MINNESOTA STATE
Centers of Excellence

Train-the-Trainer Workshops

Small Engine Tool Kit

Small Gas Engine Technology
L Head Four Cycle Job Sheet

Name_____ Engine Locker #_____

Instructor_____

Make_____

Model_____

Type_____

Code_____

I. Outcomes:

A. Complete disassembly and inspection for overhaul of four-cycle engines.

B. To analyze and record the mechanical conditions of the four-cycle engine you will be disassembling and overhauling.

II. **Reference**:

A. Class Notes
B. Manufacturer's Shop Manual
C. Small Engine Mechanics Text
D. Small engine manufacturer's websites

II. **Procedure Notes**:

Follow all shop policy and safety rules. **ALWAYS!!! Wear Safety Glasses. Safety Glasses are a Must!** Keep your work area neat and clean.

Note: Follow the list prior to any disassembly. Complete all steps that way until noted differently.

Safety Note: Be careful of any moving belts, pulleys, levers, and mower blades!! When making tests that require cranking the engine, remove spark plug wire and ground it.

A. Check Oil:
    1. Correct oil level_____ High_____ Low_____
    2. Oil Condition: Dirty_____ Clean_____
       Heavy_____ Light_____ Water_____

B. Check Fuel:
    1. Sufficient fuel in tank: _____
    2. Check fuel condition: good_____ old_____
       Oil in fuel_____ water in fuel_____

C. Check Ignition: Use the spark tester from the tool room.
   Does the engine have spark?
   Does the kill switch work?

D. Test Compression:

    1. Use compression gauge, test and record your findings.

Results_____

E. Perform cylinder leakage test: Follow instructions supplied with tester. Be careful- Engine will rotate when air pressure is applied to spark plug hole.

% of leakage_____ Good or Bad? _____

If leaking, where is it coming from? _____

Instructor Approval _____

SAFETY NOTE: Prior to test running; make sure all safety shields are covering moving parts. Make sure fasteners that hold drivetrain components in place are tight. (Especially the mower blades). Run the engine in the test tank room or outside. **DO NOT** run engines at your workbenches.

A. Perform following running tests on your engines: Only if in running condition.

Test	Manufacturer Specification	Actual Result
Idle RPM	_____	_____
Max RPM	_____	_____

1. Observe during operation the following conditions:
   a. Does engine idle well_____
   b. Does engine accelerate well_____

A. Remove high-tension lead.

B. Remove blade and blade adapter.

C. Remove engine from unit:

1. Drain Oil.

D. Following manufacturer's shop manual disassembly procedure. Disassemble your four-cycle engine. **Thoroughly clean all components and work space before proceeding.**

Instructor Approval _____

A. Engine mechanical inspection:

1. **Physical appearance visual inspection of the:**

Bore_____

Piston_____

Connecting Rod bearing crank end_____

Connecting Rod bearing piston pin end_____

Crank pin journal_____

Piston pin journal_____

P.T.O. main bearing_____

Mag main bearing _____

P.T.O. main journal _____

Mag main journal_____

Oil pump or splasher _____

Valve seat condition_____

Valve guide bore intake_____

Valve guide bore exhaust_____

Valve face intake _____

Valve stem intake_____

Valve tip intake _____

Valve face exhaust_____

Valve stem exhaust _____

Valve tip exhaust _____

Camshaft bearings (P.T.O. & Mag) _____

Camshaft journals (P.T.O. & Mag) _____

Camshaft lobe intake _____

Camshaft lobe exhaust_____

Cam timing gear_____

Cam timing gear on crankshaft _____

Cylinder head gasket surface on the block _____

Gasket surface on the cylinder head _____

Inspect the crankcase for any cracks or flaws that may cause an oil leak_____

_____

1.) Record cylinder wear. Do at least 3 measurements at each position.

Cylinder Dimension	Actual Size (Present)	Standard Size (New)	Actual Wear	Maximum Wear Allowed	Is Boring Required	Minimum Oversize	Oversize Dimension Needed
Top (Pin side)							
Center (Pin side)							
Bottom (Pin side)							
Rotate 90 Degrees to Above Measurements							
Top (Thrust side)							
Center (Thrust side)							
Bottom (Thrust side)							

Approval_____

2.) Inspection of the engine and its components using precision measuring tools.

ITEM TO MEASURE	MANUFACTURER SPECIFICATION	ACTUAL MEASUREMENT
Piston		
Rod Bearing @ Crankshaft End		
Rod Bearing @ Piston Pin End		
Crank Pin Journal		
Piston Pin Journal		
P.T.O. Main Bearing		
Mag Main Bearing		
P.T.O. Main Journal		
Mag Main Journal		
Valve Guide Intake		
Valve Guide Exhaust		
Valve Stem Intake		
Valve Stem Exhaust		
Camshaft Bearing Mag		
Camshaft Bearing P.T. O		
Camshaft Journal Mag		
Camshaft Journal P.T.O.		
Camshaft Lobe Intake – Lift		

Camshaft Lobe Exhaust – Lift		

3.) Figure Out-Of-Round for bore:

A. Out-Of-Round for top_____
B. Out-Of-Round for center_____
C. Out-Of-Round for bottom_____
D. What is an allowable amount? _____

4.) Figure taper of the bore:

A. Actual taper_____
B. What is allowable_____

5.) Figure the clearances for the following:

CLEARANCE TO MEASURE	MANUFACTURER SPECIFICATION	ACTUAL MEASUREMENT
Rod and Crank Pin Micrometer		
Rod and Crank Pin Plastigauge		
Main P.T.O.		
Main Mag		
Valve guide to stem - intake		
Valve guide to stem – exhaust		
Cam bearing to journal –Mag		
Cam bearing to journal –P.T.O.		
First compression ring end gap		
Second compression ring end gap		
Oil ring end gap		
First compression ring side clearance		

Second compression ring side clearance		
Oil ring side clearance		

Approval_____

6. At this point you should have sufficient data to determine the following:

   A. Does your engine need new pistons: _____

   Why: _____

   B. Does your engine need new rings: _____

   Why: _____

   C. Does your engine need new valves: _____

   Why: _____

   D. List any other major components or work your engine needs and explain why

   _____

   _____

7. Follow the manufacturer's shop manual for correct reassembly of your four-cycle engine.

   A. Use this job sheet as a guide. The following procedure may not be correct for your particular engine. REMEMBER THIS IS ONLY A GUIDE.

   B. Make sure all parts are clean before reassembling them.

   C. **Lubricate any moving parts**.

   NOTE: Make sure all threads are clean of rust, carbon, and sealer. Be cautious; don't use the wire buffer to clean threads. It can damage the holding quality of the fastener. When torqueing, follow the recommended sequence. (Torque pattern and progression).

   D. Install piston to the connecting rod.

List two things to be careful of when installing the piston to the connecting rod.

1. _____

2. _____

Approval _____

E. Install piston rings to piston. Use proper tools or procedures.

F. Lubricate and install the crankshaft into block. Check for freedom of movement.

G. Install piston assembly with rod into the block. Assemble the rod to the crankshaft. Lubricate all moving parts and check for freedom when torqued.

H. Install lifters and camshaft. Make sure the timing marks align. Lubricate moving parts.

I. Install oil system.

   1. Slinger
   2. Pump
   3. Other

Approval _____

J. Install the crankcase and torque properly.

Approval _____

K. Install valves and valve train components.

Approval _____

L. Assemble the ignition system and set it up.

1. Air gap: Specification_____Actual_____
2. Point gap: Specification_____Actual_____
3. Set ignition timing: Spec_____Actual_____
4. Spin engine with a speed wrench or by hand, and check for spark.

   Yes_____ No_____

Tecumseh Engines Only

Have your engine set up with the dial indicator in place. Have a continuity tester hooked up and ready to check your timing. Let your instructor check your work.

Approval _____

M. Install carburetor and governor with their appropriate linkages at this time. Be sure the throttle operates correctly in relation to the carburetor and governor.

N. Install cylinder head. Use a new gasket in most all cases. Torque properly.

O. Perform remaining assembly operations, and just before you're ready to install your engine back to the equipment, let your instructor look it over.

Approval _____

P. Reinstall the engine to its unit and make the final test and adjustments:

1. Engine should start easily. If you have to crank and crank, look for a problem. DON'T just keep cranking!
2. Once it has started, let it run at a moderate even speed for a while. DON'T wind it up tight right away.

3. Listen for odd noises and abnormal vibrations. Remember, many small engines won't run well or at all without their mower blades on.
4. Make carburetor adjustments as necessary after the engine is warmed up. At the same time, observe for proper governor operation. Make adjustments if necessary.
5. After running your engine for a while, and it is adjusted well, don't just set it aside. Play around with it a bit. See how it acts in a rich condition. Observe the color of the exhaust. Maybe try different plug gaps. When you're done, put the engine back in what you consider its best running condition.
6. Record the following

    Smoothness of idle_____

    Vibration characteristics_____

Notes_____

_____

Have a tach hooked up to your engine. Record the manufacturer specs.

Idle RPM Manufacturer spec_____

Max RPM Manufacturer spec_____

Idle RPM Actual _____

Max RPM Actual_____

Leave the tach hooked up and have your instructor inspect your engine's performance.

Starts well: _____

Idles well: _____

Smooth acceleration: _____

Proper max RPM: _____

Approval _____

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Small Engine Tool Kit

Small Gas Engines
Four Cycle OHV Job Sheet

Make_____ Name_____

Model_____ Instructor_____

Type_____ Locker #_____

Code_____

I. Objectives:

A. Complete disassembly, inspection, and reassembly of a small gas OHV engine.

B. To analyze and record the mechanical conditions of the four-cycle engine you will be disassembling and overhauling.

II. Reference:

A. Class Notes

B. Manufacturer's Shop Manual

C. Small Gas Engines Text

D. Illustrated Parts Manual

E. Advanced Product Service Manual

F. Small engine manufacturer's websites.

G. This is part 1 in a series of tear down, inspection and reassembly of a Briggs and Stratton vertical shaft overhead valve (ohv) 103m02 engine. We go through the entire processes of disassembly of the engine. This can be applied to most small engine disassembly procedures. https://www.youtube.com/watch?v=kbnYimBkMTU

III. Procedure Notes:

Follow all shop policy and safety rules.
ALWAYS WEAR SAFETY GLASSES!
Keep your work area neat and clean.
Use baggies and label them with a sharpie marker.

Safety Note: Be careful of any moving belts, pulleys, levers, and mower blades!! When making tests that require cranking the engine, remove spark plug wire and ground it.

A. Check the oil and select the appropriate answer to the following:

1. Oil level: Correct ___ High ___ Low ___

2. Oil Condition: Dirty ___ Clean ___
Heavy ___ Light ___
Is there water in the oil? ___

B. Check the fuel

1. Is there sufficient fuel in the tank? _____

C. Take a fuel sample from the tank.

1. Check the fuel condition: good ___ old ___
2. Is there oil in the fuel? _____
3. Is there water in the fuel? _____

D. Check ignition spark with spark tester from tool room

1. Do you have a spark? _____
2. Does the kill switch work? _____

E. Test Compression

1. Use a compression gauge, test and record your findings. _____
2. Is that result good or bad? _____

F. Perform cylinder leak down test.

1. Follow instructions supplied with the tester. Be careful- The engine will rotate when air pressure is applied to the spark plug hole.
2. % of leakage _____
3. Is that result good or bad? _____
4. If leaking, where is it coming from? _____

SAFETY NOTE: Prior to test running; make sure all safety shields are covering moving parts. Run engines outside DO NOT run engines at your workbenches.

A. Perform the following running tests on your engine. If your engine won't start, have your instructor approve skipping this section. _____

Test	Manufacturer Specification	Actual Result
Idle RPM	_____	_____
Top no load RPM	_____	_____

B. While running the engine observe the following conditions:

1. Does the engine idle well? _____

2. Does the engine accelerate well? _____

C. Disconnect the high-tension lead (spark plug wire).

D. Drain the oil from the engine.

1. Dispose of the oil properly and clean your oil pan before continuing.

E. Check the crankshaft end play with a dial indicator.

1. Actual _____
2. Manufacturer's Spec _____

F. Check the radial run out. (Bent Crankshaft) _____

A. Following the manufacturer's shop manual, disassemble your engine. Pay close attention to any alignment marks that will make reassembly easier.

B. **Thoroughly** clean all components and work space before proceeding.

C. Bag and label parts to make reassembly easier.

A. Engine mechanical inspection

1. **Record your visual inspection of the following components**
2. Cylinder bore _____
3. Piston _____
4. Connecting rod bearing (crank end) _____
5. Connecting Rod bearing (piston pin end) _____
6. Crank pin journal _____
7. Piston pin journal _____
8. P.T.O. main bearing _____
9. Mag main bearing _____
10. P.T.O. main journal _____
11. Mag main journal _____
12. Oil pump or splasher _____
13. Valve seat (intake) _____
14. Valve seat (exhaust) _____

15. Valve guide bore (intake) _____

16. Valve guide bore (exhaust) _____

17. Valve face (intake) _____

18. Valve stem (intake) _____

19. Valve tip (intake) _____

20. Valve face (exhaust) _____

21. Valve stem (exhaust) _____

22. Valve tip (exhaust) _____

23. Camshaft bearings (P.T.O. & Mag) _____

24. Camshaft journals (P.T.O. & Mag) _____

25. Camshaft lobe intake _____

26. Camshaft lobe exhaust _____

27. Compression release mechanism (if so equipped) _____

28. Cam timing gear _____

29. Cam timing gear on crankshaft _____

30. Cylinder head gasket surface on the block _____

31. Gasket surface on the cylinder head _____

32. Inspect the crankcase for any cracks or flaws that may cause an oil leak

_____

B. Record cylinder wear. Do at **least** 3 measurements at each position. Keep measuring until you are getting consistent readings.

Cylinder Dimension	Actual Size (Present)	Standard Size (New)	Actual Wear	Maximum Wear Allowed	Is Boring Required	Minimum Oversize	Oversize Dimension Needed
Top (Pin side)							
Center (Pin side)							
Bottom (Pin side)							
Rotate 90 Degrees to Above Measurements							
Top (Thrust side)							
Center (Thrust side)							
Bottom (Thrust side)							


STOP

A. Inspection of the engine and its components using precision measuring tools.

ITEM TO MEASURE	MANUFACTURER SPECIFICATION	ACTUAL MEASUREMENT
Piston		
Rod Bearing @ Crankshaft End		
Rod Bearing @ Piston Pin End		
Crank Pin Journal		
Piston Pin Journal		
P.T.O. Main Bearing		
Mag Main Bearing		
P.T.O. Main Journal		
Mag Main Journal		
Valve Guide Intake		
Valve Guide Exhaust		
Valve Stem Intake		
Valve Stem Exhaust		
Camshaft Bearing Mag		
Camshaft Bearing P.T.O.		
Camshaft Journal Mag		
Camshaft Journal P.T.O.		

Camshaft Lobe Intake – Lift		
Camshaft Lobe Exhaust – Lift		

A. Figure Out-Of-Round for the cylinder bore.

1. Out-Of-Round for the top _____

2. Out-Of-Round for the center _____

3. Out-Of-Round for the bottom _____

4. What is an allowable amount? _____

B. Figure taper of the bore.

1. Actual taper _____

2. What is allowable _____

C. Figure the clearances for the following.

CLEARANCE TO MEASURE	MANUFACTURER SPECIFICATION	ACTUAL MEASUREMENT
Rod and Crank Pin Micrometer		
Rod and Crank Pin Plastigauge		
Main P.T.O.		
Main Mag		
Valve guide to stem - intake		
Valve guide to stem – exhaust		
Cam bearing to journal –Mag		
Cam bearing to journal –P.T.O.		
First compression ring end gap		
Second compression ring end gap		
Oil ring end gap		
First compression ring side clearance		
Second compression ring side clearance		
Oil ring side clearance		

A. At this point you should have sufficient data to determine the following.

1. Does your engine need a new piston? _____

a.Why: _____

2. Does your engine need new rings? _____

a.Why: _____

3. Does your engine need new valves? _____

a.Why: _____

4. List any other major components or work your engine needs and explain why.

_____

_____

B. Follow the **manufacturer's shop manual** for correct reassembly of your four-cycle engine. REMEMBER THIS SHEET IS ONLY A GUIDE.

C. Make sure all parts are clean before reassembling them.

D. Lubricate any moving parts.

NOTE: Make sure all threads are clean of rust, carbon, and sealer. Use thread chasers if needed to clean threads. When torqueing bolts be sure to follow the recommended sequence and progression.

E. Install piston rings to piston. Use proper tools or procedure.

F. Install the piston to the connecting rod.

1. Which direction does the piston go on? _____

2. What direction do the circlips go in? _____

G. Lubricate and install the crankshaft into block. Check for freedom of movement.

H. Install piston assembly with rod into the block.

I. Assemble the rod to the crankshaft.

1. Lubricate all moving parts and check for freedom when torqued.
2. What is the torque for the connecting rod bolts? _____
3. What page in the manual did you find this? _____

J. Install the lifters, camshaft, and pushrods.

1. Lubricate all moving parts.
2. Make sure the timing marks align.

K. Install the oiling system.

1. What type of oiling system is this? _____
2. Be prepared to explain how it works.

    a. How does it lubricate the rocker arms?

A. Install the crankcase and fasten properly.

1. If the bolts that came out of the engine are self-tapping bolts replace them with non-self-tapping bolts from your instructor.
2. Is there an appropriate torque pattern and sequence? _____

3. What is the torque for the sump cover bolts? _____

4. What page of the manual did you find the torque? _____

B. Check for proper crankshaft endplay and freedom of movement.

1. Manufacturer specification _____
2. Actual end play you set _____
3. How do you adjust endplay if it is not within spec?

   _____
4. Leave the dial indicator installed for inspection.

A. Install the valves, valve train components, and cylinder head.

1. What type of lube do you use on the valve guides? _____
2. Install cylinder head.
   i. Is there an appropriate torque pattern and sequence? _____
   ii. What is the torque for the sump cover bolts? _____
   iii. What page of the manual did you find the torque? _____
3. Make final inspection of valve lash.

   Intake Specification _____ Actual _____

   Exhaust Specification _____ Actual _____
4. Leave the valve cover off for inspection.

A. Assemble the ignition system and set it up.

1. Air gap: Specification _____ Actual _____

2. What sets the ignition timing? _____

3. Spin engine with a speed wrench or by hand, and check for spark.

4. Do you have a spark? Yes ____ No ____

5. What is the flywheel nut torque? _____

a. What page in the manual did you find the flywheel nut torque? _____

A. Install the carburetor and governor with their appropriate linkages at this time. Be sure that the throttle operates correctly in relation to the carburetor and governor.

B. Perform static governor adjustment.

C. Perform remaining assembly operations and just before you're ready to run your engine let your instructor look it over.

A. Perform the final running tests

1. The engine should start easily. If you have to crank and crank, look for a problem. DON'T just keep cranking!

2. Once it has started, let it run at a moderate even speed for a while. DON'T rev it to top no load RPM right away.

3. Listen for odd noises and abnormal vibrations.
4. Make carburetor adjustments as necessary after the engine is warmed up. At the same time, observe for proper governor operation.
5. After running your engine for a while, and it is adjusted well, don't just set it aside. Play around with it a bit. See how it acts in a rich condition. Observe the color of the exhaust. Maybe try different plug gaps. When you're done, put the engine back in what you consider its best running condition.
6. Record the following
    a. Smoothness of idle _____
    b. Vibration characteristics _____
    c. Notes _____
7. Have a tach hooked up to your engine.
    a. Idle RPM Manufacturer spec _____
    b. Max RPM Manufacturer spec _____
    c. Idle RPM Actual _____
    d. Max RPM Actual _____
8. Leave the tach hooked up and have your instructor inspect your engine's performance.
    a. Starts well: _____
    b. Idles well: _____
    c. Smooth acceleration: _____
    d. Proper max RPM: _____

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Small Engine Tool Kit

Name: _____ Date: _____ Total Points: ___/56

Small Gas Engines
Unit: Using a Service Manual
Briggs Service Manual Quiz

Complete the following questions using the Briggs and Stratton Service Manual. Write down the page number where you found the answer after each question.

1. Identify the ignition section. 2pts Page #: _____

2. Describe the importance of having a service manual when working on a small gas engine. 2pts Page #: _____

3. Model number is 170342. Determine the valve clearance. Be sure to include range. 2pts Page #: _____
   a. Intake _____
   b. Exhaust _____

4. Model number is 80000. Determine the crankshaft journal reject sizes. 3pts Pg.
   a. Magneto Journal _____
   b. Crankpin Journal _____
   c. PTO Journal _____

5. Model number is 190000. Determine the ring gap reject sizes. 2pts Pg. # ____
   a. Compression rings _____
   b. Oil rings _____

6. T or F Model number 90000 is synchro-balanced. 2pts Pg. #: _____

7. List the spark plug gap for all Briggs and Stratton engines. 2pts Pg. # _____

8. Identify the table for connecting rod reject sizes. 3pts Pg. # _____
   a. Table _____
   b. Section _____
   c. Page _____
9. Fuel and oil recommendations. 2pts Pg. #
   a. Determine the proper oil SAE viscosity for 60 degrees F _____.
   b. Identify the minimum octane rating recommended for small gas engines _____.

10. Reading Briggs and Stratton model, type, and code numbers, determine the following for a model 92902 type 1234-01 code 92062003 numbers. 4pts Pg.#
    a. Cubic inch _____
    b. Crankshaft orientation _____
    c. Type of starter _____
    d. Type of bearings _____

11. Determine the piston pin reject size for a model 92902 number engine.2pts Pg. #
    a. _____ O. D.
    b. _____ I. D.

12. List the proper cylinder hone set number for a cast iron bore small engine. 2pts_____. Pg. #

13. List 3 types of carburetors commonly used on Briggs and Stratton engines. 3pts Pg #
    a. _____
    b. _____
    c. _____

14. Determine the oil capacity for a 60000-model series engine. 2pts Pg. #

15. Describe the purpose of a governor on a small gas engine. 2pts Pg. #

16. Engine model is 10B900. Determine rewind starter rope size and length. 2pts Pg. #

17. List the first 2 steps in completing an engine tune-up. 2pts Pg. #

18. Identify the Lubrication Section. 2pts Pg. #

19. List the two types of ignition systems found on a Briggs & Stratton engine. 2pts Pg. #

20. Determine the manufacture date and assembly line production for the following engine, model 92902 type 1234-01 code 92062003. 2pts Pg. #

21. What is Section 11 in the Service Manual? 2pts Pg.#

22. List the 2 methods used by Briggs and Stratton to balance their engines internally. Be specific. 2pts. Pg.#

23. English to metric conversion. What fractional size wrench is closest to a 10mm wrench? 2pts. Pg.#

24. T F There is a detailed Troubleshooting Section found in the Briggs and Stratton Service Manual. 2pts Pg.#

25. Describe the procedure for cleaning the Oil-Foam Element on a Briggs air cleaner. 3pts Pg.#

26. List the first step recommended in the Service Manual when completing an engine Tune-Up. 2pts Pg.#

27. List the 2 crankshaft positions found on a Briggs and Stratton engine. 2pts Pg.#

28. What is Section 6 in your manual? 2pts Pg.#

Bonus: Solve the following. 2pts each

1. Death/ Life

2. O
   M.D.
   P.H.D.
   B.S.

3. ECNALG

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Small Engine Tool Kit

Name: _____ Due Date: _____ Total Points: ___/

Small Gas Engines

Engine Specifications

Calculating Horsepower

Resources: https://www.youtube.com/watch?v=eh7uFumf-vc&feature=results_main&playnext=1&list=PL3EE86E23668789E1

Work= Force X Distance Power= Work/Time

d = distance (ft) F = force (lbs) t = time (sec) p = power (ft-lbs/sec)

Formula for power: p = (F X d) / t

1 horsepower (hp) = 550 ft-lbs/sec

Directions:

Step 1: Solve the power formula for different variables

Solve the formula for force.

1. F=

Solve the formula for distance.

2. d=

Solve the formula for time.

3. t=

Step 2: Apply the formulas above using your small engines horsepower (show your work):

Make and model of small engine: _____ My small engine has _____ horsepower.

4. Use your engines' horsepower to calculate how much total power it has.
(Hint 1 hp=550 ft-lbs/sec)

5. How many pounds of force could your engine apply through a distance of 300 feet in 1 minute? (Hint 60 sec = 1 min)

6. Say your engine applies 275 pounds of force in 4 minutes. Through what distance would it be applied?
(Hint: The answer should be in feet.)

7. How much time would it take for your engine to apply a force of 625 pounds through a distance of 200 feet?
(Hint: The answer should be in seconds.)

Work= Force X Distance Power= Work/Time

d = distance (ft) F = force (lbs) t = time (sec) p = power (ft-lbs/sec)

Formula for power: $p = (F \times d) / t$

1 horsepower (hp) = 550 ft-lbs/sec

Step 3: Use the power formulas above to help you calculate the horsepower in the following scenarios (show your work):

8. A tractor pulled a 1200 lb. manure spreader 500 feet in 2min 30 seconds. How much horsepower would it be using?

9. In order to use all of its drawbar horsepower rating of 295, how heavy would the equipment have to be if pulled at 5mph? (Hint 5 mph= 7.5 feet per second)

10. How much time should it take a 15 hp electric motor to lift a 500lb weight up 85 feet?

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Name: _____ Date: _____ Total Points: ___/

Small Gas Engines

Engine Compression Ratio Lab

I. Objectives:

A. Calculate the compression ratio on a small gas engine.
B. Define compression ratio.

II. Resources:

A. Class Notes
B. Small gas engine manufacturers websites.

Directions: Complete the following table using the formulas provided and a calculator.

Bore (inches)	Stroke (inches)	Cylinder Displacement (inches^3)	Cylinder Displacement (Cm^3)	Comb. Chamber Displacement (Cm^3)	Compression Ratio
2.250”	2.500”			30	
2.500”	2.375”			30	
3.000”	3.250”			57	
2.000”	2.125”			23	
2.750”	2.750”			54	
2.500”	2.625”			34	
1.500”	1.750”			13	

2.250”	2.125”			22.5
3.000”	3.750”			72.4
3.000”	3.125”			67

Cylinder Displacement (inches^3) = Bore^2 □ 4 * 3.14 * Stroke
Cylinder Displacement (cm^3) = Displacement (inches^3) * 16.4
Compression Ratio = Cylinder Displacement (Cm^3) □ Comb. Chamber Displacement (Cm^3)

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Small Engine Tool Kit

Name: _____ Date: _____ Total Points: ___/

Small Gas Engines

Engine Compression Ratio Lab

I. Objectives:

A. Calculate the compression ratio on a small gas engine.
B. Define compression ratio.

II. Resources:

A. Class Notes
B. Small gas engine manufacturers websites.

Directions: Complete the following table using the formulas provided and a calculator.

Bore (inches)	Stroke (inches)	Cylinder Displacement (inches^3)	Cylinder Displacement (Cm^3)	Comb. Chamber Displacement (Cm^3)	Compression Ratio
2.250”	2.500”			30	
2.500”	2.375”			30	
3.000”	3.250”			57	
2.000”	2.125”			23	
2.750”	2.750”			54	
2.500”	2.625”			34	
1.500”	1.750”			13	

2.250”	2.125”			22.5
3.000”	3.750”			72.4
3.000”	3.125”			67

Cylinder Displacement (inches^3) = Bore^2 □ 4 * 3.14 * Stroke
Cylinder Displacement (cm^3) = Displacement (inches^3) * 16.4
Compression Ratio = Cylinder Displacement (Cm^3) □ Comb. Chamber Displacement (Cm^3)

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Name: _____ Due Date: _____ Total Points: ___/

Small Gas Engines

Cooling Systems

Objectives:
Identify the parts of the small engine cooling system.
Explain the functions of the parts of a small gas engine cooling system.

Directions: Prepare a google slide show or youtube on the cooling system of a small gas engine. Be sure to include the parts and their function of the cooling system. Explain how the engine is cooled. Be sure to discuss the purpose of the fins on the cylinder block and head.

Resources:

https://quizlet.com/278020213/small-engines-cooling-system-flash-cards/

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Names: _____ Hr.: ____ Total Points: ____/60

Small Gas Engines
Demonstration Project

Students will demonstrate an activity related to the class. The demonstration must be a hands-on activity.
Demonstration Name: _____

Purposes:

1. Allows students to demonstrate proficiency in a specific skill or task.
2. Provides students an opportunity to teach others.
3. Hands–on activity, which involves all students.
4. Improves student's organizational skills.

Requirements:

1. The demonstration must be related to the class. I.e. Small Gas engines – Demonstrate the procedure for removing and installing a piston.
2. Complete a hands-on demonstration to the class.
3. Provide a detailed step by step procedure for completing the skill or task.
4. Complete a Google Slide presentation using a minimum of three slides.
5. Obtain materials for completing your demonstration.

Evaluation:

1. Demonstration related to the class. ___/10
2. Quality of Google Slide presentation. ___/20
3. Presentation skills- eye contact, voice and intro. body and conclusion ___/10
4. Competence of presenters ___/20

Total Points:
_____/60

Demonstration Examples:
1. Engine Leak down Test
2. Removing, Inspecting the flywheel and key and setting the armature air gap.
3. & 4. Using the Measuring Tools: Micrometer, Caliper
5. Conducting Piston Measurements
6. Repairing a rewind
7. Overhauling the carburetor
8. Testing the Ignition System
9. Servicing the Valves
10. Servicing the Engine brake
11. Adjusting the Governor
12. Completing Power Tune up

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Small Gas Engine

NAME: _____ Date: _____ Total Points: ___/

Engine Reject Sizes and Engine Measurements_

Comments: Use the Service Manual to determine the engine reject sizes. Use the calipers, micrometers, telescoping gages, and a flat feeler gauge to measure the following parts of your engine. Then indicate your recommendation for each of the parts.

Rejection Size / Your Measurement / A or R

1. Crankshaft
   a. Magneto Journal _____
   b. Crankpin journal _____
   c. P.T.O. journal _____

2. Block bearings (crankcase or sump cover)
   a. Magneto side (plug gauge) _____
   b. P.T.O. side (plug gauge) _____
3. Camshaft (cam gear)
   a. Journals _____
   b. Lobes _____

4. Connecting Rod
   a. Crank pin _____
   b. Piston Pin _____

5. Rings
   a. Compression
      i. Side clearance (land wear) _____
      ii. End gap _____

   b. Oil
      i. Side clearance (land wear) _____
      ii. End gap _____

Instructor's Approval: _____

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Small Gas Engine

NAME: _____ Date: _____ Total Points: ___/

Engine Reject Sizes and Engine Measurements_

Comments: Use the Service Manual to determine the engine reject sizes. Use the calipers, micrometers, telescoping gages, and a flat feeler gauge to measure the following parts of your engine. Then indicate your recommendation for each of the parts.

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   b. P.T.O. side (plug gauge) _____
3. Camshaft (cam gear)
   a. Journals _____
   b. Lobes _____

4. Connecting Rod
   a. Crank pin _____
   b. Piston Pin _____

5. Rings
   a. Compression
      i. Side clearance (land wear) _____
      ii. End gap _____

   b. Oil
      i. Side clearance (land wear) _____
      ii. End gap _____

Instructor's Approval: _____

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Small Engine Tool Kit

Name: _____ Date: _____ Total Points: ___/

Small Gas Engines
Unit: Engine Systems

1. Identify the different engine systems used in a small engine.

2. List 2 components of the fuel system?

3. Explain what is meant by the term “rich mixture” in the fuel system.

4. List 2 components found in the compression system.

5. List 2 components found in the ignition system.

6. List the 2 types of governors used in small engines.

7. Explain the purpose of the ignition system.

8. List 2 components found in the lubrication and cooling systems.

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Small Engine Tool Kit

Name: _____ Date: _____ Total Points: ___/

Small gas Engines Final project

I. Objectives:

A. After Completing the disassembly, inspection, and reassembly of a small gas engine prepare a google slideshow or YouTube identifying parts listed below and their function.

II. Reference:

A. Class Notes
B. Manufacturer's Shop Manual
C. Small Gas Engines Text
D. Illustrated Parts Manual
E. Advanced Product Service Manual

During your final teardown, take a picture of each part listed below. You will be given time to prepare a google slideshow or YouTube. Each slide must include a picture with the part name and function included. Be creative.

Air Cleaner
Cylinder
CAM Lobes
Push Rods
Camshaft
Carburetor
Carburetor Float
head Gasket
Choke Plate
Throttle Plate
Connecting Rod

Crankcase
Crankcase Gasket
Connecting Rod Journal
Crankshaft
Cylinder Block
Cylinder Head
Rocker Arms
Flywheel
Flywheel key
Governor
Connecting Rod Cap
Piston Pin
Head Bolts
Armature
Timing Gear
Governor (All parts)
Intake Valve
Exhaust Valve
Muffler
Piston & rings
Piston Pin
Spark Plug
Spark Plug Lead wire
Valve Tappet

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Resources:

L- Head Assembly
https://www.youtube.com/watch?v=PJgDUHcpQrU

Basic measurements on a small engine.
https://www.youtube.com/watch?v=yGHHQwQVpVk

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L Head ENGINE REASSEMBLY

Objective: Properly reassemble the engine and to get it in good repair and operating condition.

Special Notes: You should not depend on the workmanship of the person who previously worked on this engine. That person, in fact, may have reassembled certain engine parts improperly. Therefore, it is necessary to follow manufacturers' specifications and recommendations very carefully. Please use the checklist provided for the engine reassembly. If you are in doubt about any phase of the reassembly procedure, or you find any broken parts, be sure to ask the advice of your instructor.

At each step in the process, indicate which tools you used. Good Luck.

Make sure to thoroughly clean and lubricate **each part** before reassembly.

1. In the manual – look up the piston orientation in relation to the magneto side of the engine. Which way should the notch in the piston be facing?

_____

2. Install rings on the piston and the piston on the connecting rod. Be sure to install the piston pin retainer in the end where you will find the groove.
Tools to use: _____ _____ _____

3. Install the crankshaft and the crankshaft timing gear.

Signature _____ Date _____

4. Where should the connecting rod be in relation to the crankshaft when you install the piston?

5. Install the piston in the cylinder.
Tools: _____ _____

6. ***Find the torque specification for connecting rod cap bolts. _____
Section and Page # _____
7. How should the bolts be torqued? _____

8. Line up the assembly marks on the connecting rod and cap.
Tools: _____ _____ _____

9. Tighten the connecting rod bolts to the proper torque.

10. Install tappets and camshaft. Make sure the camshaft is properly timed with the crankshaft.

11. Make sure the oil slinger is installed properly. Draw the governor and the governor rod. Make sure they are assembled properly.

Signature _____ Date: _____

11a. ***Install the crankshaft cover and gasket. Tighten the bolts using the correct pattern. Does the crankcase cover get torqued? If it does, what is the specification found in the manual? _____ Section and Page # _____

12. Valve lapping demonstration: Describe how you lap valves and the tools that you use.
_____

Why do you "lap" valves? _____

13. Install valves, valve springs and retainers
Tools: _____

14. Check valve tappet clearances. What are your valve tappet clearances?

Intake: _____ Exhaust: _____

Signature _____ Date: _____

15. Install the valve cover plate/breather and gasket. Do NOT use a ratchet – only use your socket driver! Use of a ratchet may strip the holes.

16. Install the flywheel. Make sure the key fits in its key-way properly.

17. *** What is the proper torque specification for the flywheel nut? _____
Section and Page # _____

18. Tighten the flywheel nut. (Check governor linkage **before** tightening flywheel)
Tools: _____

19. Reattach the flywheel brake. Make sure the brake does not touch the flywheel or the kill switch.

20. ***The armature air gap should be _____ to _____.
Section and Page # _____

21. Position the armature legs to the flywheel magnets with the proper armature air-gap. Tighten these bolts with the nut driver not ratchet! What can you use to measure the armature air gap? _____

22. Cylinder head torque sequence is crucial. Trace your head gasket and show the recommended head bolt torque sequence.
***Draw the gasket here. Section and Page # _____

23. ***What is the proper torque for the head bolts?? _____
Section and Page # _____

24. Install the cylinder head and head gasket**. Be sure to mount any engine parts such as shrouding or fuel tank mounts under the proper head bolts.**

25. Do a compression test. Put your thumb over the spark plug whole and check your compression as you carefully spin the flywheel

26. Install muffler.

27. Install governor and linkage.

28. Install gas tank, carburetor, and linkage.

29. Install the rewind starter/shroud and the plastic shroud.

30. Do a spark test. Do you have a good spark? _____

31. What is the recommended sparkplug gap? _____.

32. Install spark plug.

***Fill the crankcase with the proper grade of fresh oil. What classification and weight of oil should this be? _____ Section and Page # _____

33. Put about one inch of gas in your gas tank.

Signature: _____ Date: _____

34. START YOUR ENGINE

35. Drain the gas and oil from the engine.

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Small Engine Tool Kit

Name: _____ Date: _____ Total Points: ___/

Small Gas Engines

Lab Sheet 1: Engine Identification

Engine ID Lab

I. Objectives:

A. Complete inspection of a small gas engine.
B. Locate and use the model, type, and code numbers on a small gas engine.
C. Properly use a small gas engine service manual.

II. Resources:

A. Class Notes
B. Manufacturer's Shop Manual
C. Small Gas Engines Text
D. Illustrated Parts Manual
E. Advanced Product Service Manual
G. Small gas engine manufacturers websites.

III. **Key terms:** Small engine manufacture, Honda, Briggs & Stratton, Kohler, Generac, Subaru, Kawasaki, vertical crankshaft, horizontal crankshaft, and small gas engine systems.

Directions: Complete the following using a small gas engine, manufacturers Service Manual and website specific to your engine. I.e. Briggs & Stratton engine briggsandstratton.com

1. Make _____

2. Model Number _____

3. Type number _____

4. Code number _____

5. Location of numbers _____

6. 2 stroke or 4 stroke cycle engine _____

7. Vertical or horizontal crankshaft _____

8. Starting system _____

9. Carburetor type _____

10. List the types of ignition systems used on small gas engines. Circle the type used on your engine.

a._____

b. _____

11. List the type of cooling systems used on small gas engines. Circle the type used on your engine.

a._____

b._____

10. List the types of fuel systems used on small gas engines. Circle the type used on your engine.

a._____

b. _____

10. List the types of lubrication systems used on small gas engines. Circle the type used on your engine.

a._____

b. _____

11. Does your engine have safety compliance features? _____

12. Determine when the engine was manufactured _____

_____

Instructor's Approval: _____

Teacher Feature:

The five largest manufacturers of small engines for power equipment are Honda, Briggs & Stratton, Kohler, Generac, and Kawasaki.

Websites

https://www.briggsandstratton.com/na/en_us/support/vocational-education.html

Whether you are a first-year instructor or a seasoned expert, Briggs & Stratton offers hands-on, multi-media training materials that will help prepare your students for a successful career path.

*****Register for the power portal**

powerportal.com is an excellent resource. After you have registered for the power portal complete the following steps.

Search: Courses **Next**: Technical Courses **Choose:** Basic, intermediate or advanced

You may have students complete the course independently. Followed by completing the exams provided.

Small Engine Manufacturers websites:

https://engines.honda.com/

http://www.lausonpower.com/EpiphanyWeb/FlexPage.aspx?ID=137

https://kohlerpower.com/en/engines/

https://www.kawasakienginesusa.com/

https://www.briggsandstratton.com/na/en_us/home.html

https://www.generac.com/

Name: _____ Date: _____ Total Points: ___/

Small Gas Engines
Unit: Engine Systems

1. Identify the different engine systems used in a small engine.

2. List 2 components of the fuel system?

3. Explain what is meant by the term “rich mixture” in the fuel system.

4. List 2 components found in the compression system.

5. List 2 components found in the ignition system.

6. List the 2 types of governors used in small engines.

7. Explain the purpose of the ignition system.

8. List 2 components found in the lubrication and cooling systems.

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Small Engine Tool Kit

Name: _____ Due Date: _____ Total Points: ___/

Small Gas Engines

Lab Sheet 2: Engine Specifications

Use the Advanced Product Service Manual. Make sure to be looking under the correct model number!

1. Engine manufacture:
   Engine Model number:
   Engine Type number:
   Engine Code number:

2. What tool size would you use to take off the following parts:
   a. flywheel nut: _____
   b. Armature: _____
   c. Cylinder Head: _____
   d. Muffler: _____
   e. Spark Plug: _____
   f. Blower Housing: _____
   g. Fuel Tank: _____
3. What would you torque the following parts to (make sure to use units)?
   a. Flywheel nut: _____
   b. Connecting Rod: _____
   c. Crankcase Cover: _____
   d. Cylinder Head: _____
   e. Spark Plug: _____
4. What should the following dimensions be for the engine (use units!)?
   a. Cylinder Bore: _____
   b. Stroke: _____

c. Crankshaft PTO Journal: _____
d. Starter Rope Length: _____
e. Exhaust Valve seat angle: _____

5. What should the spark plug gap be for this engine?

6. What should the armature air gap be for this engine?

7. What is the valve clearance for the intake and exhaust valves?

8. What type of Governor System does this engine have?

9. What type of lubrication system does this engine have?

10. What is the oil capacity?

11. How much fuel can the gas tank hold?

12. Cubic inch displacement _____
    Displacement = .7854 x (bore x 2) x stroke
    Show work.

https://spicerparts.com/calculators/engine-displacement-calculator#:~:text=Read%20More...-,Engine%20displacement%20is%20determined%20by%20calculating%20the%20engine%20cylinder%20bore,air%20displaced%20by%20the%20engine.

Instructors Approval: _____

Engine Displacement

Definition & Description

Displacement is the size of the engine. It tells you how much air can be pumped through the engine.

Engine displacement can be listed in cubic inches (c.i.d.), cubic centimeters (cc), or liters (L).

How is it calculated?

Displacement is calculated from other engine measurements. You will need to know the Cylinder Bore Diameter and Stroke Length. Use one of the formulas below.

c.i.d. = 0.7854 x Bore^2 (in.) x Stroke (in.) x Number of Cylinders

cc = (0.7854 x Bore^2 (mm) x Stroke (mm) x Number of Cylinders) ÷ 1,000

L = cc ÷ 1,000

Example

Chevy LM7 Engine Specs			
	Bore	**Stroke**	**# of Cylinders**
Inches	3.780 in.	3.622 in.	8
Metric	96mm	92mm	

$0.7854 \times 3.780^2 \times 3.622 \times 8 = 325$ c.i.d.

$(0.7854 \times 96^2 \times 92 \times 8) \div 1{,}000 = 5{,}327$cc

$5{,}327\text{cc} \div 1{,}000 = 5.3\text{L}$

How does it affect performance?

As you may have heard, there is no replacement for displacement. Larger engines can move more air. More air means more power.

The downside of larger engines is that they also require more fuel. So, they cost more to run and maintain.

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Name: _____ Date: _____ Total Points: ___/

Small Gas Engines

Lab Sheet 3*:* Engine Starting Lab

I. Procedure Notes:

Follow all shop policy and safety rules.
ALWAYS WEAR SAFETY GLASSES!
Keep your work area neat and clean.
Use Ziplock bags and label them with a sharpie marker.

Safety Note: Be careful of any moving belts, pulleys, levers, and mower blades!! When making tests that require cranking the engine, remove spark plug wire and ground it.

Engine manufacturer:
Engine Model Number:
Engine Code number:
Engine Type number:

A. 1. Check the oil and select the appropriate answer to the following:

1. Oil level: Correct ___ High ___ Low ___

2. Oil Condition: Dirty ___ Clean ___

Is there water in the oil? _____

B. Check the fuel

1. Is there sufficient fuel in the tank? _____

C. Take a fuel sample from the tank.

1. Check the fuel condition: good ___ old ___

2. Is there oil in the fuel? _____
3. Is there water in the fuel? _____

D. Check the ignition spark with the spark tester from the tool cabinet.

1. Does the engine have spark? _____
2. Does the kill switch work properly? _____

E. Mount the engine on the starting table.

F. Add gas to the engine

G. Attach Tiny Tach to the spark plug wire.

H. Obtain instructor permission to start the engine.

I. Start the engine.

1. Record idle RPM _____
2. Record high speed RPM _____

J. Allow the engine to cool and drain gas and oil into the appropriate containers.

K. Perform cylinder leak down test.
https://www.youtube.com/watch?v=l95j1pr7mg4
https://www.youtube.com/watch?v=jc3j4ShE-tk

1. Follow instructions supplied with the tester. Be careful- The engine will rotate when air pressure is applied to the spark plug hole.
2. % of leakage _____
3. Is that result good or bad? _____

4. If leaking, where is it coming from?

_____

Instructor Approval: _____
Comments:

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Name: _____ Due date: _____ Total Points: ___/

Small Gas Engines
Service Manuals & Ordering Parts

Small Engine Manufacture Service Manuals and Parts ordering Lab

Objective: To familiarize yourself with engine service manuals and how to look up and order parts for small engines.

You will use the Briggs power portal, Briggs website, Advanced Product Service Manual, and Illustrated Parts Manual.

Please refer to your engine in the shop to find the following:

Model: _____

Type: _____

Code: _____

*Hint, if you go to www.briggsandstratton.com and click the "Find Your Model Number" under the search bar in the upper right-hand corner, it will help with finding where this information is on your engine.

Part 1: How to look up and order parts.
For this you will use the illustrated parts manual and the briggsandstratton.com website. First use the manual to find the reference and part numbers for the listed parts. Then go to the Briggs website and hover over "part" in the top right-hand corner, then click on "repair parts". Then you can select Briggs & Stratton Engines and type in your part number to get a price.

PART	PARTS DIAGRAM REFERENCE NUMBER	PART NUMBER	PRICE
Spark Plug			
Engine Gasket Set			
Carburetor			
Piston Rings			

Starter Rewind			
Armature-Magneto			
Fly-Wheel Key			

Teacher Feature:

The five largest manufacturers of small engines for power equipment are Honda, Briggs & Stratton, Kohler, Generac, and Kawasaki.

https://www.briggsandstratton.com/na/en_us/support/vocational-education.html

Whether you are a first-year instructor or a seasoned expert, Briggs & Stratton offers hands-on, multi-media training materials that will help prepare your students for a successful career path.

*****Register for the power portal**

Manufacture Websites:

https://engines.honda.com/

http://www.lausonpower.com/EpiphanyWeb/FlexPage.aspx?ID=137

https://kohlerpower.com/en/engines/

https://www.kawasakienginesusa.com/

https://www.briggsandstratton.com/na/en_us/home.html

https://www.generac.com/

Potential Partnerships:

Contact your local auto parts store or small engine repair shop to see the procedure for ordering parts.

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Name: _____ Date: _____ Total Points: ___/

Small Gas Engines

Fuel and Governor Systems*:*

Carburetion and Governor Lab

I. Objectives:

A. Complete disassembly, inspection, and reassembly of a small gas engine fuel and governor systems.

B. To analyze and record the mechanical conditions of the four-cycle engine you will be disassembling and overhauling.

II. Resources:

A. Class Notes

B. Manufacturer's Shop Manual

C. Small Gas Engines Text

D. Illustrated Parts Manual

E. Advanced Product Service Manual

F. powerportal.com login: klindgren@isd2170.k12.mn.us password:power4u

III. Procedure Notes:

Follow all shop policy and safety rules.

ALWAYS WEAR SAFETY GLASSES!

Keep your work area neat and clean.

Use Ziplock bags and label them with a sharpie marker

Safety Note: Be careful of any moving belts, pulleys, levers, and mower blades!! When making tests that require cranking the engine, remove spark plug wire and ground it.

IV. Key terms: Venturi, carburetor, governor, parts of the Governor System, Throttle, Choke, Idle Valve, Needle Valve, parts of small gas engine carburetor

*****Take pictures as needed for engine reassembly and your google slideshow.***

1. Remove the Gas Tank so the **Governor System** is visible.

2. List the parts of the Governor System.

3. What is the function of the governor?

4. Take pictures of any engine parts for your google slideshow.

5. Remove the Governor System—take note of how all parts were connected to the carburetor.

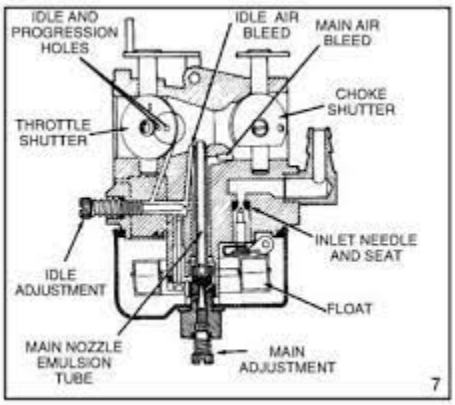
   5 a.What is the basic purpose of a carburetor?

   _____
   _____
   _____
   _____
   ___

6.Explain how the air-fuel mixture is drawn through the carburetor into the cylinder in a 4-stroke engine.

   _____
   _____
   _____
   _____
   ___

Remove the air filter, guards, and the carburetor from your engine. **Do not disassemble the carburetor.**



Locate and give the function of each carburetor part listed below.

a. Venturi_____

_____

_____

b. Throttle

plate_____

_____

_____

_____

c. Fuel bowl

_____

_____

_____

_____

d. Choke

_____

_____

_____

_____

What are the 3 types of carburetors used on Briggs and Stratton engines?

e. _____

f. _____

g. _____

What type of carburetor does your engine have?

_____

Remove the bowl of the carburetor and inspect the float. What is your float made of?

_____

Locate the idle and needle valves on your carburetor. List the function of each valve:

h. Idle

   Valve_____

   _____

i. Needle Valve

   _____

   _____

Take photos of any parts you have disassembled to add to your google slideshow.

Put the carburetor in a Ziplock.

Teacher Feature:

The six largest manufacturers of small engines for power equipment are Honda, Briggs & Stratton, Kohler, Generac, Subaru and Kawasaki.

Websites

https://www.briggsandstratton.com/na/en_us/support/vocational-education.html

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https://engines.honda.com/

http://www.lausonpower.com/EpiphanyWeb/FlexPage.aspx?ID=137

https://kohlerpower.com/en/engines/

https://www.kawasakienginesusa.com/

https://www.briggsandstratton.com/na/en_us/home.html

https://www.generac.com/

Online links:

Eliminator performance provides an excellent explanation of how a carburetor works.

https://www.youtube.com/watch?v=3ri2_bKiuMo

The Briggs and Stratton video are pretty good.

https://www.thepowerportal.com/nA/English/PowerChannel/Foundations/FuelSystems.htm

Description of the 2 governor types, and quick summary on how each works in a small engine

https://www.thepowerportal.com/nA/English/PowerChannel/Courses/ServiceShorts.htm

Learn about the differences in gasoline that are made throughout the year.

https://www.thepowerportal.com/nA/English/PowerChannel/Courses/ServiceShorts.htm

Potential Partnerships: Contact a local small engine repair shop for discarded carburetors to use for a hands-on carburetor lab or other small engine components.

Contact a local small engine post-secondary program instructor to see if the instructor and some students would be willing to visit and complete hands-on demonstrations on small gas engines.

Search: Small Engine Mechanics and Repair Technology/Technician Programs in MN to find programs near your school.

Small Gas Engines

Unit: Careers in Small Gas Engines
Post-Secondary Education Small Gas Engine Programs

Name_____ Date_____ Total Pts:_____/20

Research information on post-secondary education small gas engine programs available after graduating from High School and complete the following questions. At least 2 programs must be in Minnesota.

School 1: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

School 2: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

School 3: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

School 4: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

MINNESOTA STATE
Centers of Excellence

Train-the-Trainer Workshops

Small Engine Tool Kit

Name: _____ Date: _____ Total Points: ___/

Ignition System

Ignition Lab

I. Objectives:

A. Complete disassembly, inspection, and reassembly of a small gas ignition system.

B. To analyze and record the mechanical conditions of the four-cycle engine you will be disassembling and overhauling.

II. Reference:

A. Class Notes

B. Manufacturer's Shop Manual

C. Small Gas Engines Text

D. Illustrated Parts Manual

E. Advanced Product Service Manual

III. Procedure Notes:

Follow all shop policy and safety rules.

ALWAYS WEAR SAFETY GLASSES!

Keep your work area neat and clean.

Use Ziplock bags and label them with a sharpie marker

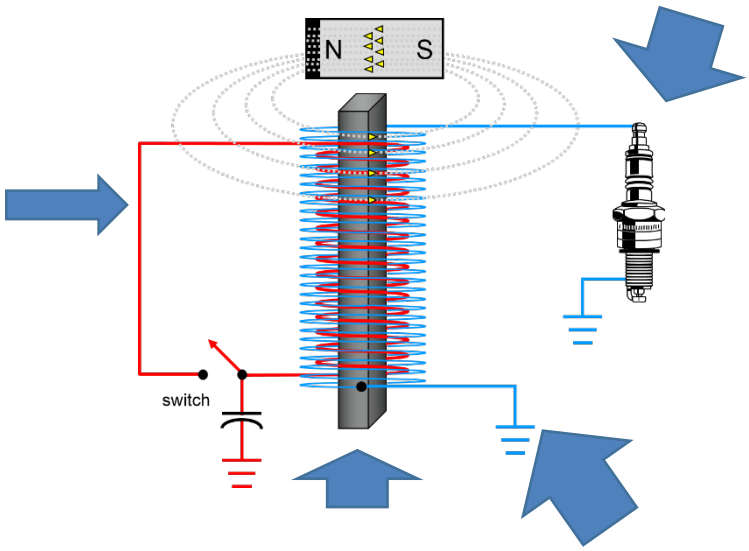
Safety Note: Be careful of any moving belts, pulleys, levers, and mower blades!! When making tests that require cranking the engine, remove spark plug wire and ground it. Use Ziploc bags and label them with a sharpie marker.

IV. Key Terms:

Otto cycle engine
Armature
Primary winding
Secondary winding
Magneto
Spark plug
Ignition system
Flywheel
Magnetic field
Flywheel magnets

Coil
Armature air gap
Spark tester
Multimeter

1. Take pictures as needed for engine reassembly and your google slideshow.
2. Disconnect any electronics, wires, etc. so the blower housing can be removed.
3. Remove the armature.
4. Label the following parts of the armature below:
    a. Primary Winding
    b. Secondary Winding
    c. Iron Core
    d. Spark Plug



5. Remove the plastic cooling fins and flywheel retainer (looks like a cup). What size socket do you need? _____
6. Answer the following multiple-choice questions.
7. On a small gas engine, the rotating magnet is attached to the _____.
    a. Piston
    b. Armature
    c. Cooling Fins
    d. Flywheel

8. A _____ is defined as an alternator with permanent magnets used to generate current for ignition.
    a. Magneto
    b. Flywheel
    c. Conductors
    d. Electromagnetic field
9. The armature will only generate enough energy required to jump the _____ gap.
    a. Spark Plug
    b. Flywheel
    c. Ignition
    d. Transistor

10. Identify the following tools used during the disassembly of the ignition system.

_____ _____ _____

10. Remove the flywheel using the proper tools. Be sure not to lose the flywheel key. **Video:** Removing a flywheel with a flywheel puller.

https://www.youtube.com/watch?v=b_pmvoMxD8Q

11. Take pictures of any parts of the engine you have not photographed.

12. Check in with the instructor to show some of your pictures. The pictures will be used for creating a google slide show of the parts of the small engine.

Instructor Approval: _____

Teacher Feature

Resources

********** "Illustrated Parts Manual" and "Advanced Product Service Manual" are excellent resources for all shop labs. Search by using the engine manufacturer, model, and type number. i.e. Manufacturer Briggs and Stratton Model number 20M100 Code number 0133

Quick links

Comprehensive learning video covering ignition theory in Briggs & Stratton engines.

https://www.thepowerportal.com/Video/PowerChannel/Courses/Basic/IgnitionSystems/IgnitionTheoryLearingModule.htm

Video: Briggs & Stratton 130G32 OHV Engine Disassembly & Assembly Good video going through the steps of disassembly and assembly of a small engine. You may consider searching your small engine specific manufacturer and model number.

https://www.youtube.com/watch?v=c_xsUi4C1FM

Video: Basic measurements on a small engine.
https://www.youtube.com/watch?v=yGHHQwQVpVk

Potential Partnerships:
Post-Secondary Robotics or Mechatronics Instructor and students prepare an electronics lab using multimeter measuring tools. Search Minnesota robotics or Mechatronics programs close to your school.

Small Gas Engines

Unit: Careers in Machine Trades
Post-Secondary Education Programs
Robotics / Mechatronics Programs

Name_____ Date_____ Total Pts:_____/20

Research information on post-secondary education small gas engine programs available after graduating from High School and complete the following questions. At least 2 programs must be in Minnesota.

School 1: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

School 2: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

School 3: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

School 4: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

Train-the-Trainer Workshops

Small Engine Tool Kit

Small Gas Engine

NAME: _____ Date: _____ Score: ___/ 15

Lab Sheet 5: Engine Reassembly

The overhaul procedure which follows is intended to help you to become accustomed to a systematic method of repairing Briggs & Stratton engines. Naturally these steps could be rearranged in different order but efficiency is obtained when the repair operations are performed in the same sequence every time. The exact procedure will vary according to the engine model being repaired.

The overhaul procedure can also be used as an index. For information on how to perform most operations listed, refer to the section number or operation. Be careful to locate the instructions covering the specific model being repaired.

10	Tappets, cam gear, camshaft
10	Camshaft and bearing support
10	Camshaft, bearing plate – adjust crankshaft end play
9	Piston, piston pin, connecting rod, rings, and dipper, if equipped
8	Oil slinger
5	Mechanical governor
10	Sump or crankcase cover – adjust crankshaft end play
6	Adjust valve tappet clearance
6	Valves, springs, retainer
2	Armature, governor blade
2	Breaker points (internal system), if so equipped
2	Condenser, if so equipped
2	Adjust armature timing
2	Condenser, if so equipped
2	Adjust and clean breaker points (External), if so equipped
2	Breaker point cover, if so equipped
2	Coil and armature, if so equipped
2	Breaker box cover, if so equipped
2	Flywheel and starter pulley or clutch
7B	Electric starter (110V) (12V)
2	Adjust air gap – armature to flywheel
2	Check spark

8	Breather or valve cover
6	Cylinder head and shield
2	Spark plug
	Muffler
3	Intake elbow or carburetor and tank
4	Carburetor, linkage and governor controls
5	Check air vane governor
5	Check and adjust mechanical governor
	Blower housing
3	Fuel filter parts, tank & line
3	Air cleaner elbow or pipe
8	Change oil (crankcase)
1	Start engine (fill with gas)
6	Retighten cylinder head screws
3	Adjust carburetor
5	Set governor to obtain correct engine speed (remote controls)
3	Clean, fill, assemble air cleaner
	Spray engine and apply decals

Student Name: _____

Instructors Signature: _____

MINNESOTA STATE
Centers of Excellence

Train-the-Trainer Workshops

Small Engine Tool Kit

Name: _____ Date: _____ Total Points: ___/

Compression System (Valve Train)

Compression (Valve Train) Lab

I. Objectives:

A. Complete disassembly, inspection, and reassembly of a small gas engine compression system (valve train).

B. To analyze and record the mechanical conditions of the four-cycle engine you will be disassembling and overhauling.

II. Reference:

A. Class Notes
B. Manufacturer's Shop Manual
C. Small Gas Engines Text
D. Illustrated Parts Manual
E. Advanced Product Service Manual

III. Procedure Notes:

Follow all shop policy and safety rules.
ALWAYS WEAR SAFETY GLASSES!
Keep your work area neat and clean.
Use Ziplock bags and label them with a sharpie marker

Safety Note: Be careful of any moving belts, pulleys, levers, and mower blades!! When making tests that require cranking the engine, remove spark plug wire and ground it.

IV. ***Key terms:*** Camshaft
Camshaft lobes
Crankshaft
Intake valve
Exhaust valve
Valve tappets
Valve springs
Valve spring retainer
Rocker arm

Valve guide
Engine cylinder
Cylinder head
Connecting rod
Connecting rod cap
Push rod
Head gasket

Part II. Compression System (Valve Train)

1. Remove the Valve Cover.

2. Take pictures as needed for engine reassembly.

3. Describe the position of each valve during the 4 strokes of the engine (Open or Closed)

Stroke	Intake Valve	Exhaust Valve
Intake		
Compression		
Power		
Exhaust		

4. Using a flat feeler gauge measure and report the valve clearance of each valve.

   L-head engine: https://www.youtube.com/watch?v=yQiE50YAPuA

   Overhead valve engine: https://www.youtube.com/watch?v=JouT2orMDAg

   Adjusting the valve clearance on an overhead valve engine:

   https://www.youtube.com/watch?v=H8C25hFv1mU

   a. Intake Valve _____

   b. Exhaust Valve _____

   Teacher Initials_____

5. **Do not remove the Rocker Arms, Push Rods, and Valves.**
6. Remove the Cylinder Head.
7. Remove the Crankcase Cover.

   Teacher Initials _____

Inspect and take pictures before removing the camshaft, crankshaft, timing gear, valve tappets and piston.

8. Remove the Cam Gear, Timing Gear, Valve Tappets, and Piston.
9. List the major parts and their function of the compression system.

10. Take pictures of any engine parts you disassembled today for your google slideshow.
11. Label your Ziplock bags using a permanent marker and put bags in your shop locker.

Teacher Feature

Resources

********** "Illustrated Parts Manual" and "Advanced Product Service Manual" are excellent resources for all shop labs. Search by using the engine manufacturer, model, and type number. i.e. Manufacturer Briggs and Stratton Model number 20M100 Code number 0133

Quick links

Basic Compression video: Covers basic terms associated with the compression system.

https://www.thepowerportal.com/nA/English/PowerChannel/Courses/Compression.htm

Basic valve video: Covers basic information on valves.

https://www.thepowerportal.com/nA/English/PowerChannel/Courses/Compression.htm

Small Engine Valve Maintenance & Repair article

https://www.briggsandstratton.com/na/en_us/support/faqs/browse/valve-repair-maintenance.html

Briggs & Stratton 130G32 OHV Engine Disassembly & Assembly Good video going through the steps of disassembly and assembly of a small engine. You may consider searching your small engine specific manufacturer and model number.

https://www.youtube.com/watch?v=c_xsUi4C1FM

Compression system study materials:

Quizlet: https://quizlet.com/96139049/flashcards

MINNESOTA STATE
Centers of Excellence

Train-the-Trainer Workshops

Small Engine Tool Kit

Name: _____ Date: _____ Total Points: ___/

Compression System (Piston and piston rings)
Compression (Piston and Piston rings) Lab

I. Objectives:

A. Complete disassembly, inspection, and reassembly of a small gas engine compression system (piston and piston rings).
B. Calculate the engine displacement of an engine.
C. To analyze and record the mechanical conditions of the four-cycle engine you will be disassembling and overhauling.

II. Reference:

A. Class Notes
B. Manufacturer's Shop Manual
C. Small Gas Engines Text
D. Illustrated Parts Manual
E. Advanced Product Service Manual

III. Procedure Notes:

Follow all shop policy and safety rules.
ALWAYS WEAR SAFETY GLASSES!
Keep your work area neat and clean.
Use Ziplock bags and label them with a sharpie marker

Safety Note: Be careful of any moving belts, pulleys, levers, and mower blades!! When making tests that require cranking the engine, remove spark plug wire and ground it. Use Ziploc bags and label them with a sharpie marker.

IV. Procedure Notes:

Follow all shop policy and safety rules.
ALWAYS WEAR SAFETY GLASSES!
Keep your work area neat and clean.
Use Ziplock bags and label them with a sharpie marker.

V. Key Terms:

cylinder bore

stroke

clocking the rings

piston

piston ring

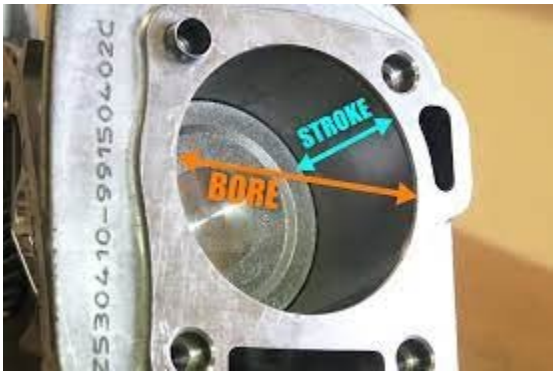
cylinder

crosshatch

diamond bore

engine displacement

Vernier caliper



1. With the piston removed from the cylinder, complete the following measurements & calculations.

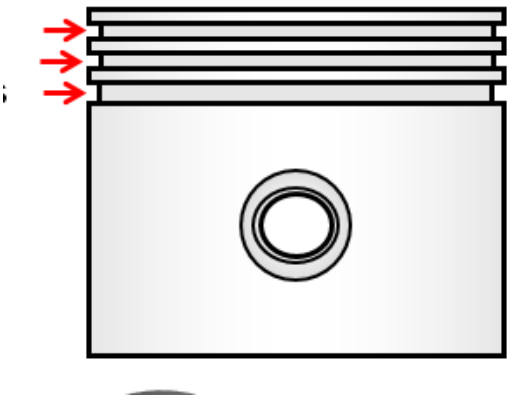
   Cylinder Bore = _____ inches

   Cylinder Stroke = _____ inches

   Engine Displacement = $\frac{(\text{Bore})^2}{4}$ x 3.14 x Stroke

   Engine Displacement = _____ inches
   (show work below)

2. Label the following rings of the piston. **Do not remove the piston rings.**



Instructor Initials: _____

2a. What tool do you utilize to put the rings back on the piston?

_____

How to measure piston diameter (using a micrometer) and piston ring side clearance and end gap (using a feeler gauge). https://www.youtube.com/watch?v=EO4HHuu9rb0

3. Check the **Ring side Clearance** of the top 2 rings using the following procedure:
    a. Obtain a feeler gauge.
    b. With the ring inserted in the groove of the piston, hold the feeler gauge flat.
    c. Insert the feeler gauge sideways into the ring groove.
    d. Utilize the different fins of the gauge to find the correct gap
    e. Record the ring-groove clearances below:
        i. Compression Ring: _____
        ii. Scraper Ring: _____
    f. Check the **ring end gap** using the engine block and rings provided.
        i. Compression Ring: _____
4. Take pictures for your Google Slideshow

Teacher Feature

Resources

********** "Illustrated Parts Manual" and "Advanced Product Service Manual" are excellent resources for all shop labs. Search by using the engine manufacturer, model, and type number. i.e. Manufacturer Briggs and Stratton Model number 20M100 Code number 0133

Quick links:

Video: Basic compression system video covering the piston, piston rings and the cylinder.

Good video highlighting the specific components listed above.

https://www.thepowerportal.com/nA/English/PowerChannel/Courses/Compression.htm

Briggs & Stratton 130G32 OHV Engine Disassembly & Assembly Good video going through the steps of disassembly and assembly of a small engine. You may consider searching your small engine specific manufacturer and model number.

https://www.youtube.com/watch?v=c_xsUi4C1FM

Basic measurements on a small engine.
https://www.youtube.com/watch?v=yGHHQwQVpVk

Potential Partnerships:
Post Secondary machine trades Instructor and students prepare a measuring tools lab using a variety of measuring tools. Search Minnesota machine trades close to your school.

Compression system flashcards:
https://quizlet.com/96139049/small-engines-compression-systems-flash-cards/

Small Gas Engines

Unit: Careers in Small Gas Engines
Post-Secondary Education Machine Trades Programs

Name_____ Date_____ Total Pts:_____/20

Research information on post-secondary education small gas engine programs available after graduating from High School and complete the following questions. At least 2 programs must be in Minnesota.

School 1: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

School 2: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

School 3: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

School 4: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

MINNESOTA STATE
Centers of Excellence

Train-the-Trainer Workshops

Small Engine Tool Kit

Name: _____ Date: _____ Total Points: ___/

Compression System (Piston and piston rings)
Compression (Piston and Piston rings) Lab

I. Objectives:

A. Complete disassembly, inspection, and reassembly of a small gas engine compression system (piston and piston rings).
B. Calculate the engine displacement of an engine.
C. To analyze and record the mechanical conditions of the four-cycle engine you will be disassembling and overhauling.

II. Reference:

A. Class Notes
B. Manufacturer's Shop Manual
C. Small Gas Engines Text
D. Illustrated Parts Manual
E. Advanced Product Service Manual

III. Procedure Notes:

Follow all shop policy and safety rules.
ALWAYS WEAR SAFETY GLASSES!
Keep your work area neat and clean.
Use Ziplock bags and label them with a sharpie marker

Safety Note: Be careful of any moving belts, pulleys, levers, and mower blades!! When making tests that require cranking the engine, remove spark plug wire and ground it. Use Ziploc bags and label them with a sharpie marker.

IV. Procedure Notes:

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V. Key Terms:

cylinder bore

stroke

clocking the rings

piston

piston ring

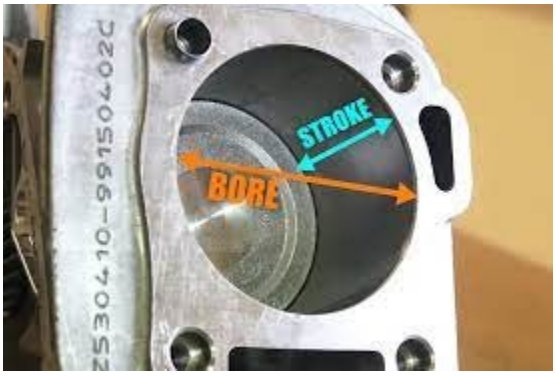
cylinder

crosshatch

diamond bore

engine displacement

Vernier caliper



1. With the piston removed from the cylinder, complete the following measurements & calculations.

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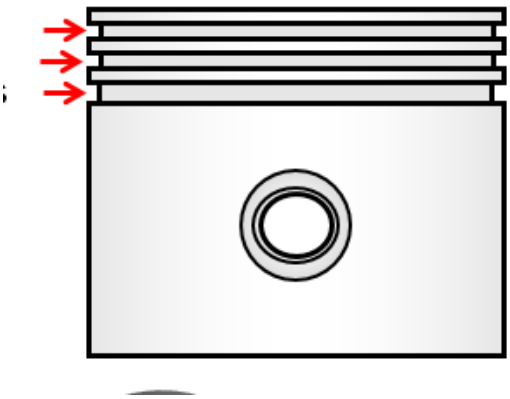
   Cylinder Stroke = _____ inches

   Engine Displacement = $\frac{(\text{Bore})^2}{4}$ x 3.14 x Stroke

   Engine Displacement = _____ inches
   (show work below)

2. Label the following rings of the piston. **Do not remove the piston rings.**



Instructor Initials: _____

2a. What tool do you utilize to put the rings back on the piston?

_____

How to measure piston diameter (using a micrometer) and piston ring side clearance and end gap (using a feeler gauge). https://www.youtube.com/watch?v=EO4HHuu9rb0

3. Check the **Ring side Clearance** of the top 2 rings using the following procedure:
    a. Obtain a feeler gauge.
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    c. Insert the feeler gauge sideways into the ring groove.
    d. Utilize the different fins of the gauge to find the correct gap
    e. Record the ring-groove clearances below:
        i. Compression Ring: _____
        ii. Scraper Ring: _____
    f. Check the **ring end gap** using the engine block and rings provided.
        i. Compression Ring: _____
4. Take pictures for your Google Slideshow

Teacher Feature

Resources

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Quick links:

Video: Basic compression system video covering the piston, piston rings and the cylinder.

Good video highlighting the specific components listed above.

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Basic measurements on a small engine.
https://www.youtube.com/watch?v=yGHHQwQVpVk

Potential Partnerships:
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Compression system flashcards:
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Small Gas Engines

Unit: Careers in Small Gas Engines
Post-Secondary Education Machine Trades Programs

Name_____ Date_____ Total Pts:_____/20

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Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

School 2: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

School 3: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

School 4: _____

Location: Website:

Requirements:

Cost:

What do you leave with?

What jobs can you do when you are done?

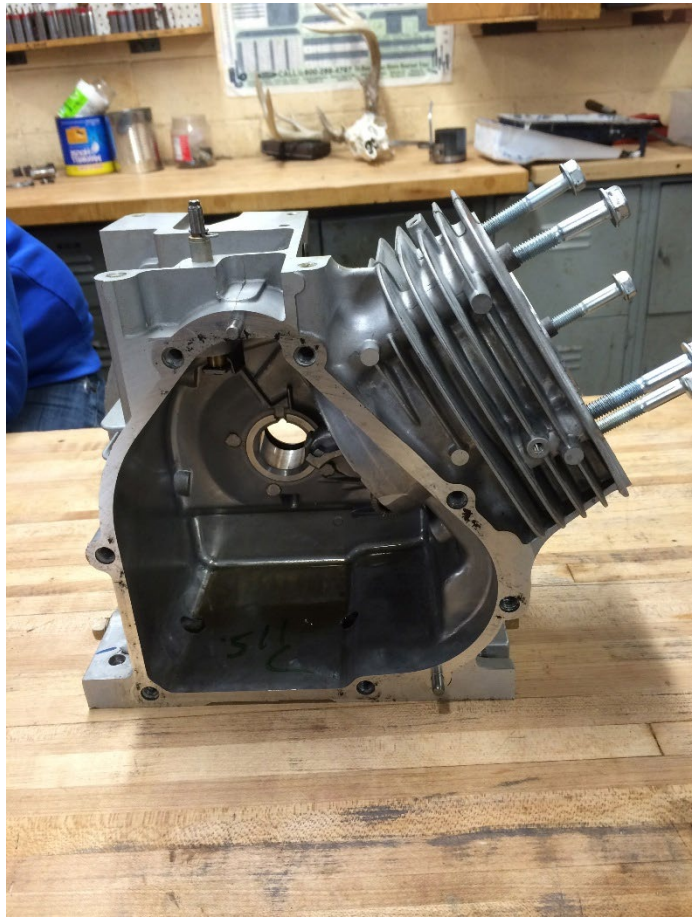
Small Gas Engine Assembly

Briggs & Stratton OHV engine
Model number: 205312
Type number: 0100-B1

Small Engine Reassembly Briggs & Stratton OHV online slideshow

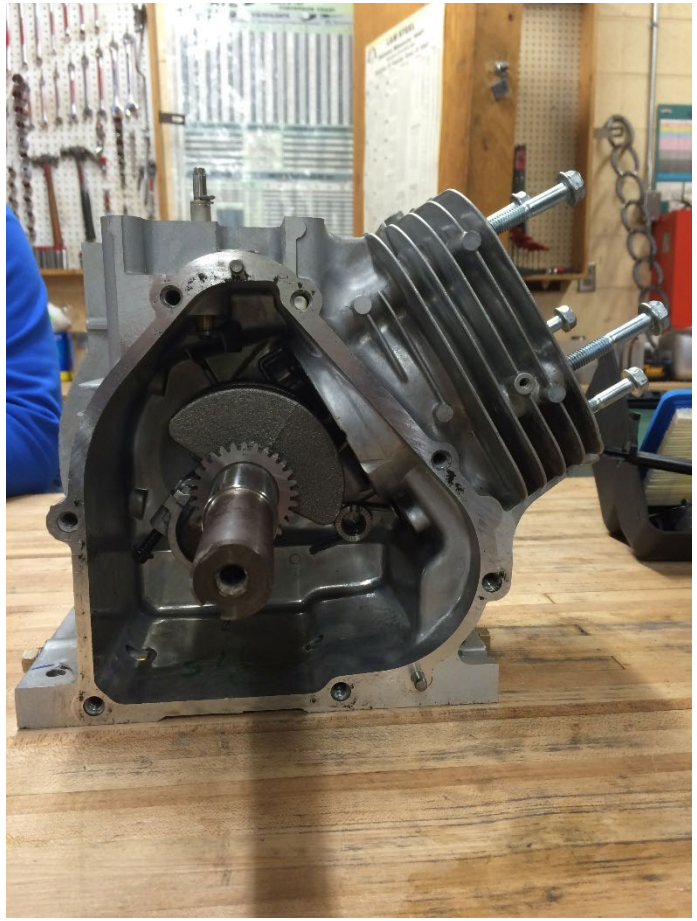
https://slideplayer.com/slide/5993118/

Crankcase

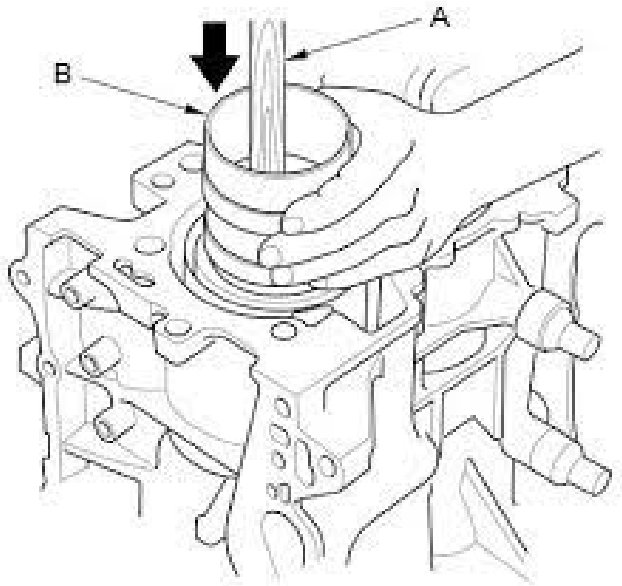


Crankshaft, connecting rod cap and oil dipper

Step 1: Install the crankshaft into the crankcase, tapered end first. Be sure to lubricate all of the bearing surfaces.



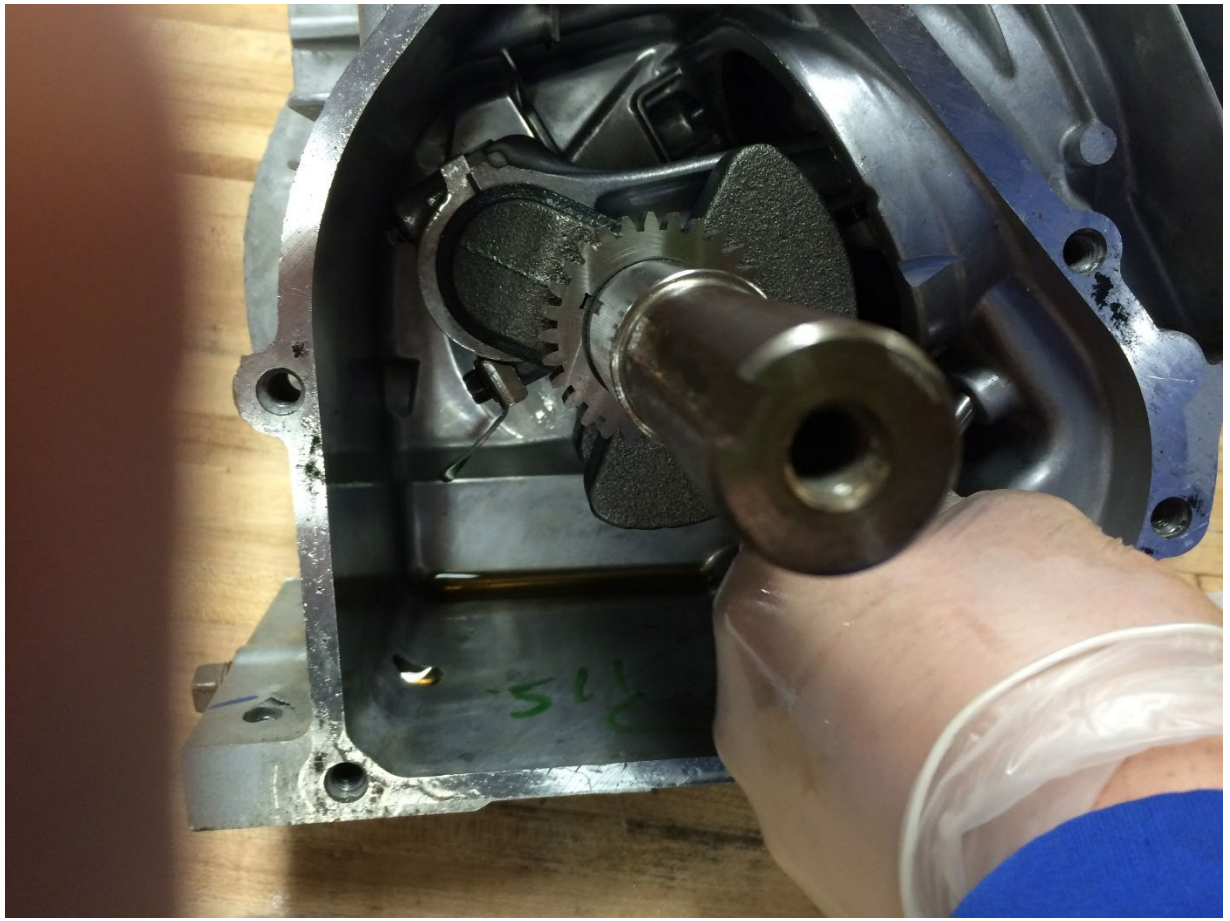
Step 2 & 3: Lubricate the cylinder walls and install the piston into the cylinder using a ring compressor. Be sure the numbers on top of the piston are up.
https://www.youtube.com/watch?v=csOHI6UbH2Y



Step 4: Replace and torque the connecting rod to the correct engine specifications on the crankshaft. Notice the location of the oil dipper.

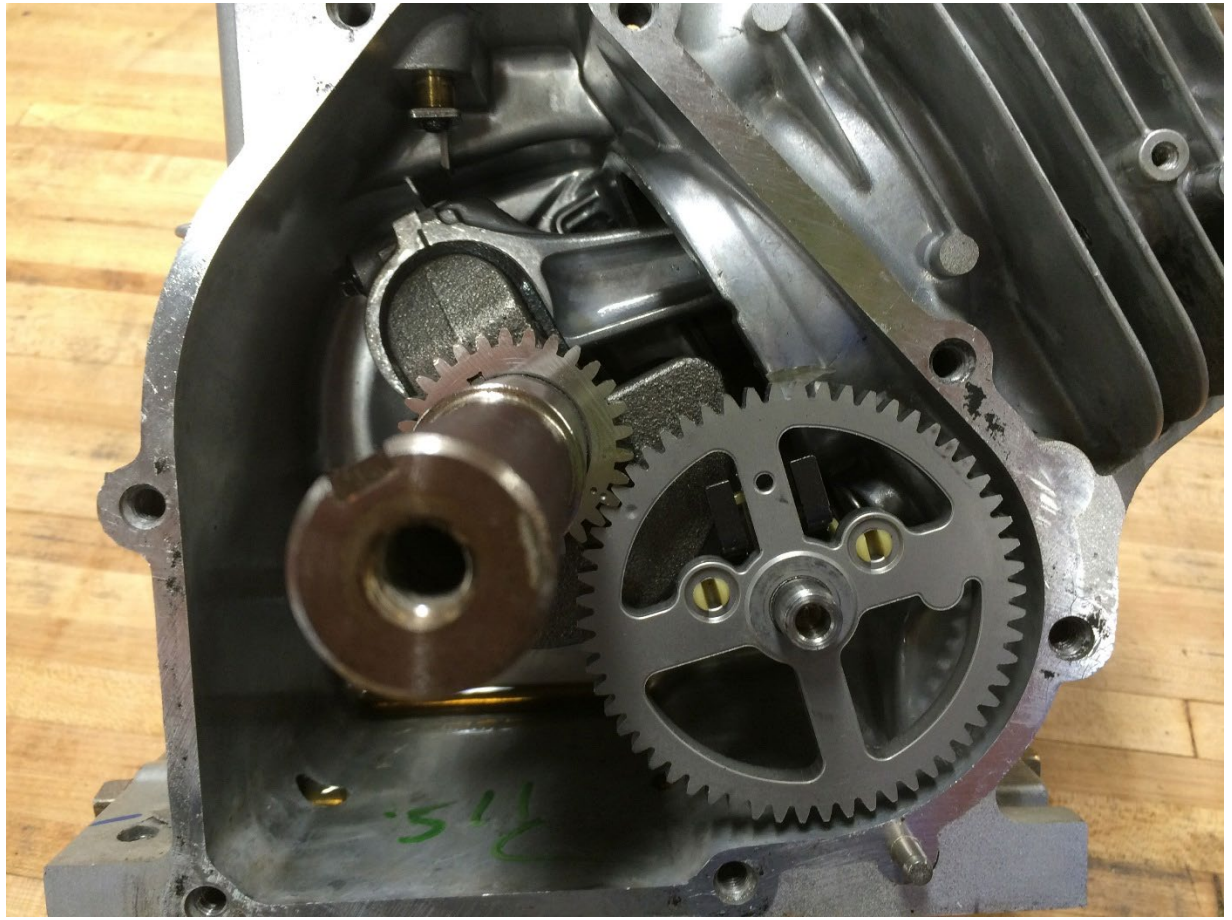
Camshaft and a valve tappet.

Step 5: Install the tappets.

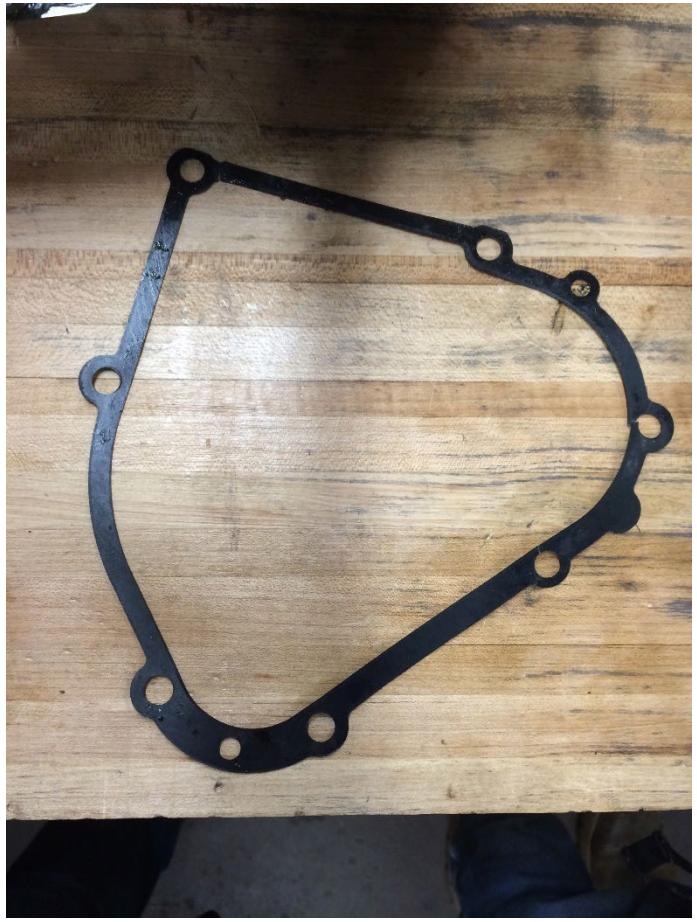


Step 6: Install the camshaft.

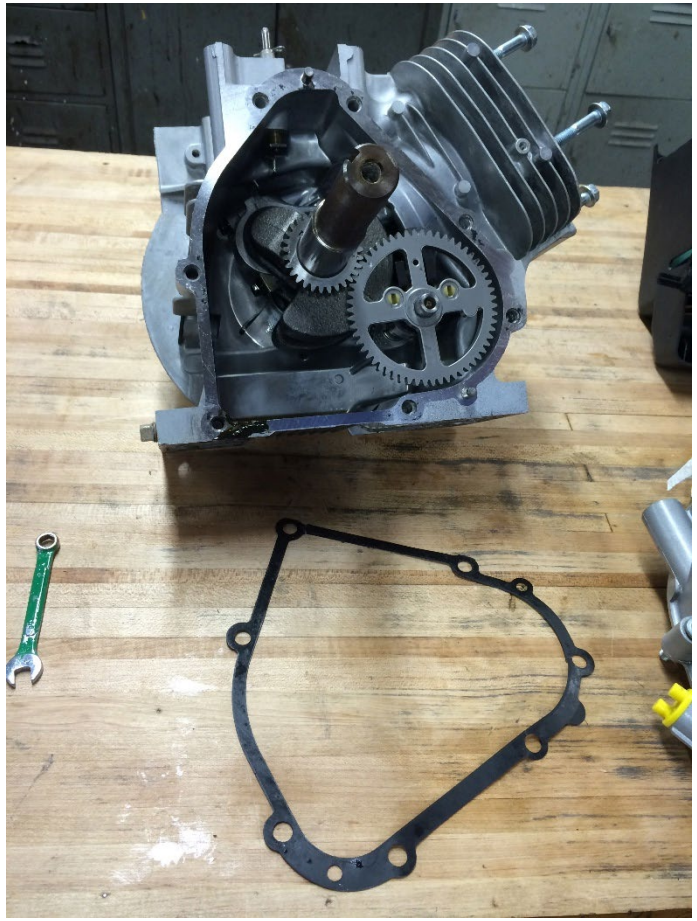
Be sure to time the engine correctly. Align the timing marks on the camshaft and the crankshaft gear.



Crankcase gasket. Be sure to handle the gasket gently. If the gasket is damaged talk with your instructor.

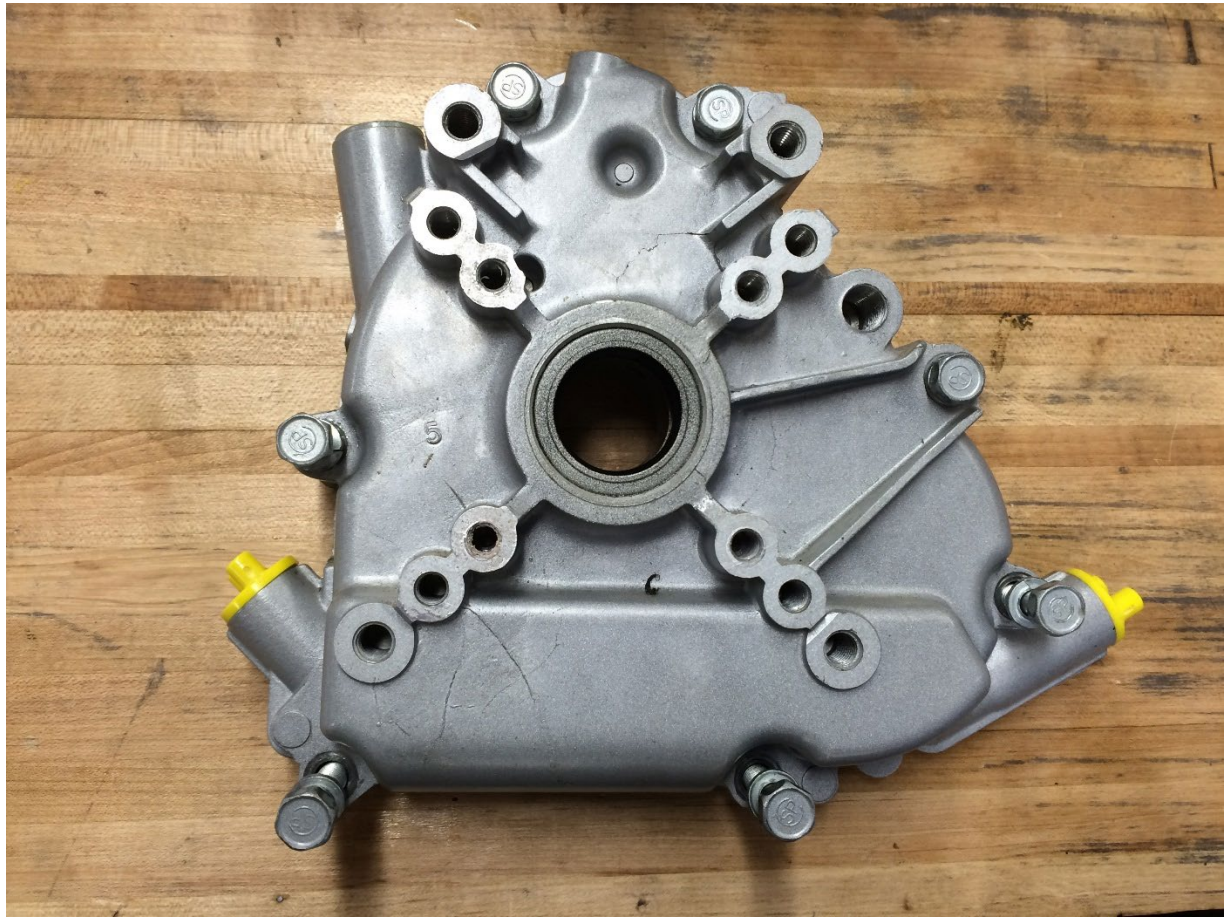


Install the crankcase gasket correctly.

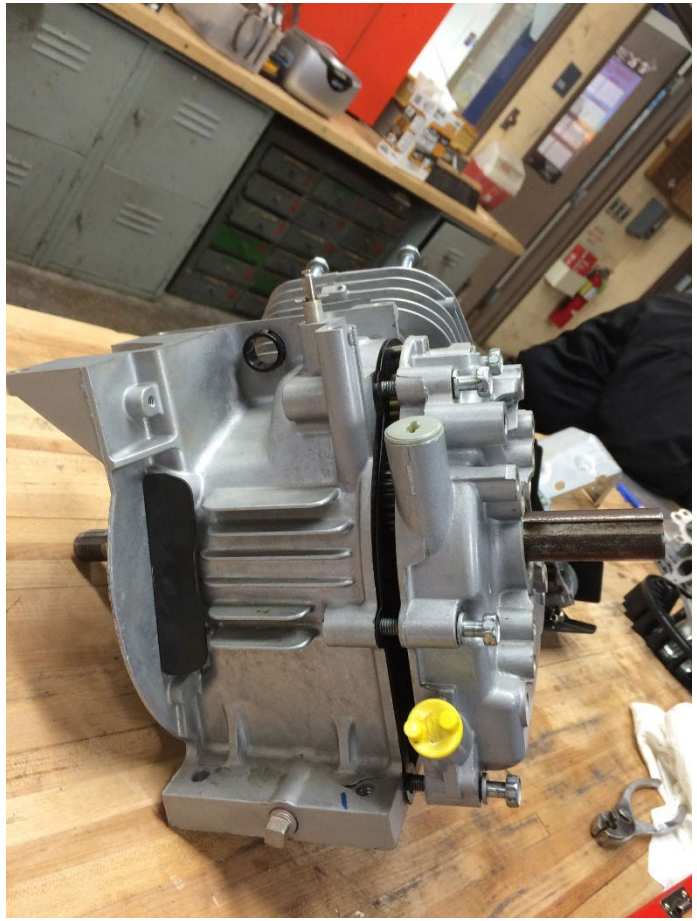


Properly mounted crankcase gasket.

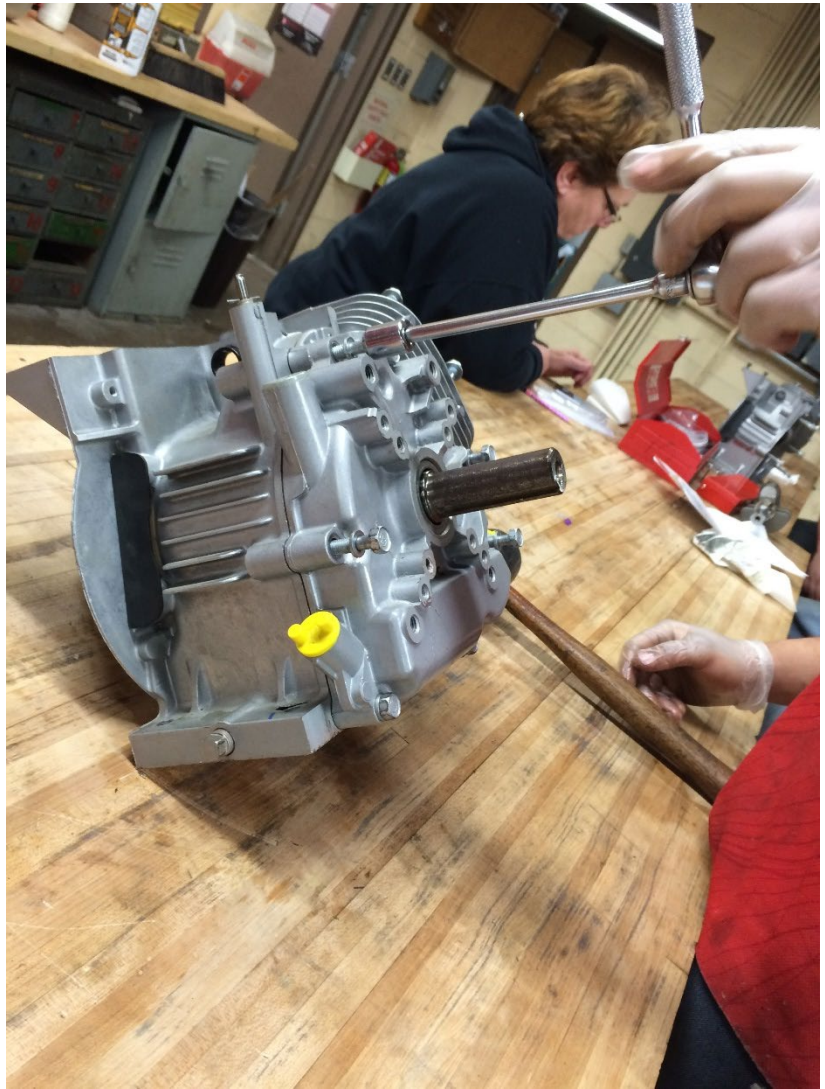
Crankcase Cover



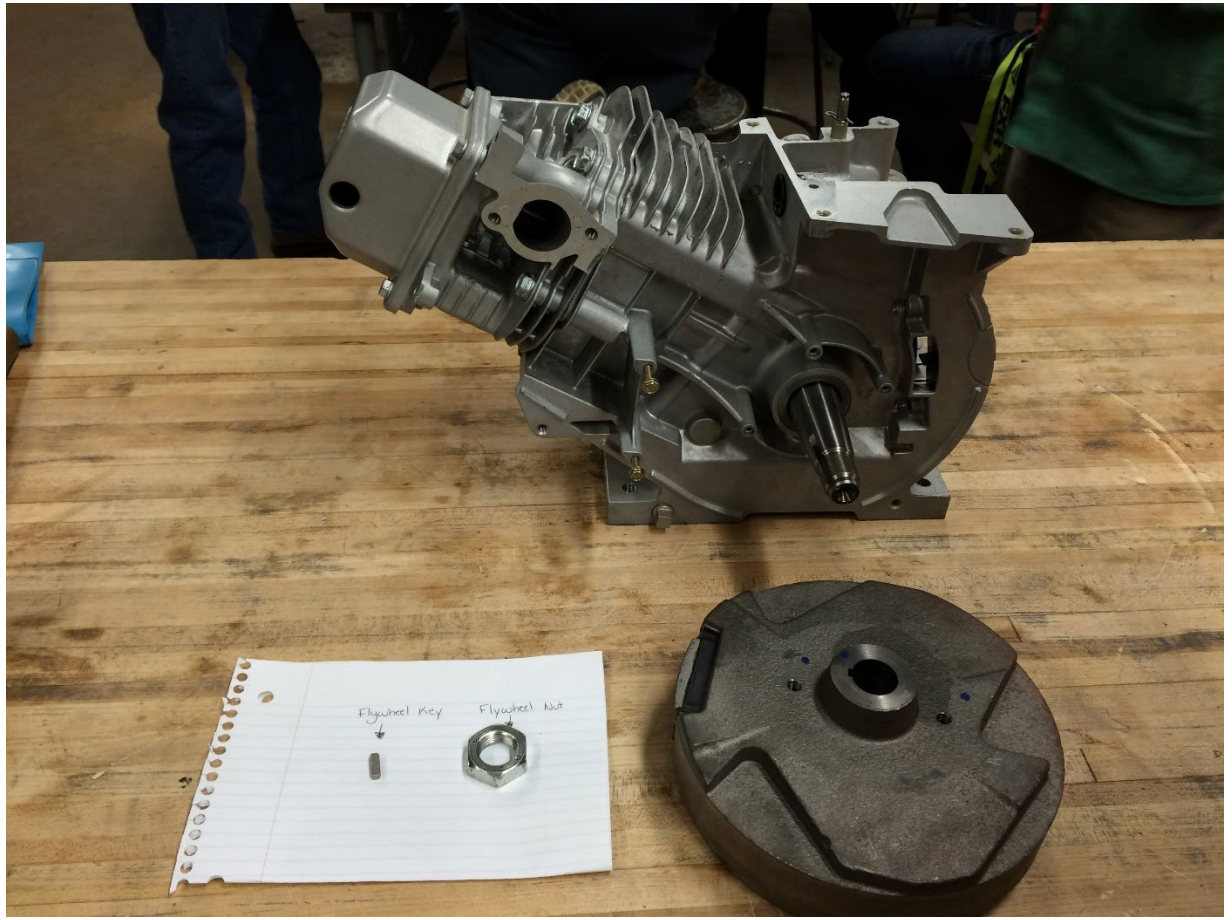
Step 7: Install the crankcase cover to the crankcase.



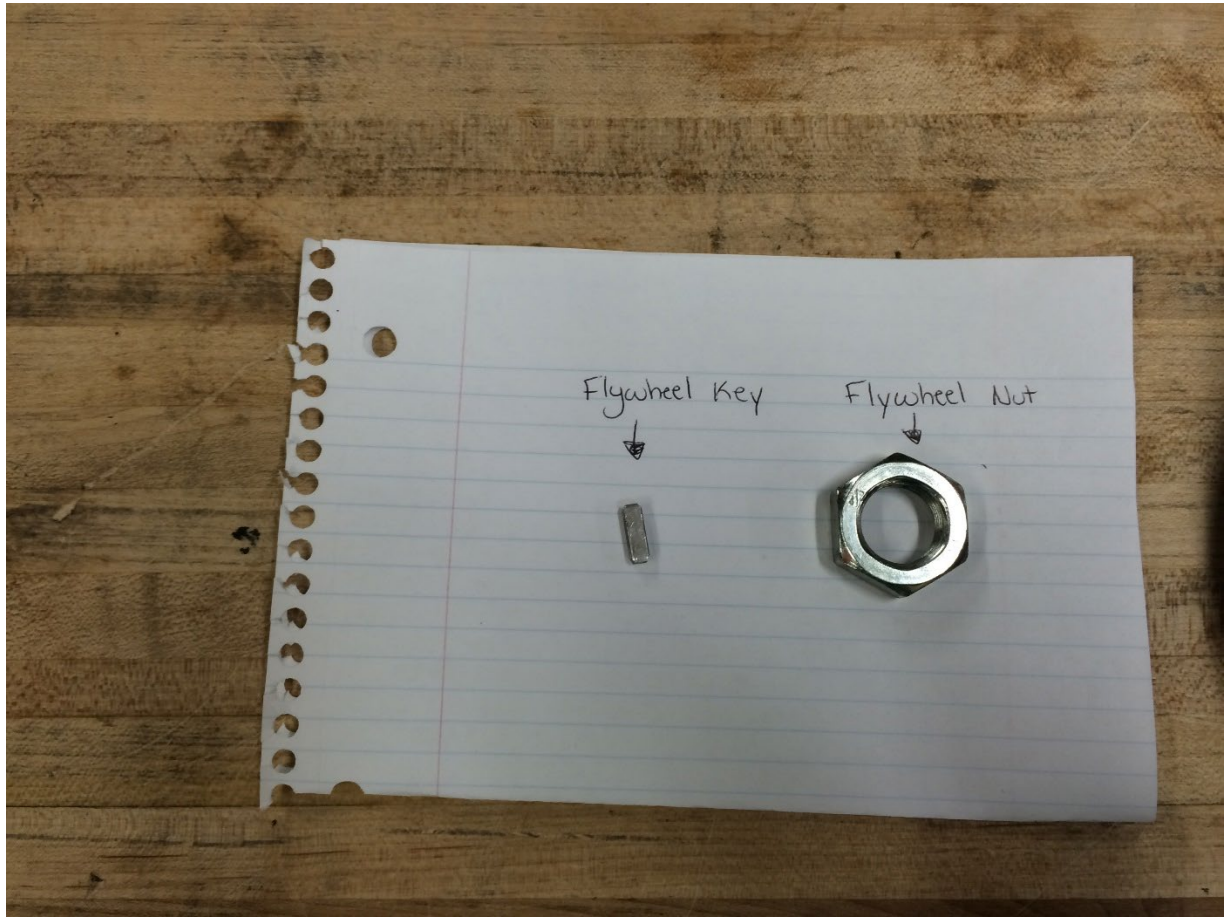
Torque the crankcase bolts in the proper sequence.



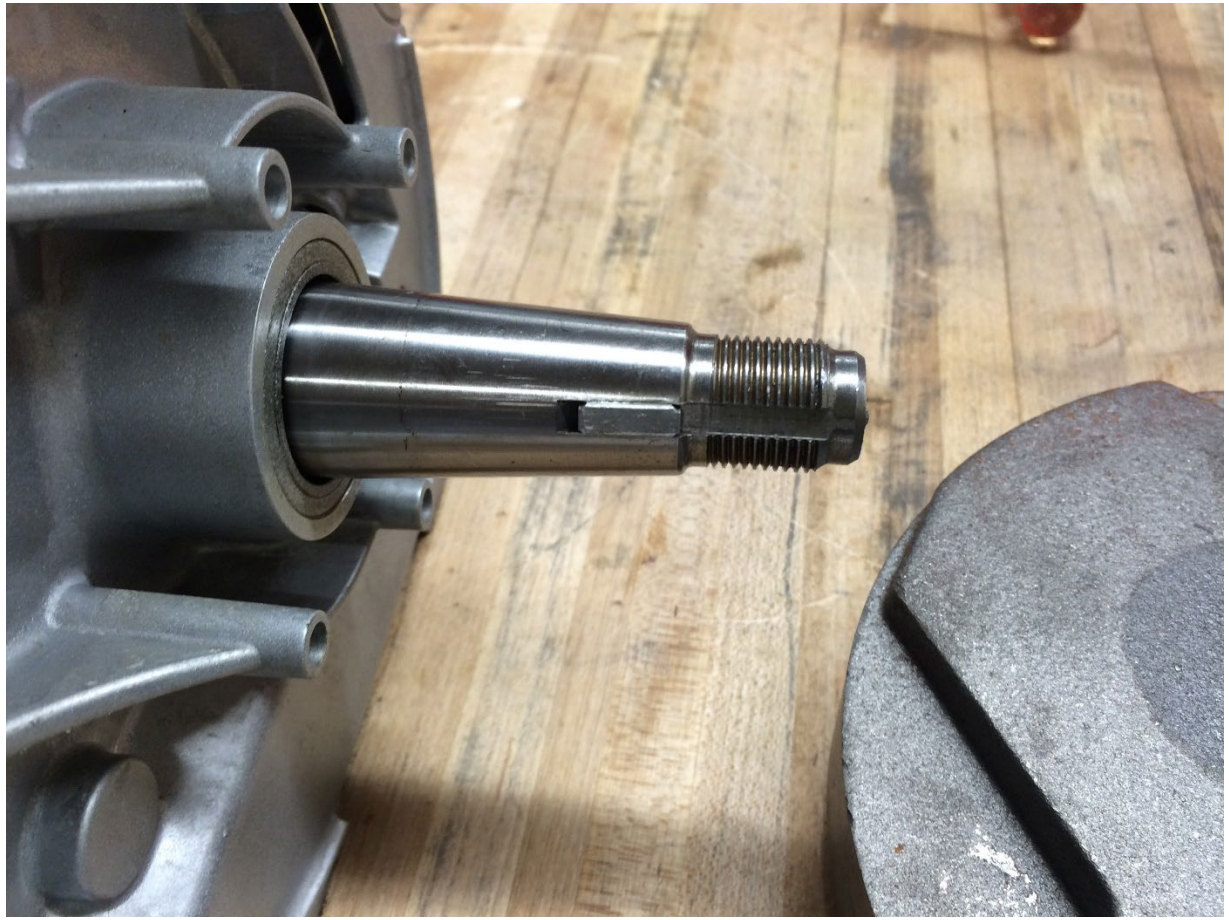
Flywheel with flywheel key and nut



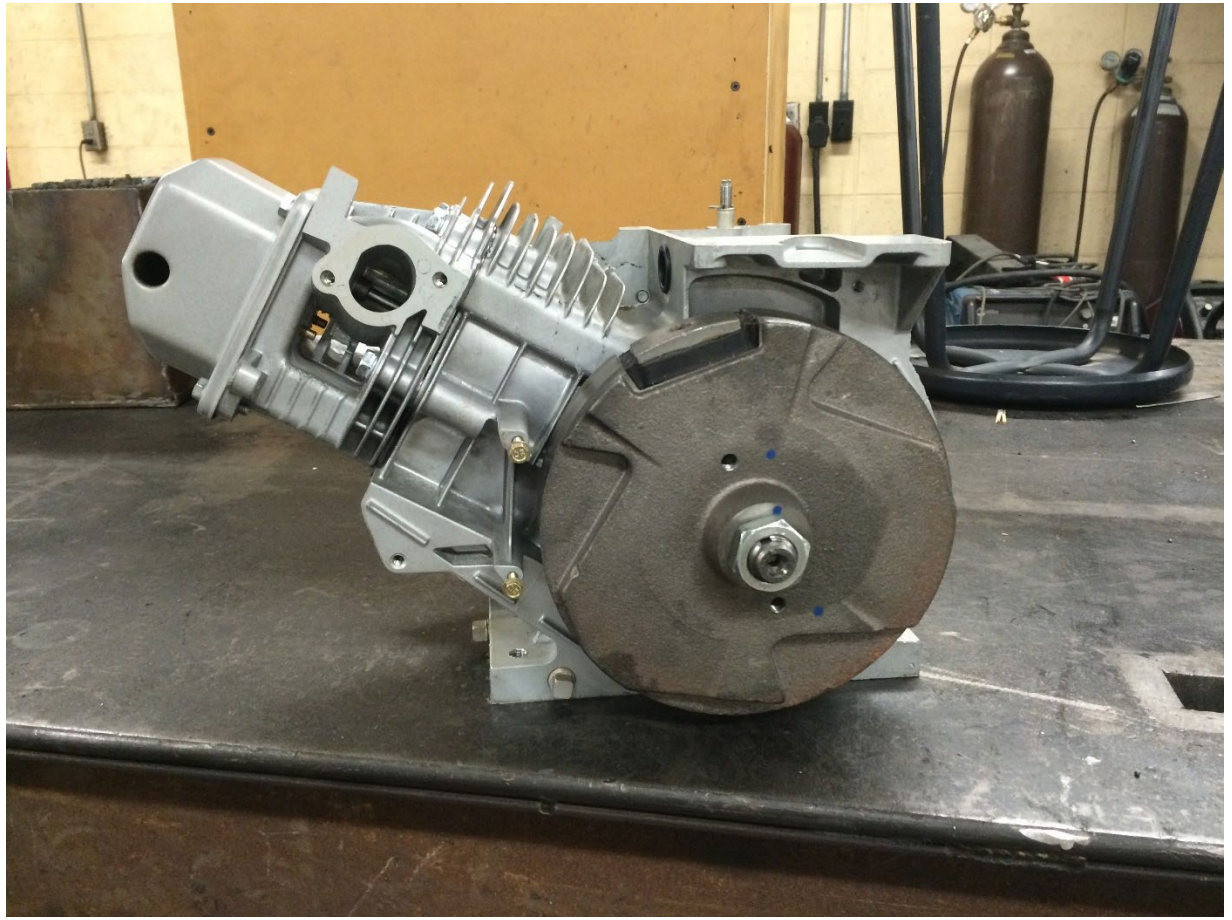
Flywheel key and flywheel nut.



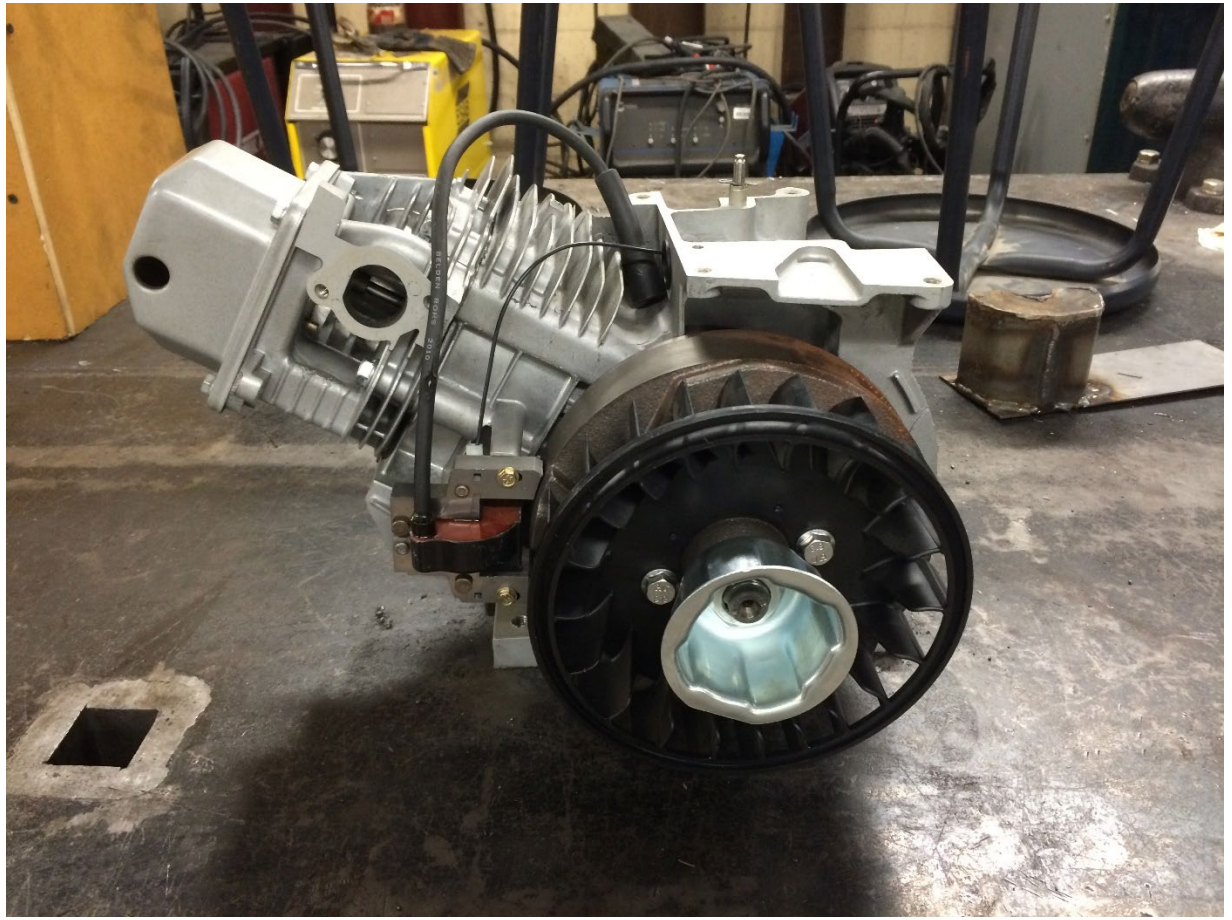
Step 8: Install the flywheel. Be sure the flywheel key is installed correctly.



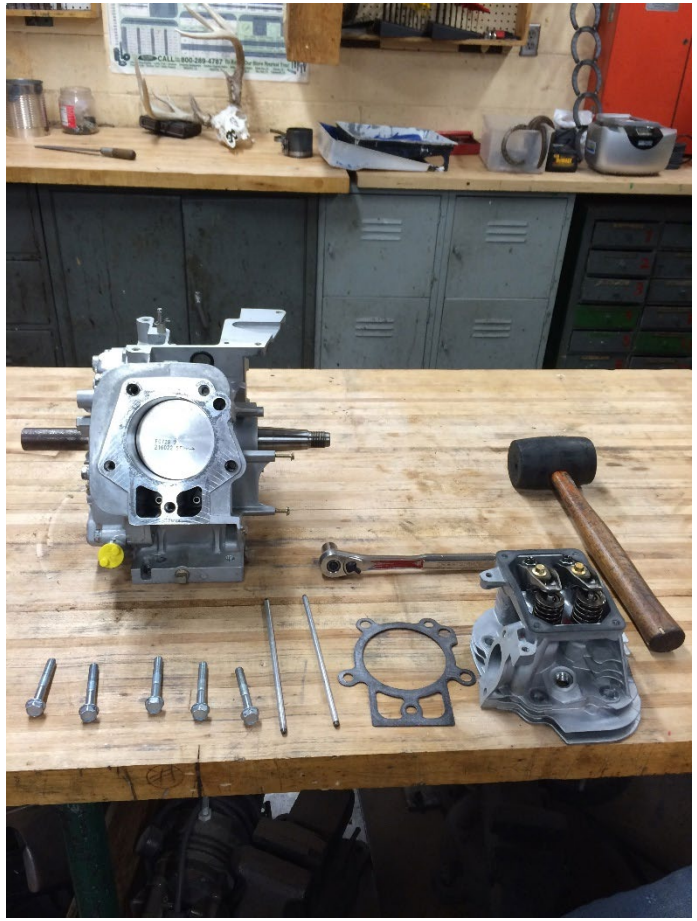
Torque the flywheel on the crankshaft



Install flywheel fins and starter cup.

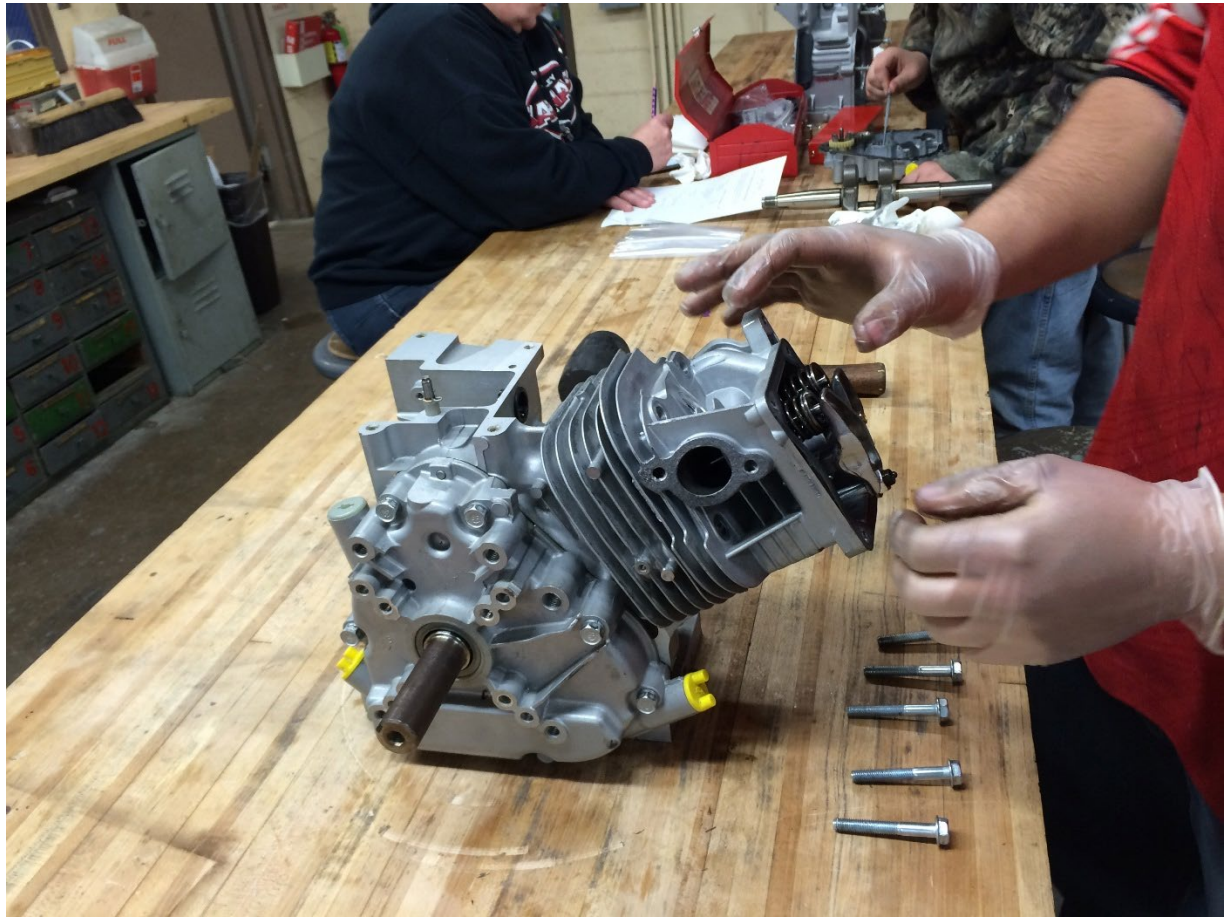


Step 9: Overhead valve assembly

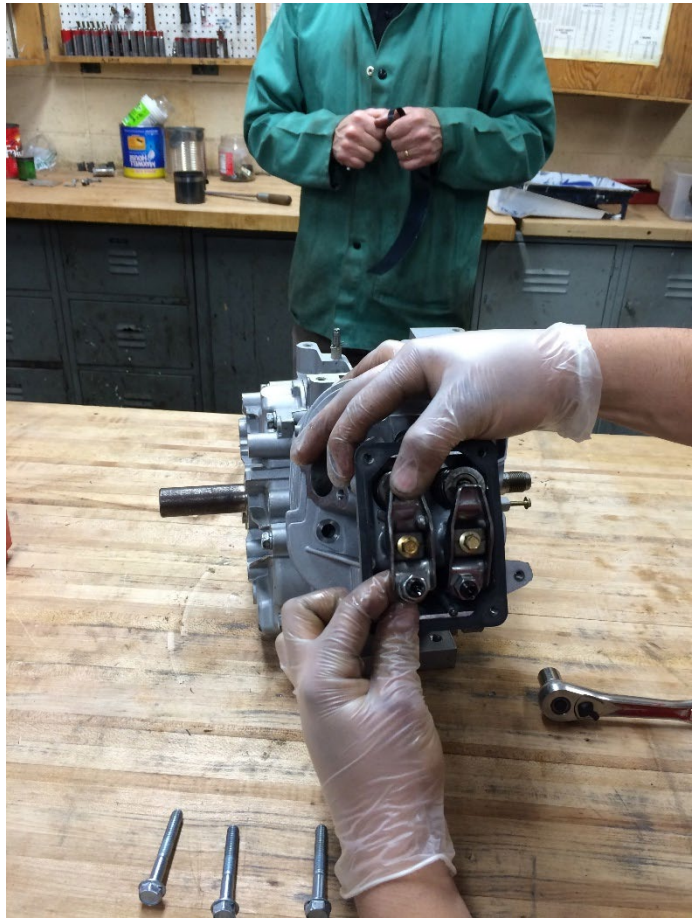


Engine cylinder with the piston installed and head bolts.

Step 10: Install the cylinder head gasket and cylinder head. Torque head bolts in a crisscross pattern.

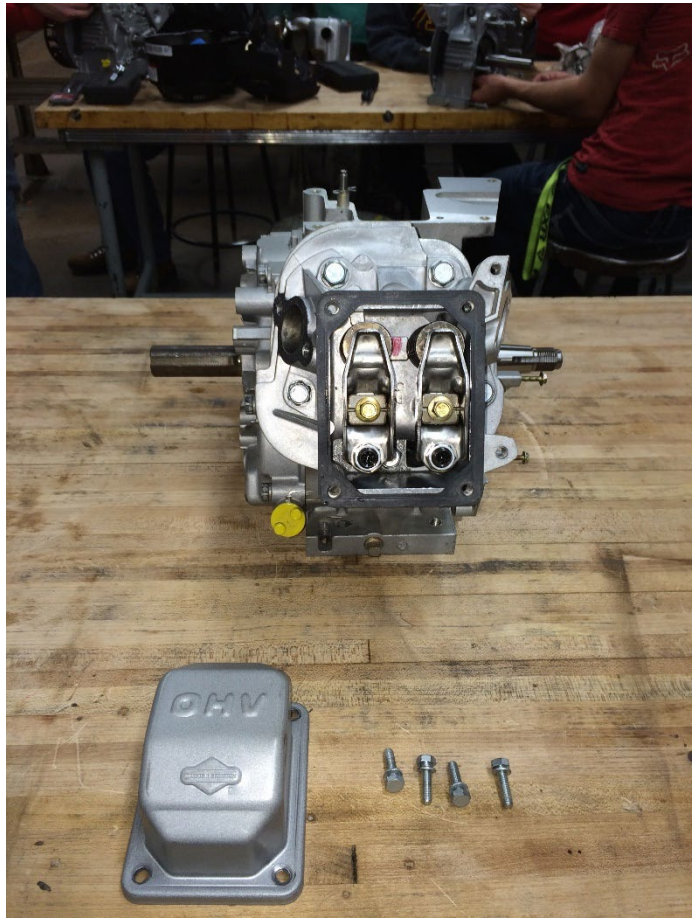


Step 11 & 12: Install valve push rods.

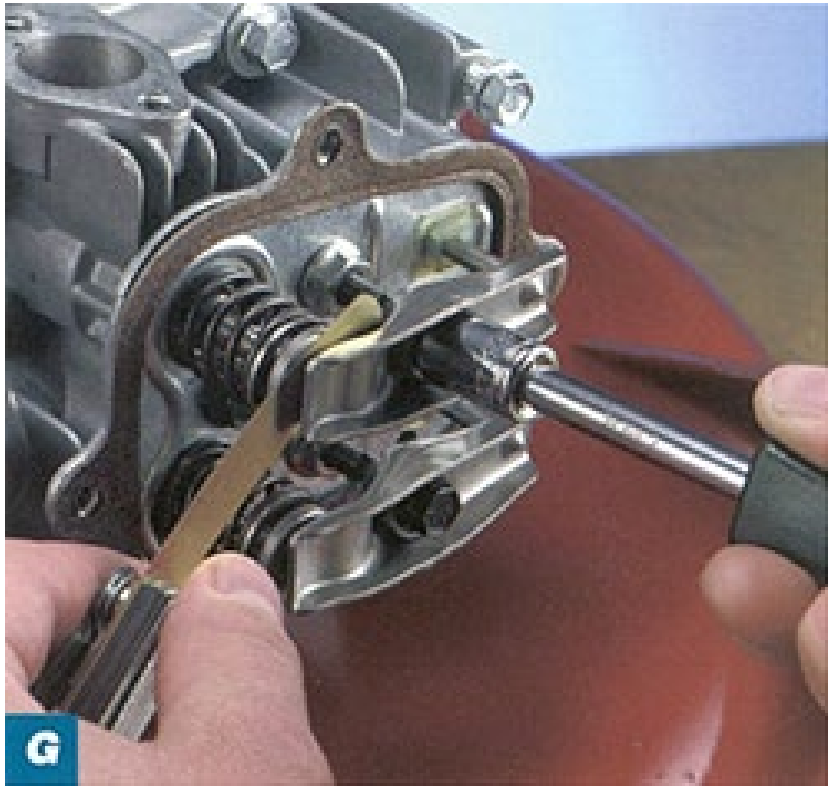


The push rods are installed correctly.

Step 13: Valve cover and parts. Rotate the cylinder to top dead center (TDC) in the compression stroke.

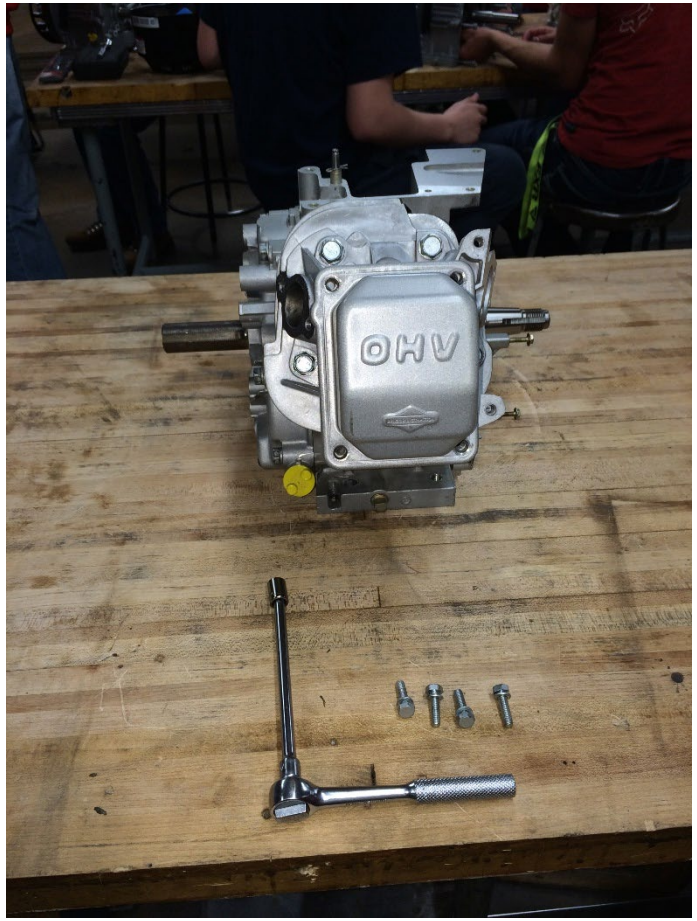


Step 14: Check the valve clearance using a flat feeler gauge.



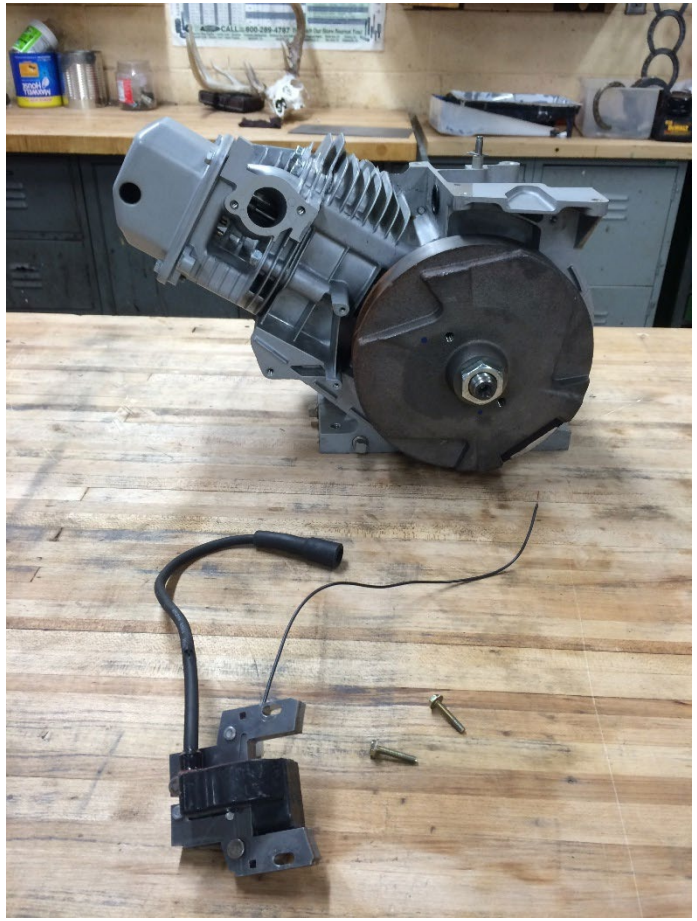
Step 15: Adjusting the valve clearance.

Step 16: Install and torque the valve cover. Do not forget to install the valve cover gasket.

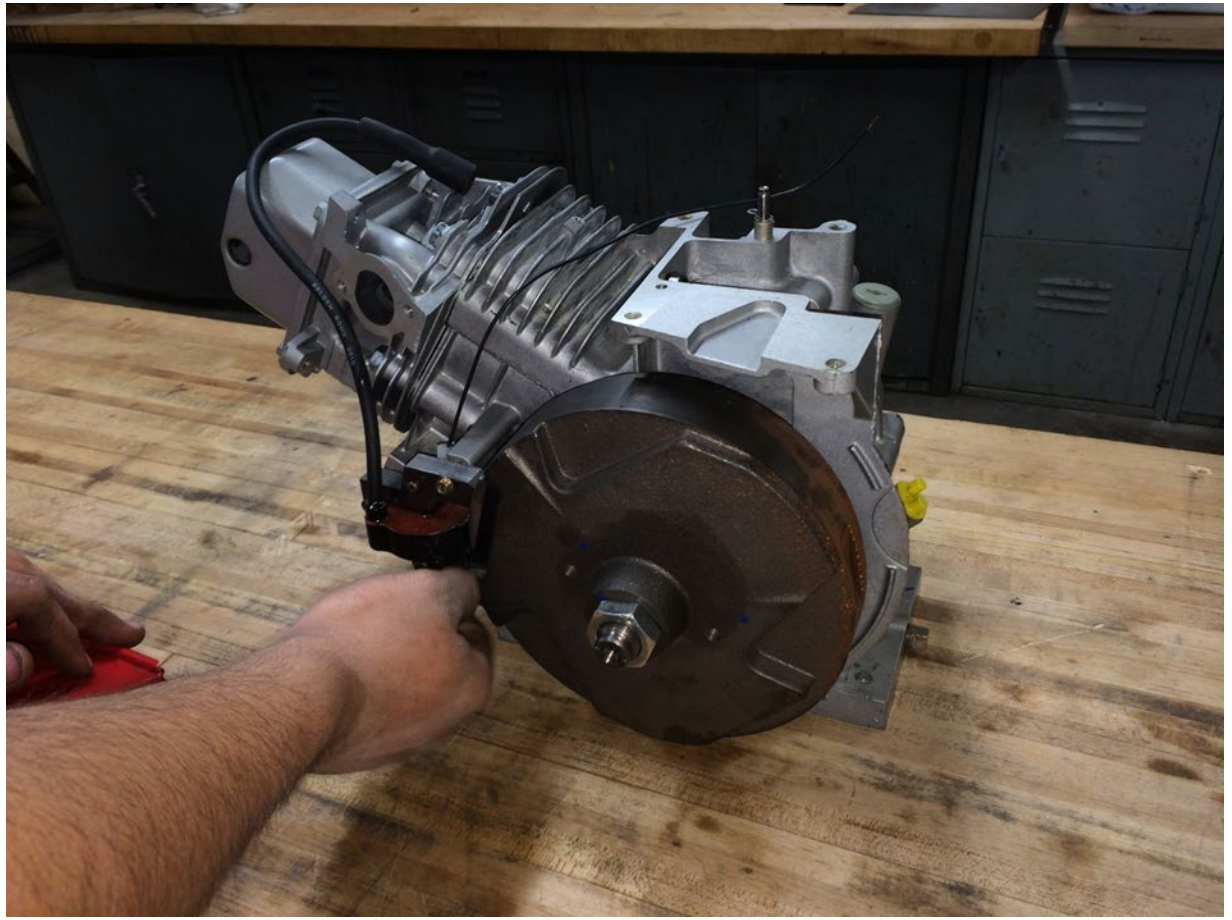


Magneto, armature, spark plug wire (high tension lead wire) and kill switch wire

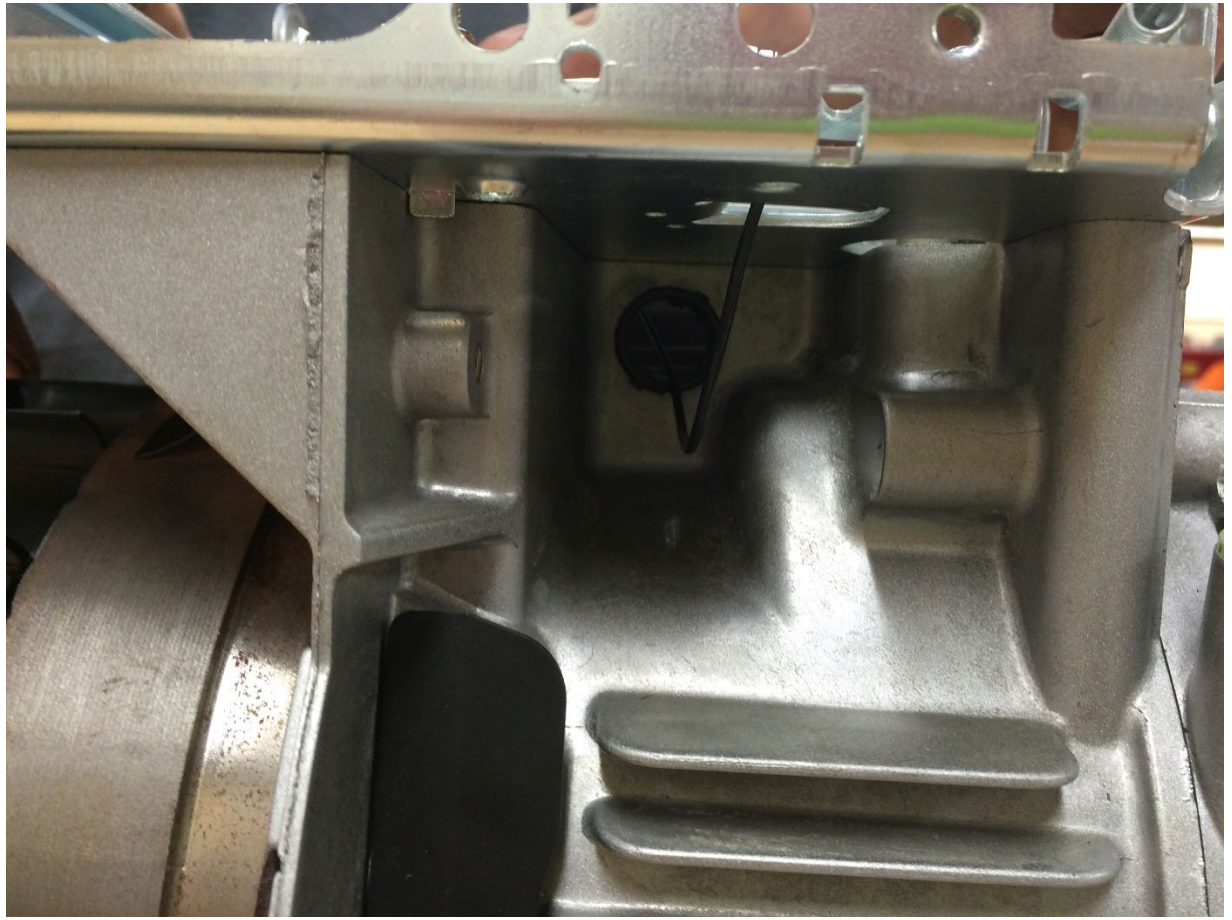
Magneto & armature and parts



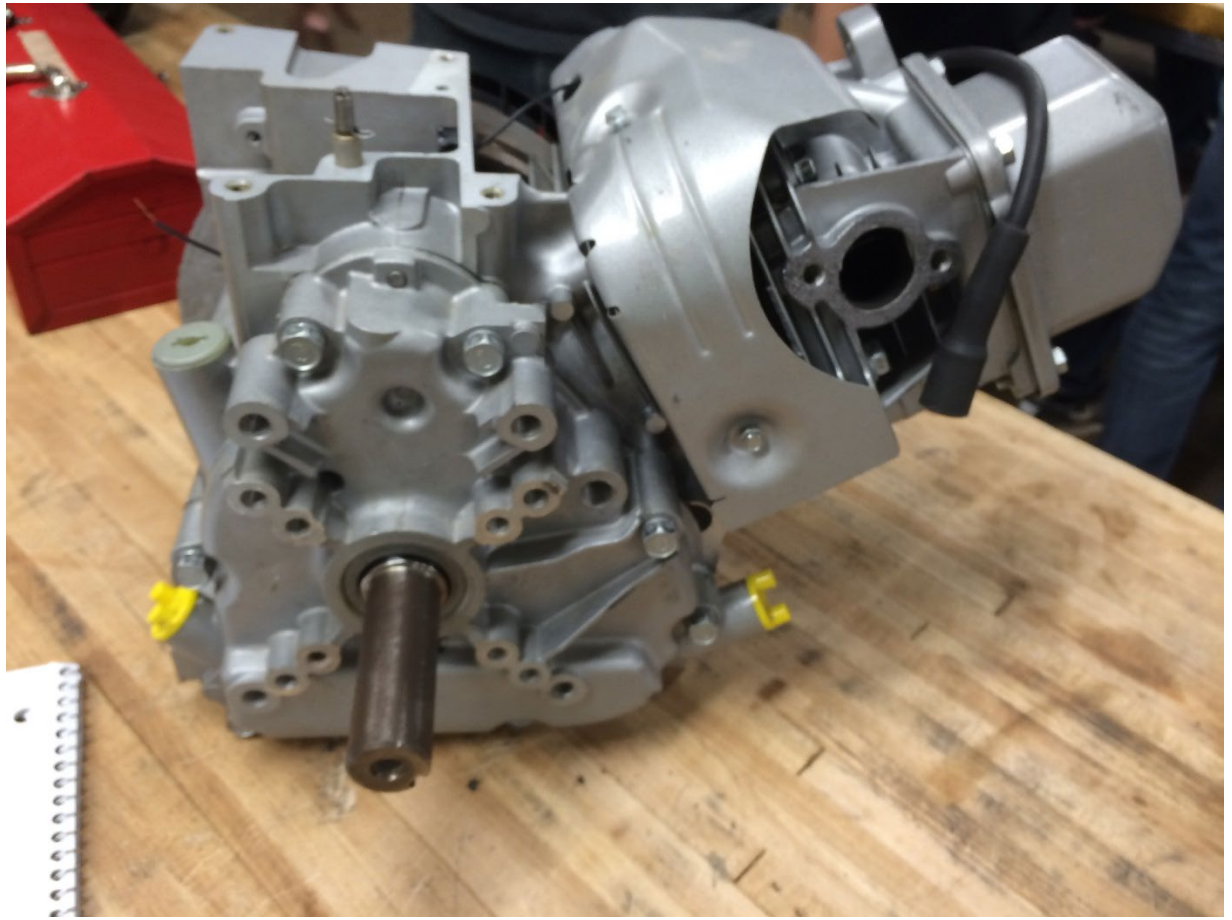
Step 17 Install the armature



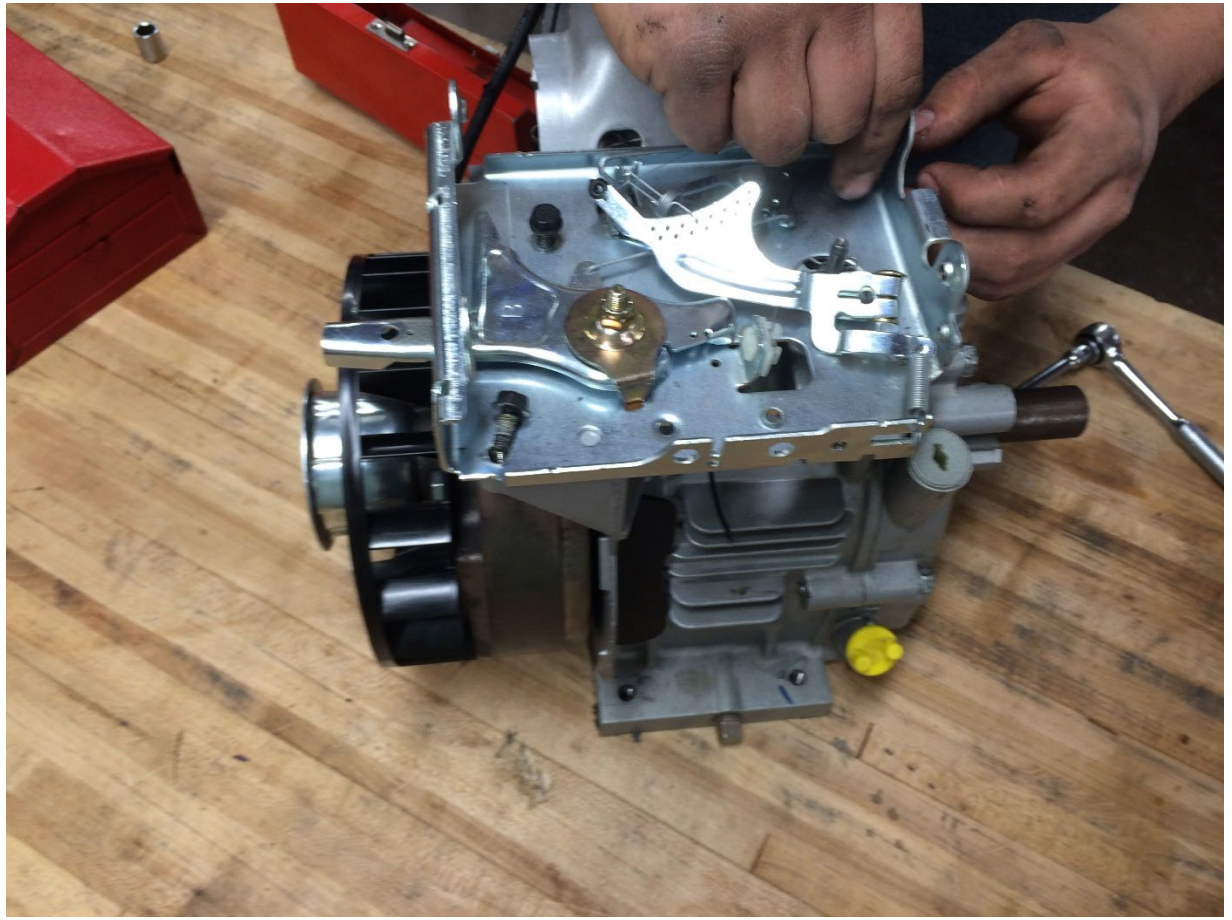
Thread the kill switch wire through the port in the engine block.



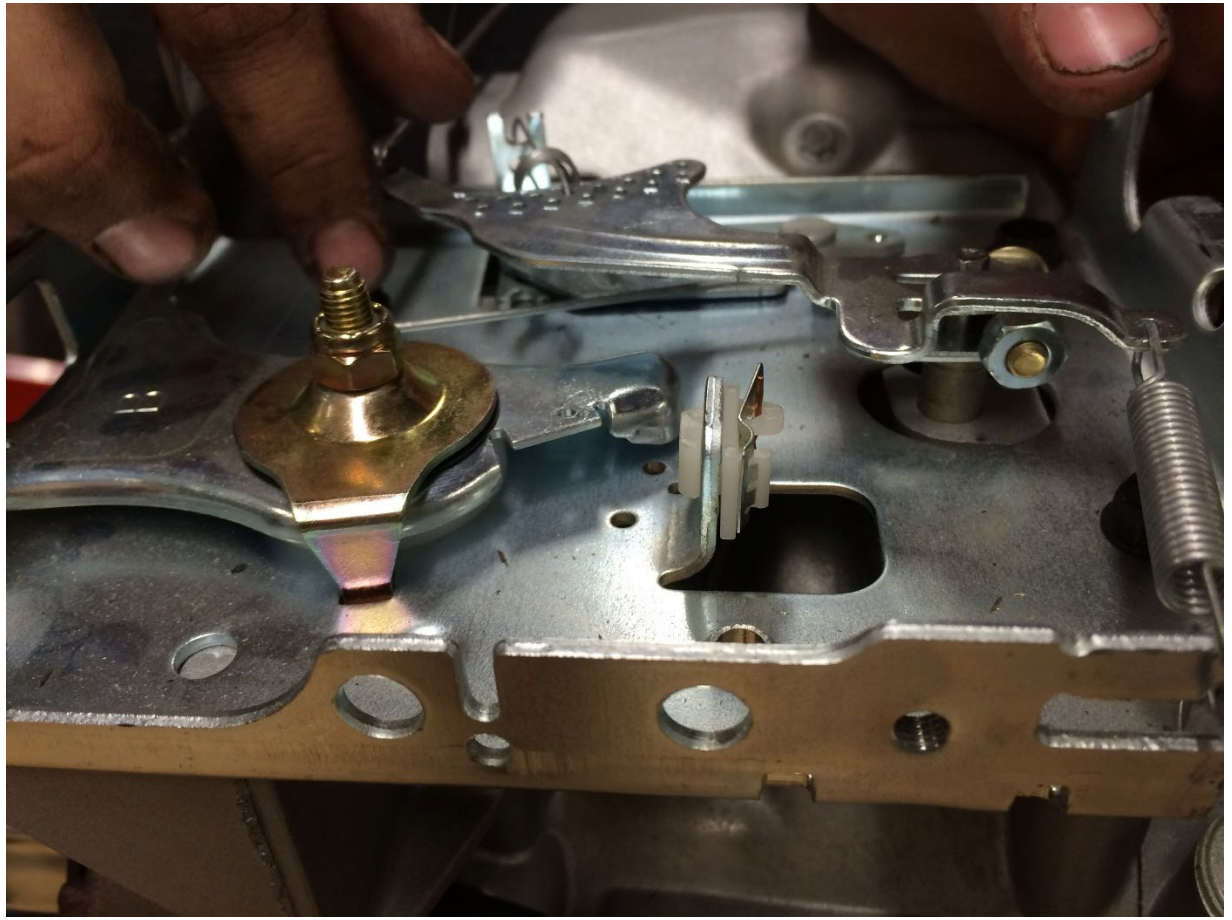
Step 18: Install heat shield.



Step 19: Replace linkage plate.

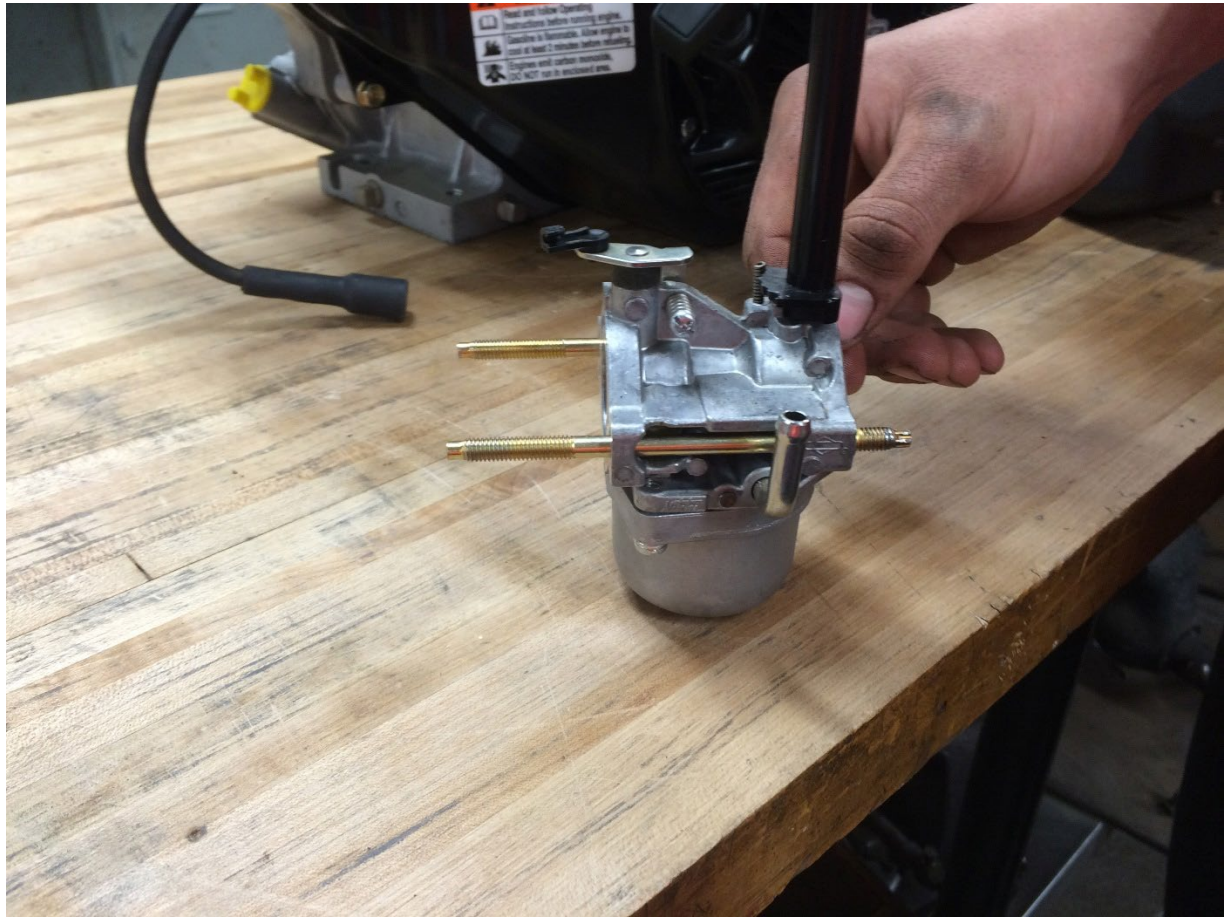


Install the kill switch correctly.

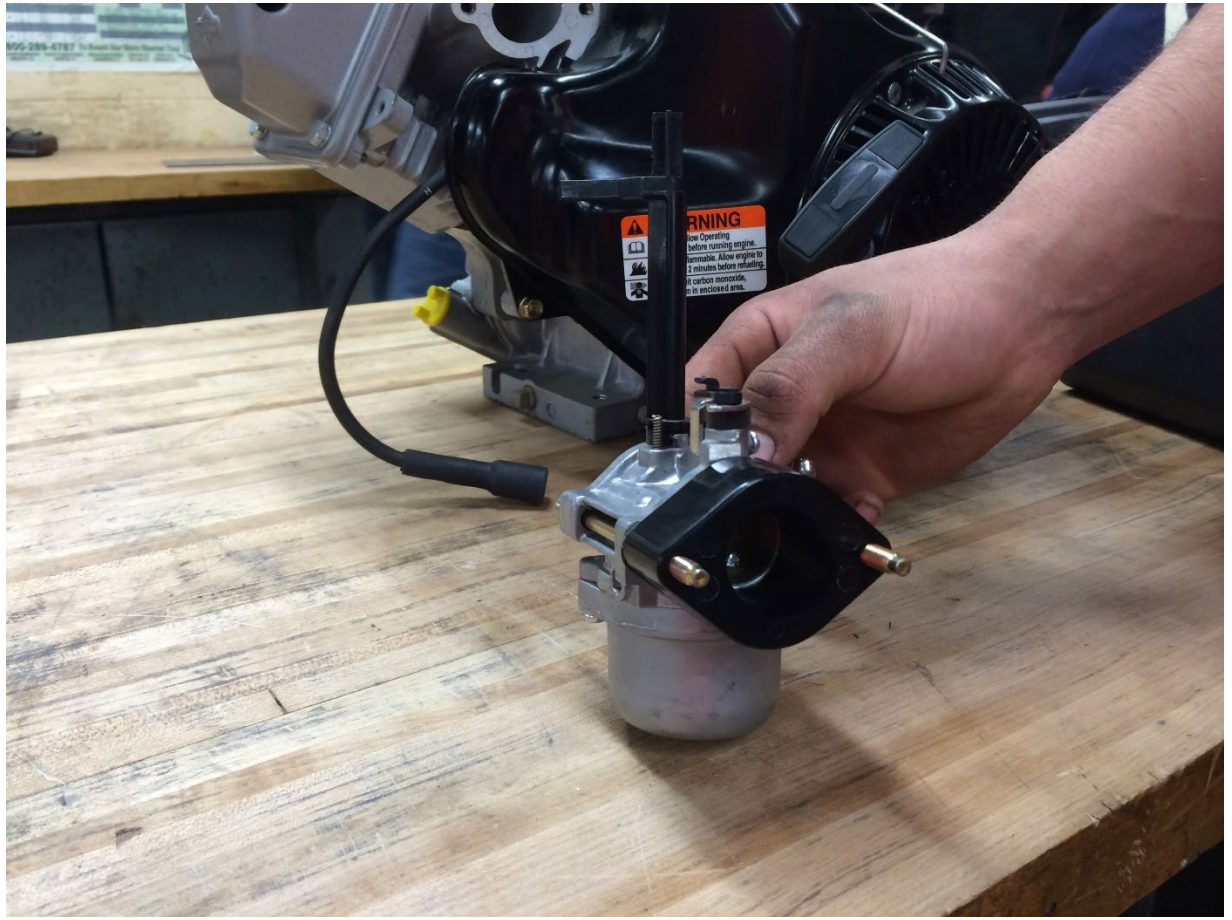


Carburetor components.

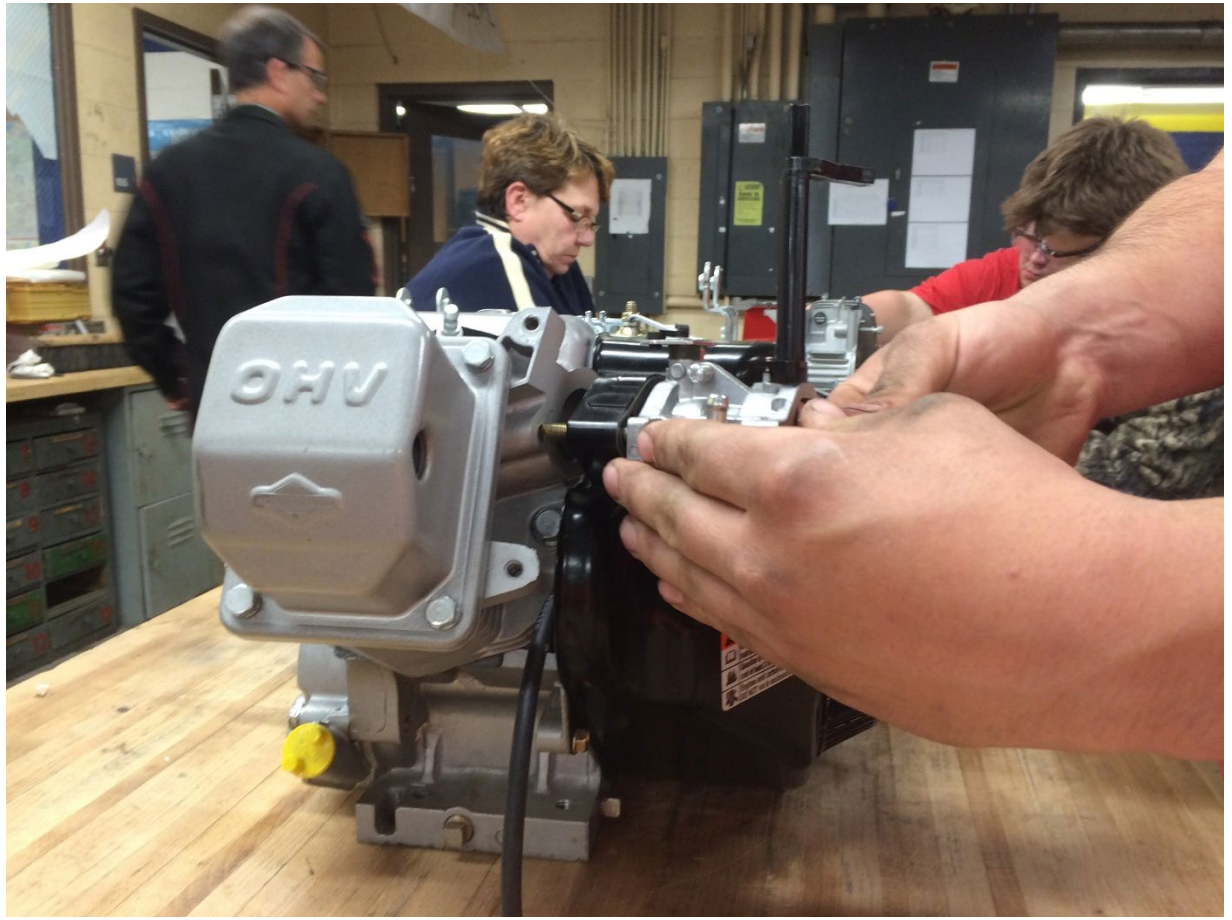
Step 20: Install the carburetor



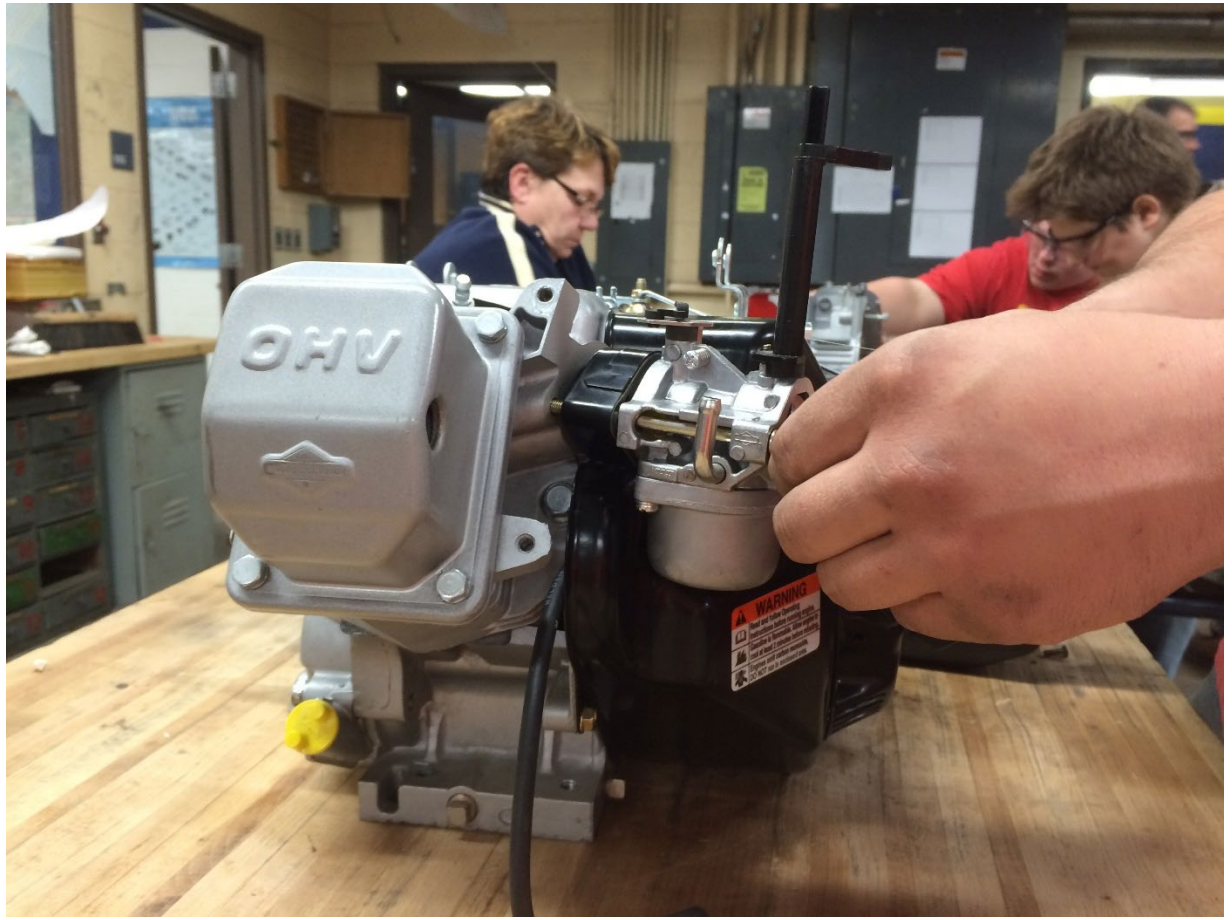
Step 20: Install the carburetor with spacer.



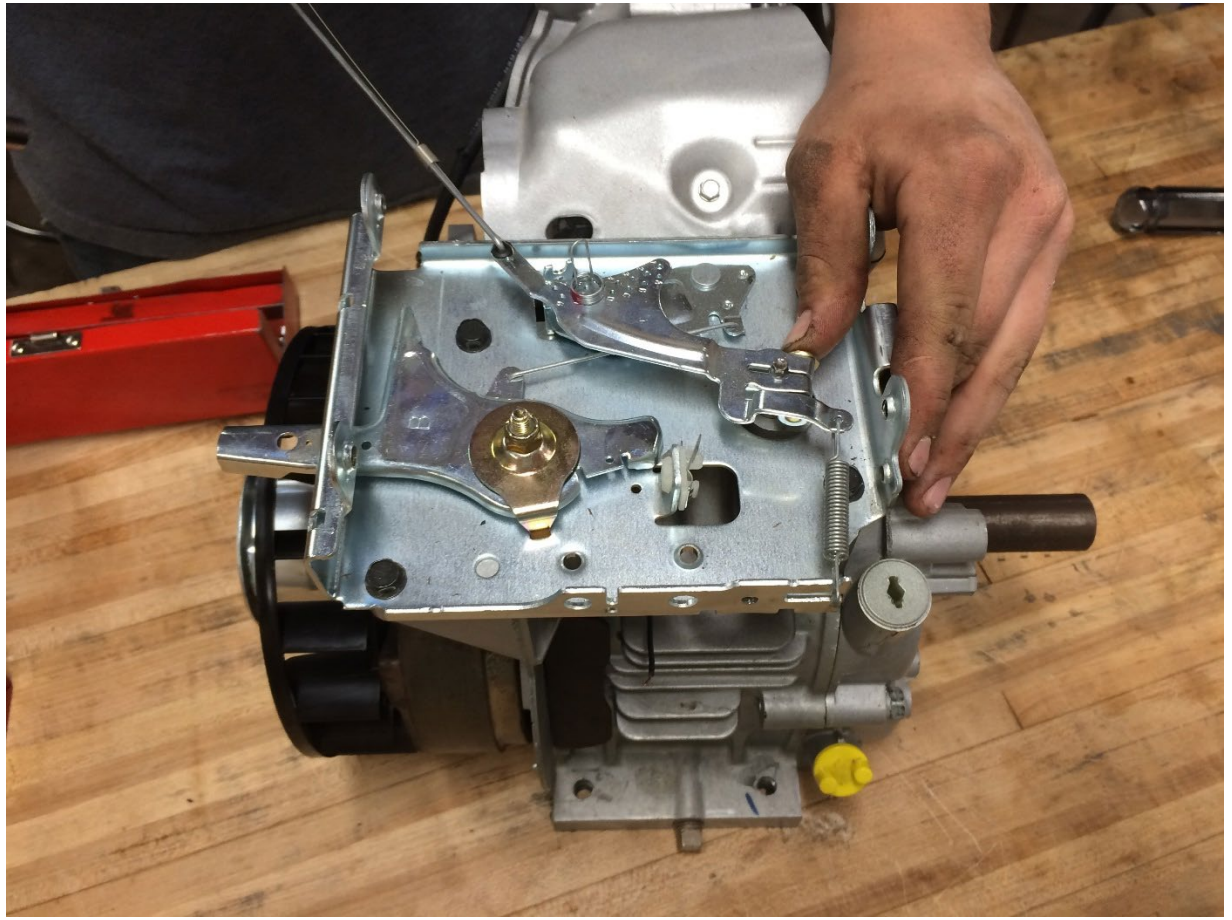
Step 20: Carburetor installation.



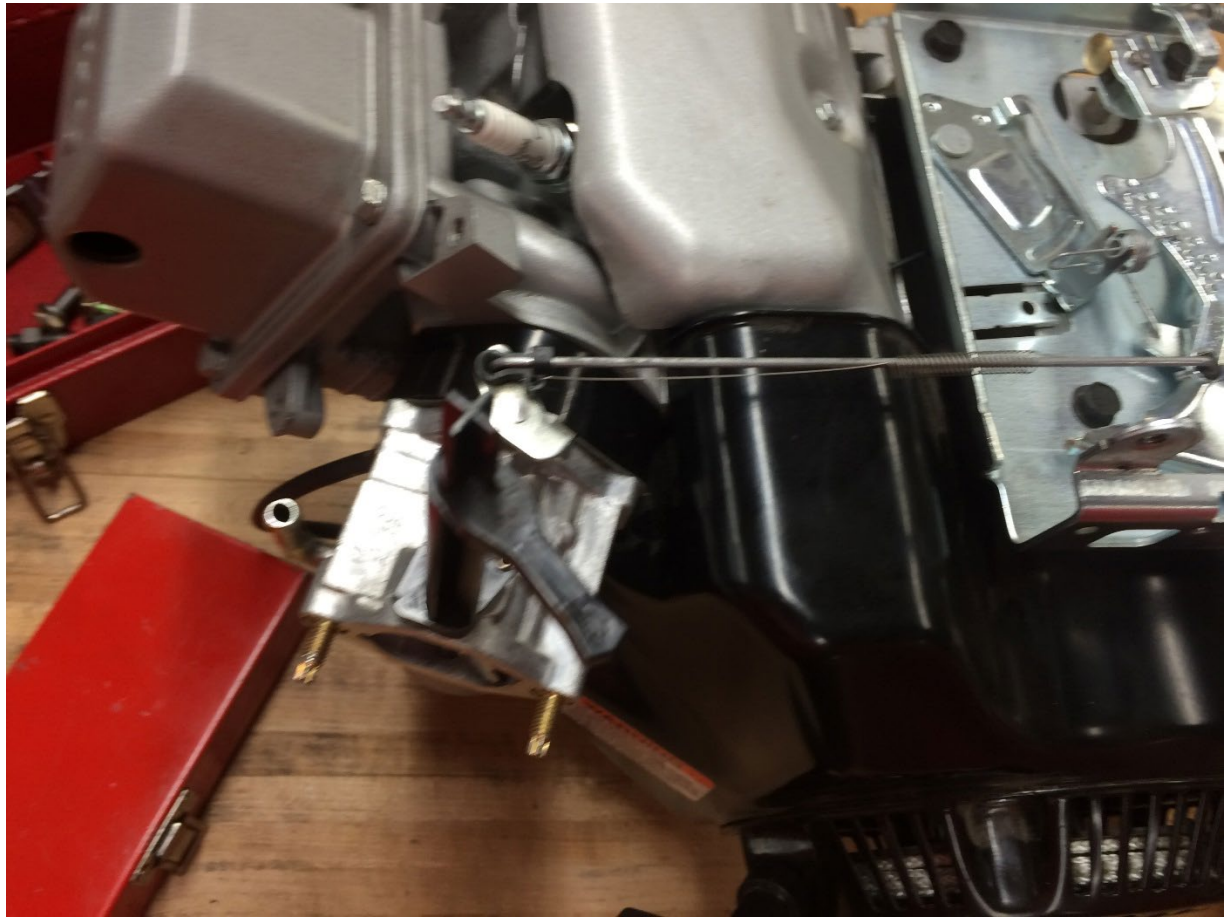
Step 20: Installing the carburetor.



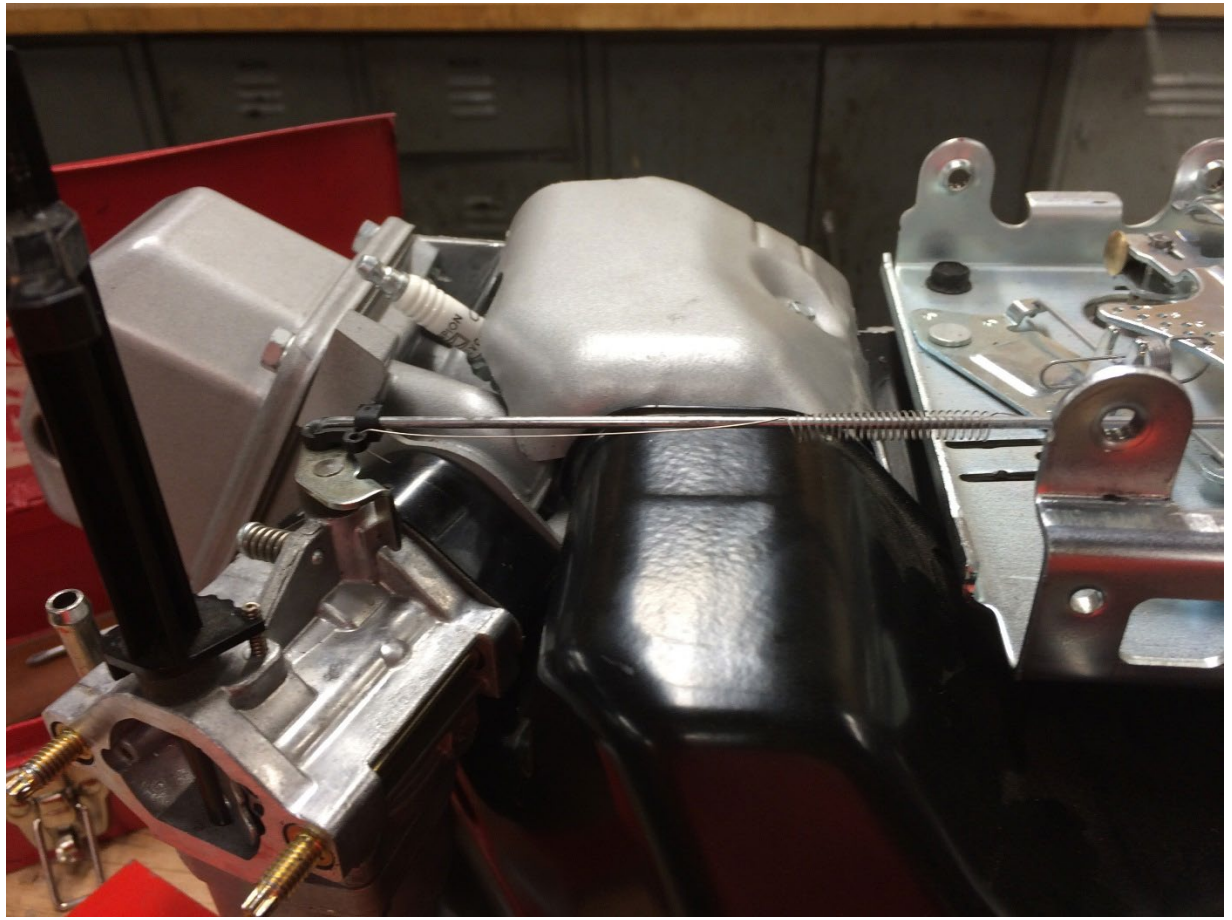
Attach governor spring and throttle to the carburetor.



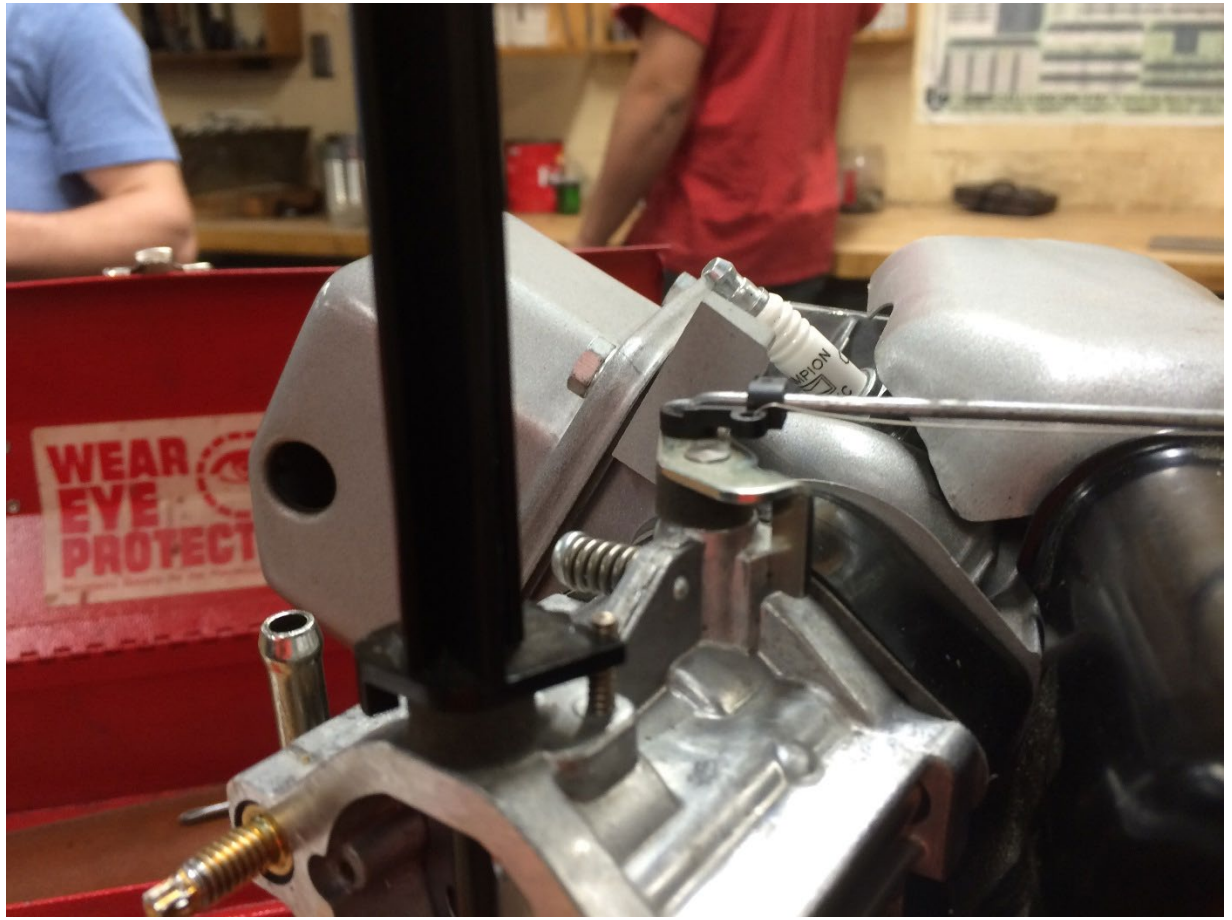
Attach governor spring and throttle to the carburetor.



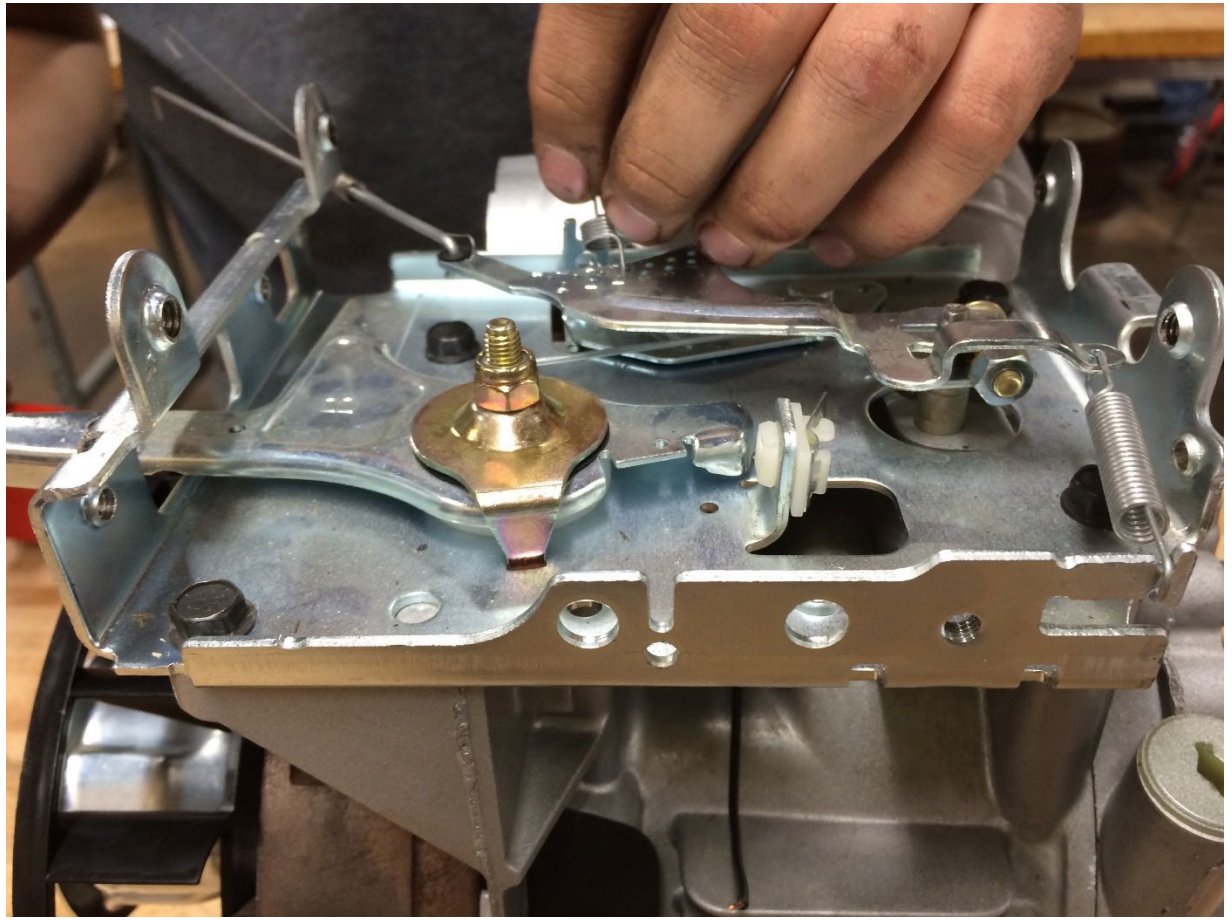
Attach governor spring and throttle to the carburetor.



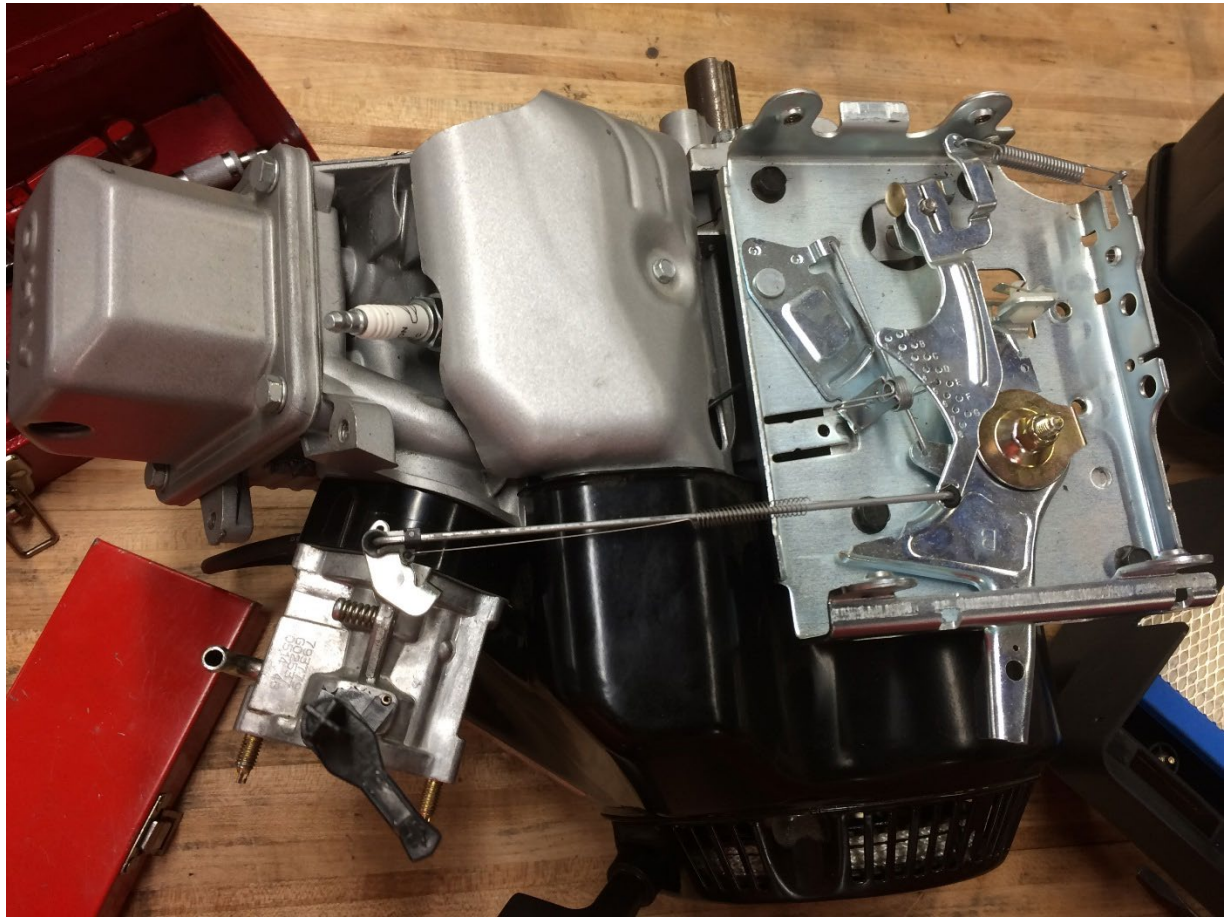
Attach governor spring and throttle to the carburetor.



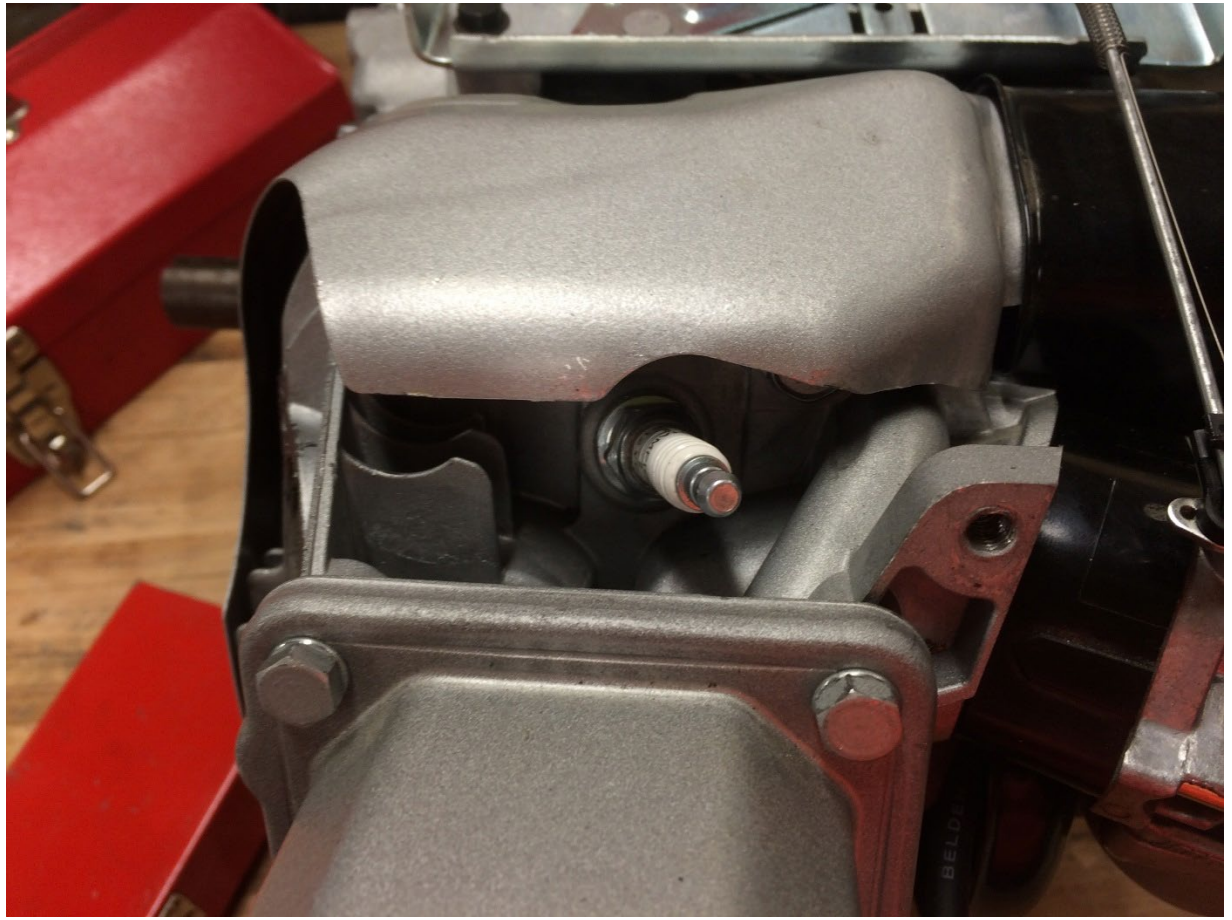
Step 21: Be sure to install the governor spring and linkage correctly and reset the governor. “Stattic governor setting” Refer to your pictures.



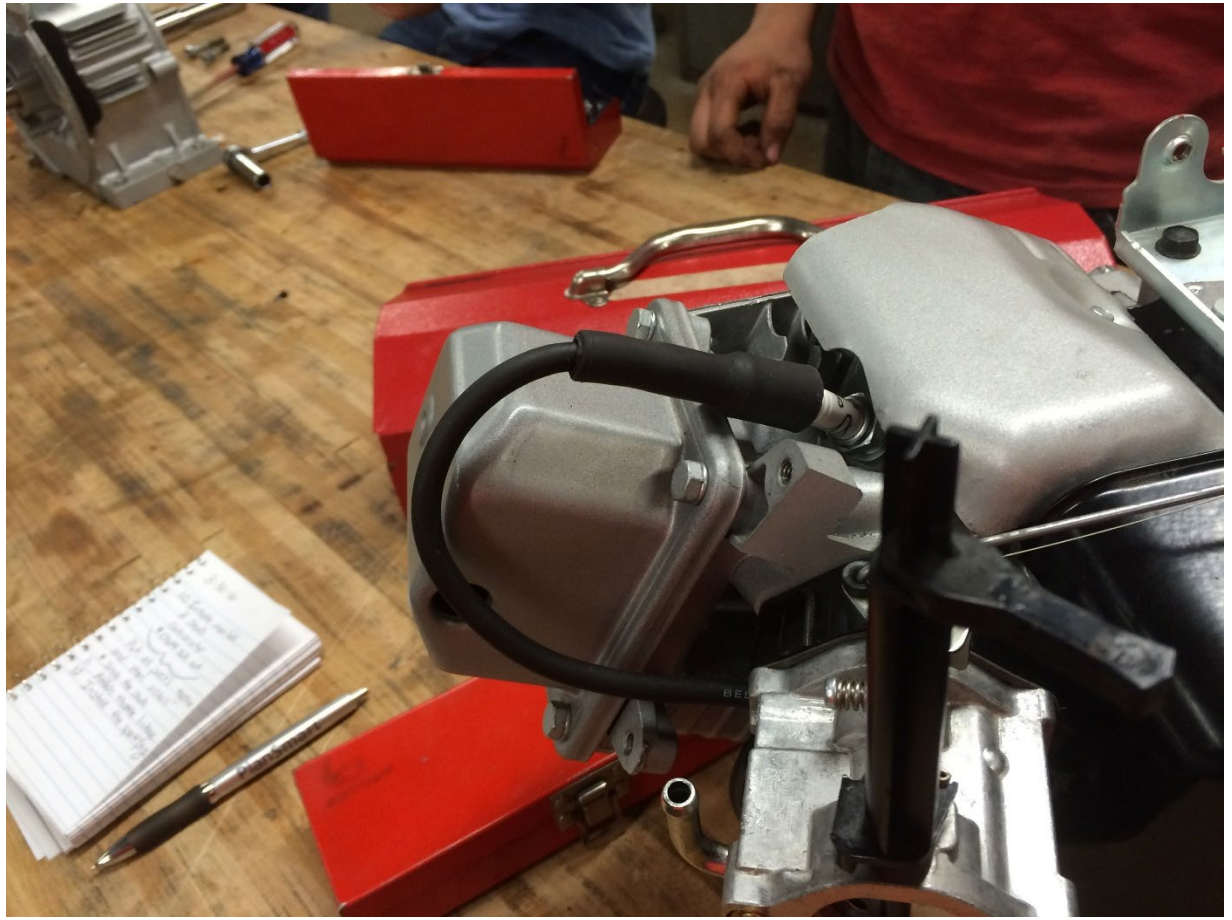
Throttle is hooked up



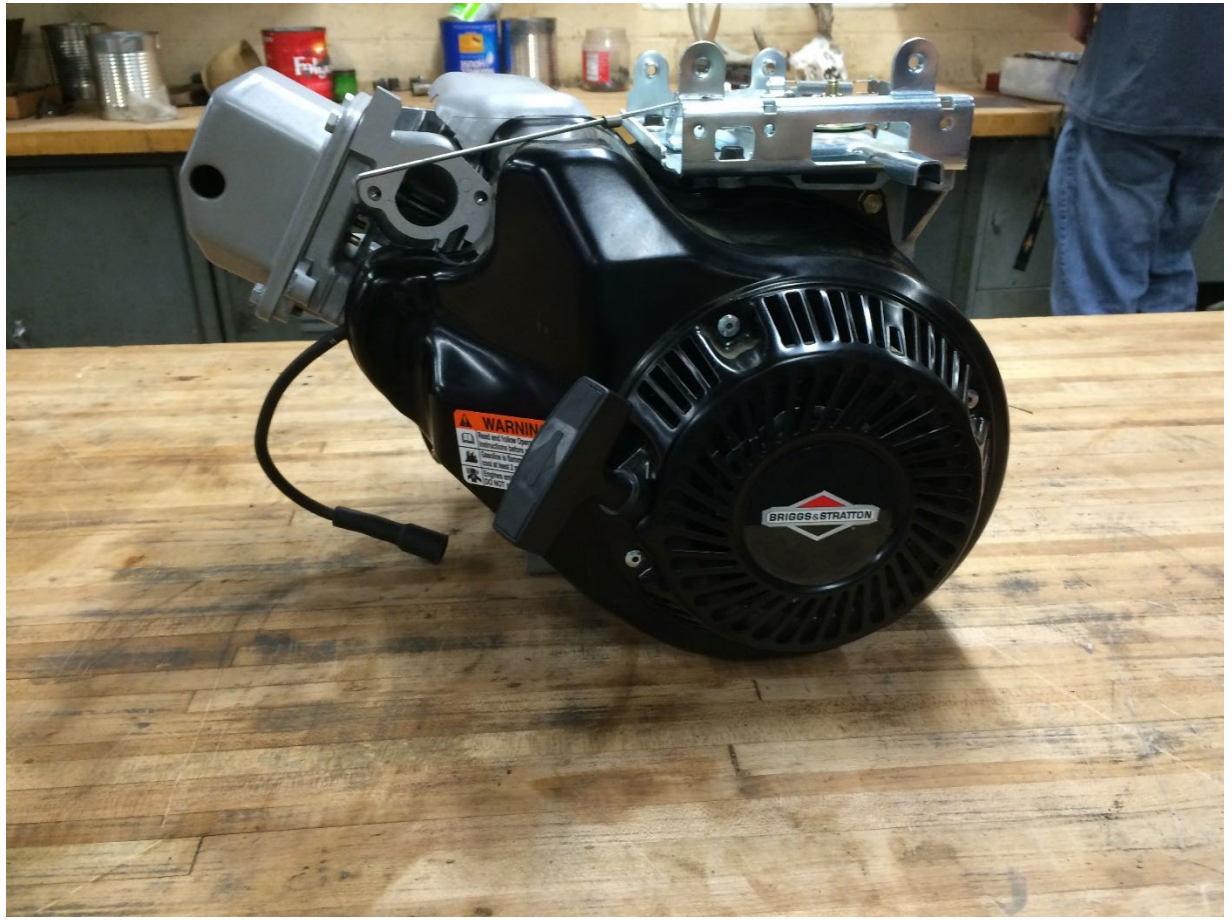
Step 21: Install the spark plug. Use your fingers to install the spark plug at first to prevent damaging the threads.



Attach the spark plug wire to the spark plug.

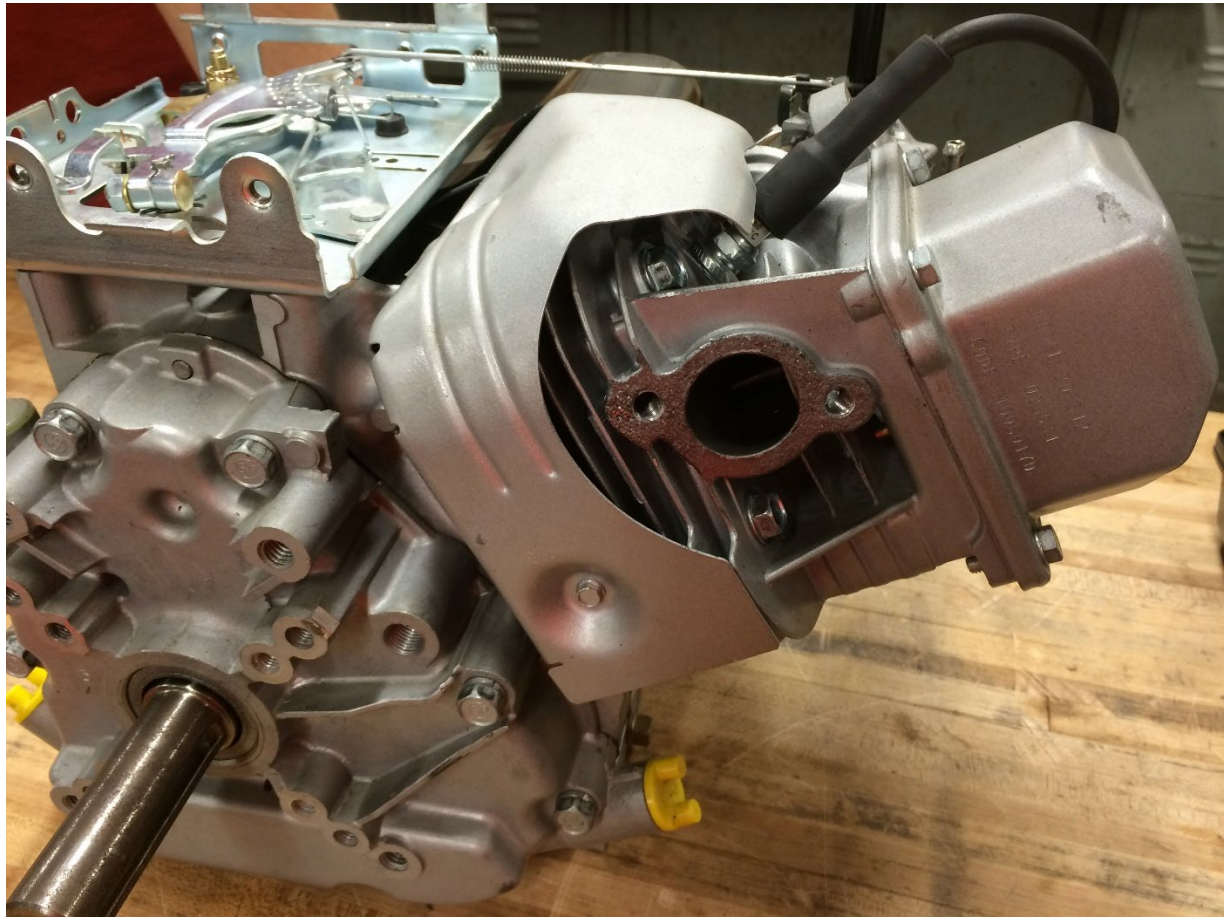


Step 23: Install the blower housing.

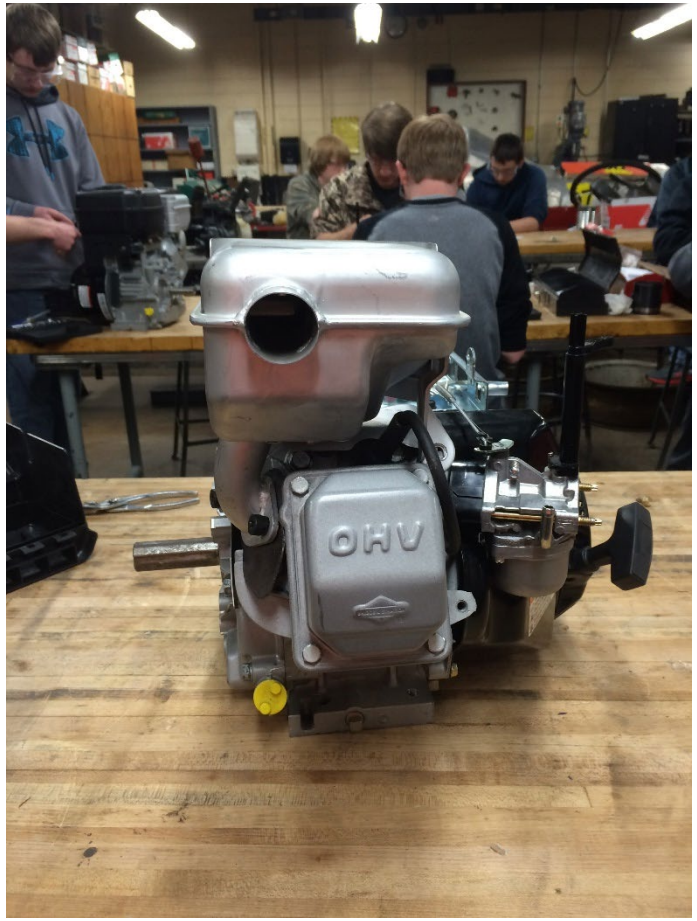


Step 24: Install the muffler.

Exhaust manifold.



The muffler is installed correctly.



Step 25: Install the fuel tank.

Throttle and fuel valve cover plate.

Step 26: Correctly installed throttle and fuel valve cover plate.

Air filter cover

Step 27: Install the air filter mounting plate.

Air filter

Breather tube connected to the valve cover.

Steps 28 & 29: Have your instructor check your engine before adding oil and fuel to the engine.

Step 30: Start and run your engine following the correct starting procedure.

A. Check the ignition spark with the spark tester from the tool cabinet.

1. Does the engine have spark? _____
2. Does the kill switch work properly? _____

A. Mount the engine on the starting table.

A. Add gas and oil to the engine

A. Attach Tiny Tach to the spark plug wire.

A. Obtain instructor permission to start the engine.

A. Start the engine.

1. Record idle RPM _____
2. Record high speed RPM _____

A. Allow the engine to cool and drain gas and oil into the appropriate containers.

Step 31: Remove the fuel and oil from the engine. Check with your instructor before putting your engine away.

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Train-the-Trainer Workshops

Small Engine Tool Kit

Small Gas Engines

Parts Ordering Lab Quiz

Directions: Find the reference #, part #, description and price for each of the following small engine parts. Use the model number for your engine in the shop.

Next go to http://www.choochooparts.com/. This is where you can look up prices. Left side of the screen is a search by **part number**. Use this to determine prices for your selected parts. Select six parts from below.

1. Spark Plug
2. Flywheel key
3. Carburetor
4. Head Gasket
5. Piston ring set
6. Crankcase gasket

Small Engine Parts Order Form

Nameplate Information:

Engine Manufacture	Briggs & Stratton
Model Number	205312-0100-B1

Reference #	Part #	Part Name	Quantity	Cost
			Sub Total	
			Sales Tax 6.875%	

			Total	

Train-the-Trainer Workshops

Small Engine Tool Kit

Resources:
Briggs and Stratton vocational education and training for educators **great resources**
https://www.briggsandstratton.com/na/en_us/support/vocational-education.html

Power portal is an excellent resource. Follow the steps for registering on the Briggs and Stratton website listed above.

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Small Engine Tool Kit

Small Engine Safety Exam

Servicing and overhauling small engines require a safety sense for your health, the engine tools, and environment. After an accident occurs the comment is made, "If he or she would only have used common sense".

List safe or unsafe in the blank provided for the statements below related to the safe operation or maintenance of the small engine.

1. ___ To store gasoline in approved containers, properly marked for gasoline and stored in a safety storage cabinet.

2. ___ To remove gasoline from the gas tank and carburetor before working on an engine.

3. ___ To refill a gasoline tank with the engine running.

4. ___ To work in a well-ventilated area.

5. ___ To use an approved solvent for cleaning engine parts.

6. ___ To remove and ground the spark plug wire before servicing or repairing an engine.

7. ___ To have carbon dioxide and dry chemical fire extinguishers available.

8. ___ To follow good safety practices and work habits.

9. ___ To read and follow your operators and /or service manual.

10. ___ To clean the engine before it is disassembled.

11. ___ To use gasoline for cleaning parts.

12. ___ To work on a hot engine.

13. ___ To store grease loaded rags and wiping rags in an airtight container.

14. ___ To clean wrenches and tools before storing.

15. ___ To secure the engine in a mount and install a momentum flywheel on a vertical shaft engine before starting.

16. ___ To operate the engine with the governor disconnected.

17. ___ To test run the engine without the shroud which covers the flywheel.

18. ___ To remove all fuel from the engine before placing it in storage.

19. ___ To operate an engine which has gasoline dripping from a connection in the fuel system.

20. ___ To operate an engine with the muffler removed.

21. ___ To assemble the engine using all bolts and cap screws of the proper grade as specified.

22. ___ To use “ether type” starting fluids with a small engine.

23. ___ To use an oxyacetylene torch to repair leaks in the gasoline tank.

24. ___ To operate a vertical shaft lawn mower with a broken, cracked or bent blade.

25. ___ To wear safety glasses at all times when working in the shop.

26. ___ To use the proper tool for the specific job.

27. ___ To operate equipment before the instructor demonstrates the proper use.

28. ___ To clean up all oil and gasoline spills immediately.

29. ___ To operate a small engine without proper ventilation.

30. ___ To check fuel lines and fittings for cracks or leaks.

I have read the above safety practices. I have successfully demonstrated the safe operation of the small engine equipment with my instructor's supervision. I promise to conduct myself in such a fashion that I will not create hazards that may cause injury to others or me while working in the shop area. Students violating safety rules may be removed from the class.

Printed Name: _____

Signed: _____

Instructor: _____

Date: _____

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Small Engine Tool Kit

Tool Box Use Agreement

Small Gas Engines

Throughout the course of this class you will need to have a set of tools in order to work on your lab projects.

Instructor Responsibilities:

- Provide each student/group with access to tools necessary to work on a given engine
- Provide training on how to use each tool properly
- Allow each student/group means of locking up their assigned tool box between class periods

Student/Group Responsibilities

- Inspect and inventory toolbox upon receiving toolbox from instructor
- Inventory toolbox once a week
- Use tools responsibly and clean tools at the end of each period
- Inform instructor of any broken tools
- Replace tools if broken due to improper use
- No intermingling of tools between toolboxes
- Keep tools organized
- Do not steal other group's tools

Upon signing this agreement, all parties agree upon the conditions/responsibilities as stated. At the end of the term, if all conditions are met, students will earn 10% of their course grade.

Locker Number: _____ Tool Box Number: _____Metric or SAE_____

Student/Group Signature: _____ _Date: _____ _____

Student/Group Signature: _____ _Date: _____ _____

Student/Group Signature: _____ _Date: _____ _____

Instructor Signature: _____Date: _____ _____

Small Gas Engines Tool Inventory Lab

Complete an inventory of the tools found in the locker. Place a check after the tool name if present.

Print Names: _____

Date: _____ Locker number: _____

TOOL LIST:

Pliers _____

Needle nose pliers _____

Flat feeler gauge _____

Standard screwdriver _____

Phillips screwdriver _____

¼ Socket set _____

10 mm socket _____

Micrometer _____

Vernier caliper _____

Knock off tool _____

Briggs & Stratton Service Manual _____

Advanced Product Service Manual _____

Illustrated Parts Service Manual _____

Briggs & Stratton engine _____

(Include the Model #) _____

Comments:

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Small Engine Tool Kit

Name: _____ Date: _____ Total Points: _____

Small Engines Lab Work Journal

(3pts daily)

Date	Work Performed

Comments: