overdrive
occurs when the drive gear is larger or has more teeth than the driven gear.





You can change the speed of a shaft by connecting them by different sized gears.
To calculate the different speed, use the following formula: Driven ÷ Drive

Driven ÷ Drive
20 ÷ 10

which calculates out to a 2:1 ratio which means the drive gear (10 teeth) rotates 2 revolutions to 1 revolution of the driven gear (20 teeth).

If the drive gear was rotating 100 rpm (revolutions per minute) then the driven gear would rotate 50 rpm.

Solve: 100 ÷ 2 = 50 rpm

Driven ÷ Drive
10 ÷ 20

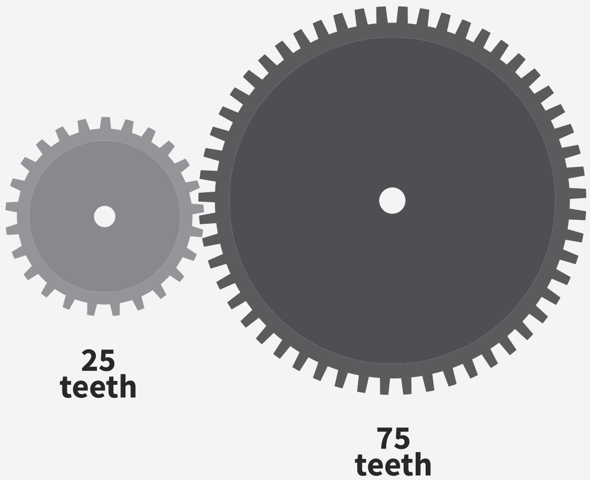
which calculates out to a 0.5:1 ratio which means the drive gear (20 teeth) rotates 0.5 (½) of a revolution to 1 revolution of the driven gear (10 teeth).

If the drive gear was rotating 100 rpm, the driven gear would be rotating 200 rpm.

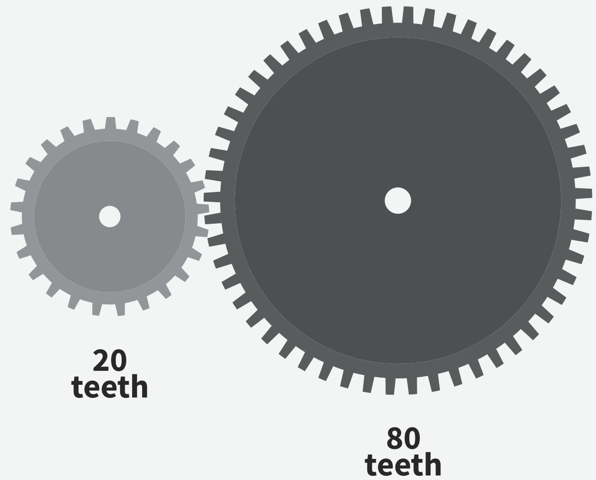
Solve: 100 ÷ 0.5 = 200 rpm

Gear Ratio Calculations

Exercise 1



Exercise 2



What is the gear ratio of the above gears?

______:1

If the drive gear was rotating at 300 rpm (revolutions per minute) how fast would the driven gear be rotating?

______ rpm

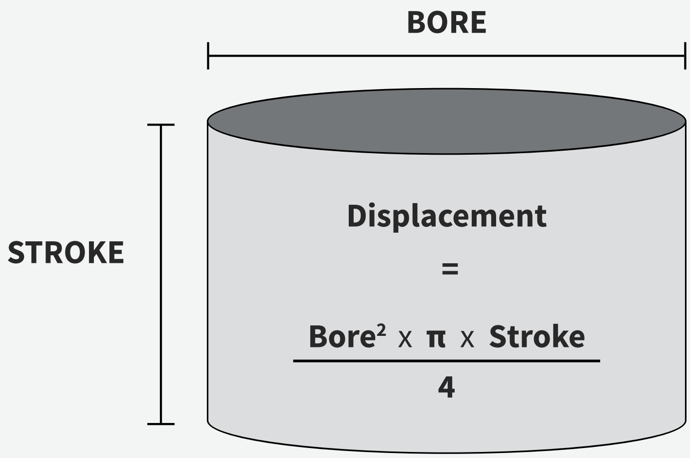
What is the gear ratio of the above gears?

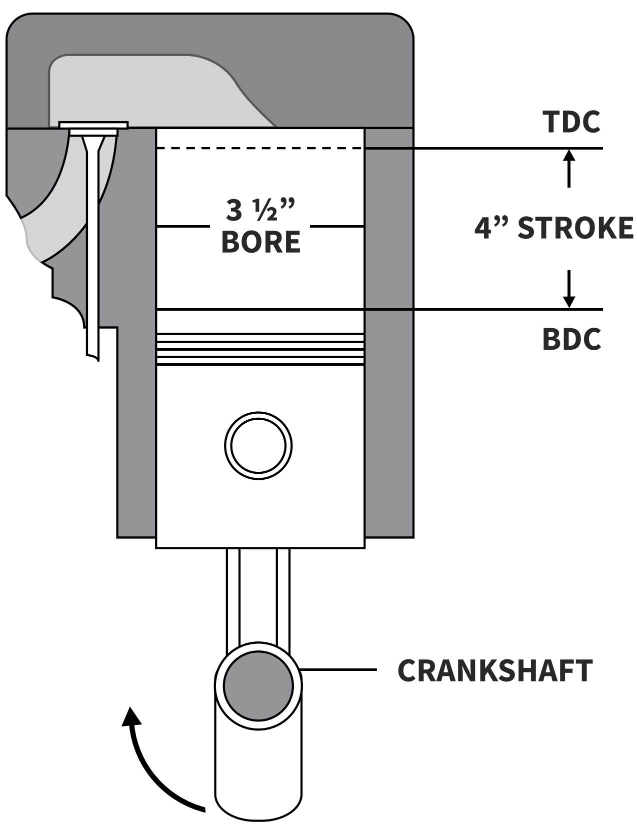
______:1

If the drive gear was rotating at 600 rpm (revolutions per minute) how fast would the driven gear be rotating?

______ rpm

Cylinder Displacement Calculations





Example

Bore 3 ½” = 3.5”
Pi π = 3.14
Stroke = 4”

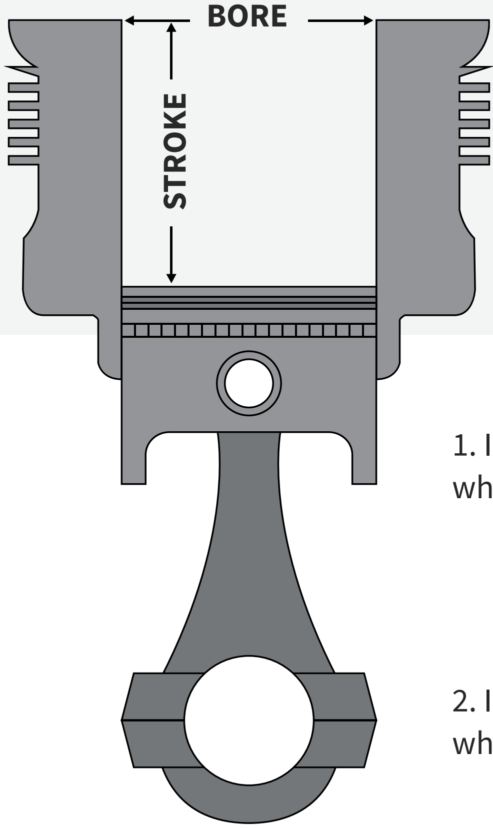
CI – Cubic Inches
CC – Cubic Centimeter

$$\frac{3.5 \times 3.5 \times 3.14 \times 4}{4}$$

$$= \frac{153.86}{4}$$

$$= 38.465 \text{ CI}$$

Displacement (Volume) Calculations



Displacement

$$\text{Displacement} = \frac{\text{Bore} \times \text{Bore} \times \pi \times \text{Stroke}}{4}$$

1. If the above engine had a 3” (inch) bore and a 4” stroke, what would the cylinder displacement be in CI (cubic inches)?

2. If the above engine had a 2” (inch) bore and a 3” stroke, what would the cylinder displacement be in CI (cubic inches)?

3. If the above engine had a 9 cm bore and a 10 cm stroke, what would the cylinder displacement be in CC (cubic cm)?

4. If the above engine had a 10 cm bore and a 8 cm stroke, what would the cylinder displacement be in CC. (cubic cm)?

Metric and Imperial Measurement Conversion Chart

Metric Equivalents

1 Centimeter		0.3937 Inch
1 Inch		2.54 Centimeters
1 Foot		0.3048 Meter
1 Meter	39.37 Inches	1.0936 Yards
1 Yard		0.9144 Meter
1 Rod		5.029 Meters
1 Kilometer		0.621 Mile
1 Mile		1.609 Kilometers

Square Measure

1 Sq. Centimeter	0.155 Sq. Inch
1 Sq. Inch	6.452 Sq. Centimeters
1 Sq. Foot	0.0929 Sq. Meter
1 Sq. Meter	1.196 Sq. Yards
1 Sq. Yard	0.8361 Sq. Meter
1 Hectare	2.47 Acres
1 Acre	0.4047 Hectares
1 Sq. Kilometer	0.386 Sq. Mile
1 Sq. Mile	2.59 Sq. Kilometers

Weights

1 Gram	0.03527 Ounce
1 Ounce	28.35 Grams
1 Kilogram	2.2046 Pounds
1 Pounds	0.4536 Kilogram
1 Metric Ton	1.102 English Tons
1 English Ton	0.907 Metric Ton

Measure of Volume

1 Cubic Centimeter	0.061 Cubic Inch
1 Cubic Inch	16.39 Cubic Centimeters
1 Cubic Foot	0.0283 Cubic Meter
1 Cubic Meter	1.308 Cubic Yards
1 Cubic Yard	0.7646 Cubic Meter
1 Litre	1.0567 Quarts Liquid
1 Quart Dry	1.101 Litres
1 Quart Liquid	0.9463 Litre
1 Litre	1.0567 Quarts
1 Gallon	3.78541 Litres
1 Peck	8.81 Litres
1 Hectolitre	2.8375 Bushels

Torque Wrench Conversions

1 ft.lb	12 in.lbs
1 ft.lb	1.36 N.m
1 N.m	0.738 ft.lb

ft.lbs **foot pounds**
in.lbs **inch pounds**
N.m **neuton meters**

Calculating Personal Horsepower

- Power is the rate at which work is done.
- It is expressed in foot-pounds/second.
- One horsepower is 550 foot-pounds/second.
- We are going to calculate your horsepower.
- Mark out 100 feet. You will time yourself running carrying a weight.
- The weight I am carrying is ___________________.
- My time is __________________.

1. First thing we need to do is figure out how much work was done.
The formula we will use for work is **Feet x Pounds = Work**

2. Show your work and calculate how much work you did, use units.

3. Divide that by the time it took you to carry your load. This gives you your ______________.
Show your work below, use units.

4. To translate your power to horsepower divide it by 550 (there are 550 foot-pounds/sec in 1 hp).
Show your work below, use units.

Note: Possible outcome on next page.

Calculating Personal Horsepower

- Power is the rate at which work is done.
- It is expressed in foot-pounds/second.
- One horsepower is 550 foot-pounds/second.
- We are going to calculate your horsepower.
- Mark out 100 feet. You will time yourself running carrying a weight.
- The weight I am carrying is **20 lbs** .
- My time is **5 sec** .

1. First thing we need to do is figure out how much work was done.
The formula we will use for work is **Feet x Pounds = Work**

2. Show your work and calculate how much work you did, use units.

100 x 20 lbs. = 2000 ft.lbs

3. Divide that by the time it took you to carry your load. This gives you your **power**.

2000 ft.lbs = 400 ft.lbs/sec
5.0 secs

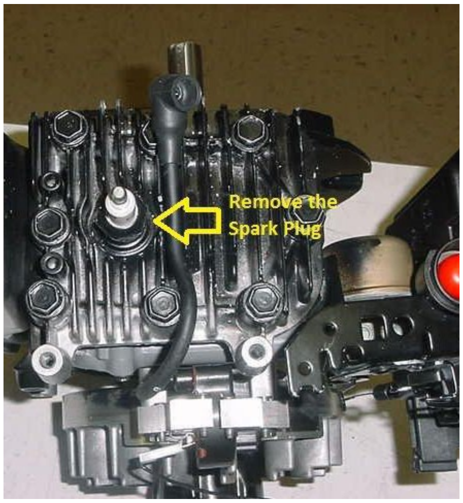
4. To translate your power to horsepower divide it by 550 (there are 550 foot-pounds/sec in 1 hp).

400 ft.lbs/sec = .7272 HP
550ft.lbs/sec

Preparing for Disassembly

You will be removing many components of the engine. Each component has bolts or small parts that can't be lost. Construct a storage method that will identify each small part as you remove it and keep it organized for reassembly. Show this method to your Instructor before proceeding.

Disassembly of Engine

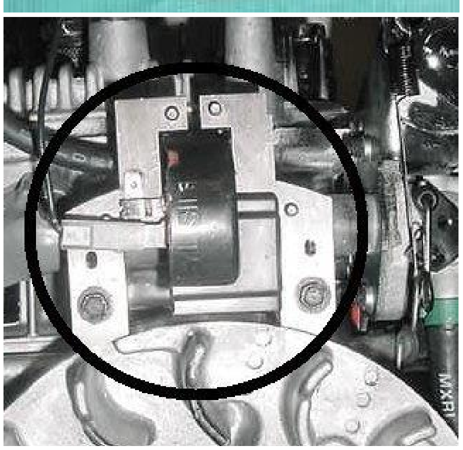


Step 1 – Compression Test
This procedure will give you the specification to compare the engine condition after you reassemble the engine.

- First remove the spark plug wire attached to the spark plug.
- With the right sized spark plug socket, turn counter-clockwise and remove the spark plug.
- Install a compression gauge into the spark plug hole and hand tighten.
- With someone holding the engine, hold the compression gauge with one hand while pulling the pull cord with the other hand.
- Record your reading: ________________PSI or _______________KG/CM2

Step 2 – Remove Starter Recoil Assembly
Better known as the pull cord assembly, this rotates the engine manually until it starts.

- Remove the bolts securing the pull cord assembly to the engine and remove the assembly

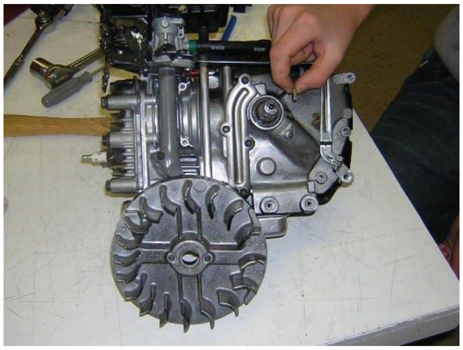


Step 3 – Remove the Ignition Coil
The coil not only creates the electrical energy to cause the spark at the spark plug but it also sends it at the proper time for combustion in the engine cylinder.

- Remove the bolts holding the coil to the engine block.
- Unhook the small wire going to the coil.

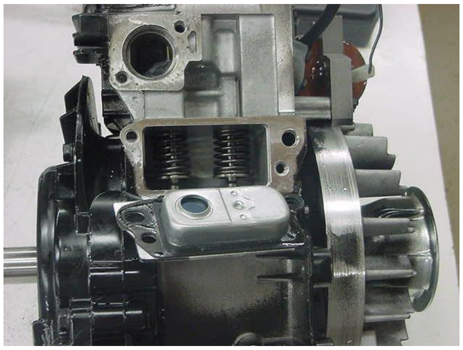
Step 4 – Remove Starter One-way Clutch Assembly
This one-way clutch assembly allows the starter recoil to crank the engine for starting and then disengage so the rope can retract back into the recoil assembly.

- Remove the screws holding the fan screen to the fan/flywheel assembly.
- Caution: There are loose steel balls behind the round black cover/ball retainer.
- Remove the round black cover/ball retainer, balls and square clutch drive off the one-way clutch housing.



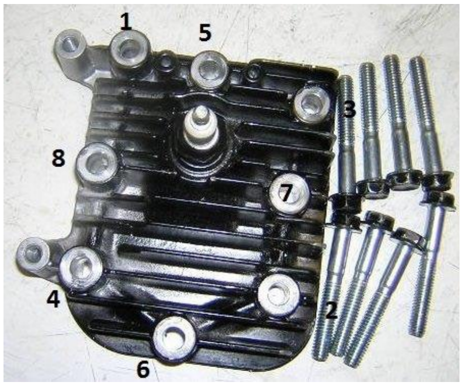
Step 5 – Remove Fan/Flywheel Assembly
The fan/flywheel assembly cools the engine by blowing air over the engine fins when the engine is running.

- Tap the clutch housing counter clockwise and unthread off crankshaft.
- Caution: There will be a drive key in a keyway (square groove) between the fan/flywheel and crankshaft.
- Remove fan/flywheel assembly by sliding it off crankshaft.



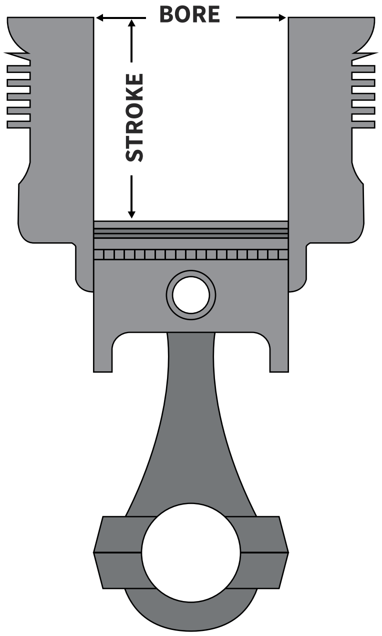
Step 6 – Remove the Crankcase Breather
The crankcase breather prevents positive or negative air pressure from building up in the engine crankcase.

- Remove the 2 bolts that are holding the breather to the engine block.



Step 7 – Remove the Engine Cylinder Head
The engine cylinder head is the non-moving side of the combustion chamber.

- It is important to loosen the cylinder head bolts in the proper sequence (order).
- Remove the cylinder head and head gasket.
- Put the head gasket somewhere safe so it will not be damaged. The head gasket creates a seal between the cylinder head and cylinder block. It prevents combustion pressure from escaping out of the combustion cylinder.

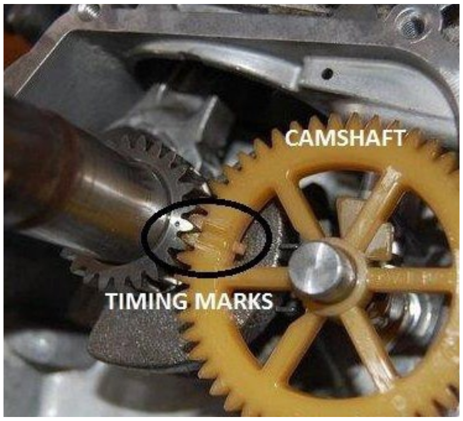


Step 8 – Measuring Piston Stroke
The piston stroke is the distance the piston travels down the cylinder bore.

- Reference the highest location the piston travels in the cylinder. It should be even with the top of the engine cylinder.
- Move the piston to the lowest point it travels in the cylinder.
- Using a machinist ruler and straight edge, measure the distance from the top of the piston to the top of the engine cylinder.
- Record your measurement: _______________ inches or ______________ cm

Step 9 – Remove Crankcase Cover
The crankcase cover holds the oil in the crankcase and once removed will give you access to the camshaft, crankshaft and piston connecting rod bolts.

- Remove bolts holding the crankcase cover to the engine crankcase.
- Remove the crankcase cover. It may take a few light taps from a soft faced hammer to loosen. Do not pry apart with screw driver or bar.

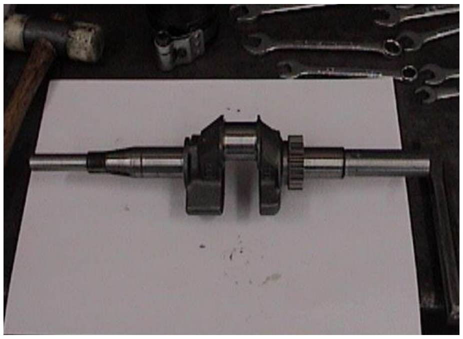


Step 10 – Remove Camshaft
The camshaft is timed to the crankshaft and is responsible for opening and closing the intake and exhaust valves at the proper time.

- Rotate the engine until both valves are closed. (timing marks are aligned)
- Pull the camshaft out with your fingers.
- The two camshaft lobe followers will fall out. This is expected.
- Identify the timing mark on the camshaft at this time for future reference.

Step 11 – Remove the Piston and Connecting Rod
The crankshaft, connecting rod and piston change the back and forth (reciprocating) motion of the piston into rotating motion of the crankshaft. The connecting rod is bolted to the crankshaft in this application (style) of engine.

- Position the crankshaft so you can access both connection rod bolts with your wrench.
- Notice the position of the oil dipper on the end of the connecting rod.
- Turning the bolts counter clockwise remove the connecting rod bolts and then cap.
- Push the piston and connecting rod out the top of the cylinder.
- Carefully inspect the connecting rod and cap to identify how it is assembled. It will only fit together one way. Put cap and oil dipper on connecting rod and finger tighten bolts.

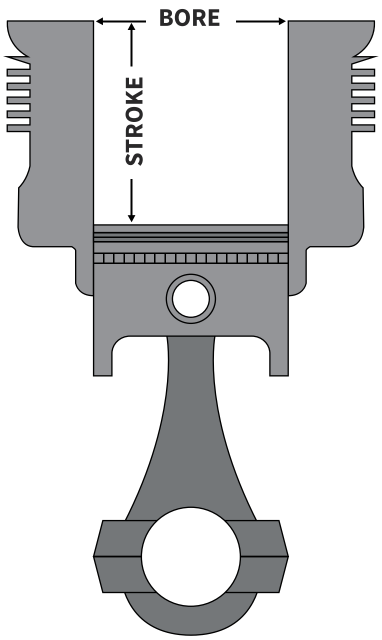


Step 12 – Remove the Crankshaft
The crankshaft is rotated by the movement of the piston. The rotating this rotating motion is used in various applications like driving a Go-Kart.

- Remove the crankshaft by pulling it straight out of the engine crankcase.
- Caution: Be careful, the crankshaft gear can fall off the crankshaft.
- Identify the timing mark on the crankshaft gear for future reference.

Disassembly is now complete.

Measurements and Calculations



Step 1 – Measure the Piston Cylinder Diameter (Bore)
Using your machinist ruler, measure the inside diameter of the piston cylinder. Record your measurements.

______________ inches

_______________ cm

Step 2 – Calculate Piston Cylinder Displacement
Calculating the volume of a cylinder requires multiplying the area times the length of the stroke.

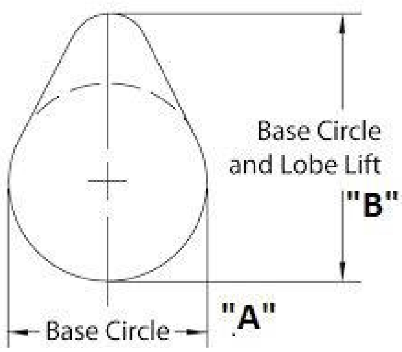
Use your "stroke" measurement from Step 8 in the disassembly procedure.

$$\text{Cylinder Displacement} = \frac{\text{Bore X Bore X } \pi \text{ X Stroke}}{4}$$

$$\frac{\quad\text{X}\quad\text{X}\quad\text{X}\quad}{4} =$$

____________ CC (cubic centimeters)

____________ CI (cubic inches)



Step 3 – Calculate Cam Lobe Lift
Use the pocket slide caliper and machinist ruler, measure across the small diameter of the cam lobe (base circle "A") and across the larger area (base circle and lobe lift "B").

Subtract (A) from (B) and that is you lobe lift. Do both camshaft lobes indicating the intake valve lobe lift (large diameter valve) and exhaust valve lobe lift (smaller diameter valve) which are located beside the engine cylinder.

Intake lobe lift: (B) – (A) = ____________________ mm

Exhaust lobe lift: (B) – (A) = ____________________ mm

Step 4 – Calculate Gear Ratio between Crankshaft Gear and Camshaft Gear
You can change shaft speeds by connecting them with different sized gears. Count the number of camshaft gear teeth and divide them by the number of crankshaft gear teeth.

Camshaft gear teeth ÷ Crankshaft gear teeth = ______:1 Gear Ratio

If the crankshaft is rotating at 100 revolutions per minute (rpm) how fast is the camshaft gear rotating per minute?__________ RPM

________ Crankshaft RPM ÷ _________ Gear Ratio = _________ Camshaft RPM

Step 5 – Measure the Connecting Rod to Crankshaft Rod Bearing Journal Clearance.
A small amount of bearing clearance is required to allow lubricating oil between the two moving parts. Use the pocket slide caliper and machinist ruler for the following measurements.

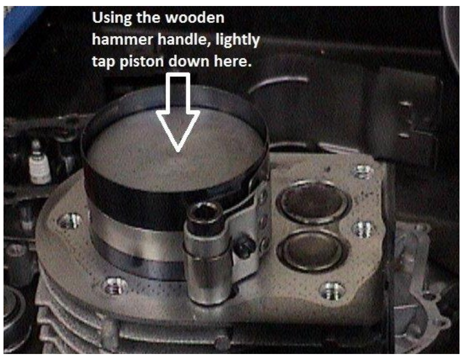
Measure the connecting rod bearing journal diameter on the crankshaft. (1) _________mm
Measure the inside diameter of the large end of the piston connecting rod. (2) _________ mm

Subtract the crankshaft journal diameter (1) from the inside diameter of the connecting rod (2).
Measurement (2) _______ - Measurement (1) _________ = Bearing Clearance _________mm

Measurements and calculations are now complete.

Reassembly of Engine

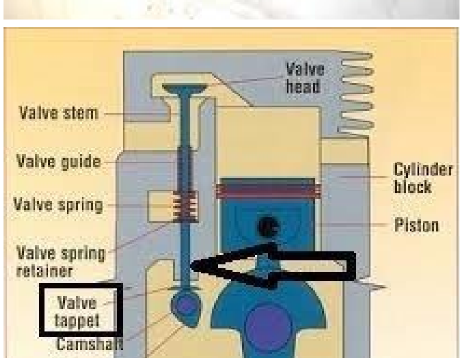
Step 1 – Install the Crankshaft
Insert the crankshaft into the engine crankcase. Make sure it is installed in the right direction.



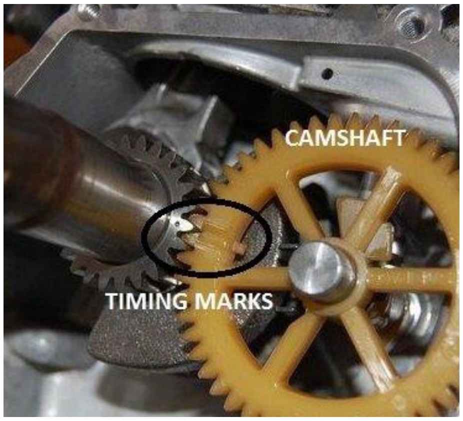
Step 2 – Install the Piston and Connecting Rod
You will need a piston ring compressor to accomplish this task.

- First install the ring compressor over the rings on the piston and while leaving some of the lower part of the piston is still visible, tighten the ring compressor on the piston.
- Make sure the piston is pointed in the right position and lightly tap the piston down through the ring compressor into the cylinder with the handle of the hammer.
- Line up the connecting rod with the crankshaft rod bearing journal
- Install the rod cap by properly lining up the rod cap to the rod. Remember, it will only go on one way.
- Finger tighten the bolts after installing the oil dipper.

Step 3 – Torque the Connecting Rod Bolts
The torque specification for these bolts is usually 100 inch pounds but for this exercise we will only torque them to only 60 inch pounds.



Step 4 – Install the Valve Lifters (sometimes called Valve Tappets)
You can keep the valve lifters in their holes by either laying the engine on its side or upside down. The lifters must stay in place until the camshaft has been installed.

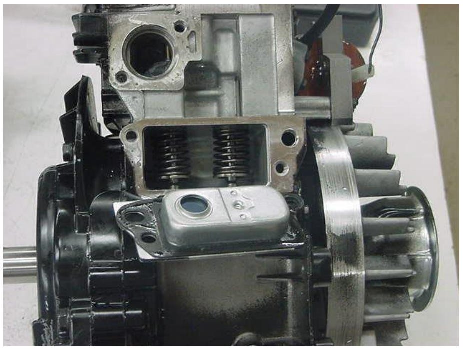


Step 5 – Install the Camshaft
While keeping the engine on its side or upside down, align the timing marks on the crankshaft gear and camshaft gear.

- The Camshaft will slide into place if the timing marks are aligned.
- Failure to align the timing marks could result in engine damage and/or engine not running.

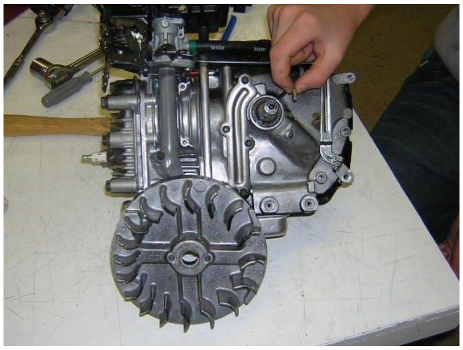
Step 6 – Install Crankcase Cover

- Tighten the bolts in a crisscross pattern to **30 inch pounds.**
- Rotate the engine 720^0 (2 complete revolutions) at this time to make sure everything has fit together OK.



Step 7 – Install the Crankcase Breather

- Install the 2 bolts and tighten very lightly.

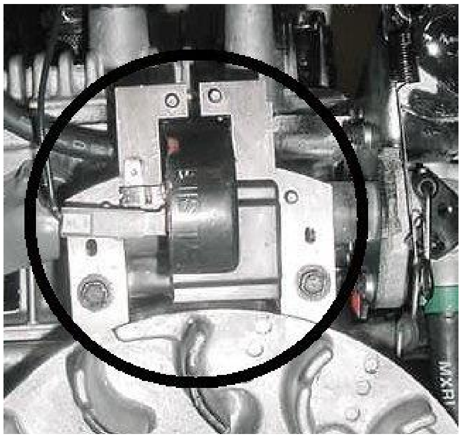


Step 8 – Install the Fan/Flywheel Assembly

- Again by laying the engine on its side, this will assist you in the installation of the next few components.
- Install the fan/flywheel assembly with the flywheel drive key.
- Install the steel washer and then thread the starter clutch housing onto crankshaft clockwise and tighten as much as possible by hand.

Step 9 – Install the Starter One-Way Clutch Assembly

- With the engine still on its side, install the square clutch drive, steel balls, round black cover/ball retainer, fan screen and (4) fan screen screws.
- Lightly tighten the screen retaining screws.



Step 10 – Install the Ignition Coil

- Install the Ignition Coil on the engine block beside the fan/flywheel assembly
- Slide the coil about 1 mm away from the fan/flywheel and lightly tighten the screws to hold it in place.

Step 11 – Install the Starter Recoil Assembly

- Install the starter recoil assembly on the engine.
- Lightly tighten the cover bolts
- Check the operation of the pull cord and clutch. The engine should only crank while pulling the cord out and the rope should then easily retract back into the housing.

Step 12 – Compression Test
By doing the compression test after reassembling the engine and comparing your readings to the readings prior to disassembly will verify the quality of your reassembly procedure.

- Install a compression gauge into the spark plug hole and hand tighten.
- With someone holding the engine, hold the compression gauge with one hand while pulling the pull cord with the other hand.

- Record your reading: _______________ PSI or ___________ KG/CM2

- Your original reading: _______________ PSI or ___________ KG/CM2

- Difference in readings: ______________ PSI or ___________ KG/CM2
-
- If your new reading is the same as or higher than your first reading, you have done a very good job reassembling your engine.
- Install your spark plug to 5 foot pounds. (60 inch pounds)

Step 13 – Clean up
Clean up your work area and clean the tools you have used.

- Have your instructor inspect your reassembled engine.
- If there is any problem with your engine, let your instructor know.
- If there are any issues with the tools, let your instructor know.
- Store everything as instructed.
- Complete your assignment and hand it in.