Name:
Group Members:
Engine Manufacturer:
Engine Displacement: **/56 POINTS**
Block:

The Engine
Unit Lab Part 2

This is the second part of *The Engine* unit. **Part 1** must be completed prior to this practical lab assignment. Using the knowledge you have learned from **part 1**, you will perform a full engine teardown. This includes removing the head, camshafts, valves, pistons, gaskets, and crankshaft. In order to successfully complete this lab, you must have Mr. Kang sign off

When removing any component pay attention of its correct location and the hardware used. Take a photo of each component being removed to correctly remember the location. BE ORGANIZED.

If you are in doubt about any step please see the teacher before proceeding.

Have your teacher initial each of the items on the checklist as you complete them.
Each student in the group must perform each of the items on the list before the next item is begun.

PROCEDURE

1. Locate the correct repair manual and photocopy the section that relates to the engine cylinder head removal. Always follow the recommended procedures from the shop manual.

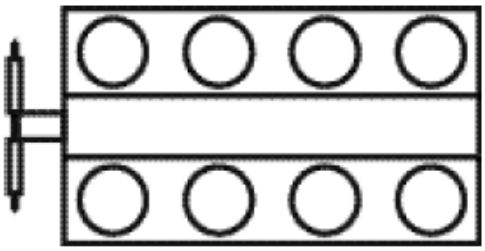
2. Remove the valve cover(s), intake and exhaust manifold(s).

3. Remove the spark plugs so the crankshaft can be turned easily.

Why will the engine turn easily with the spark plugs removed? (1 mark)

_____
_____

4. List the cylinder order below. Draw the cylinder numbers in the appropriate locations. (2 marks)



This engine has _____cylinders. (1 mark)

5. Remove the rocker arm(s) or rocker shafts and push rods from cylinder head as needed. Keep them order by using a piece of cardboard and felt pen. Why is this necessary? (1 mark)

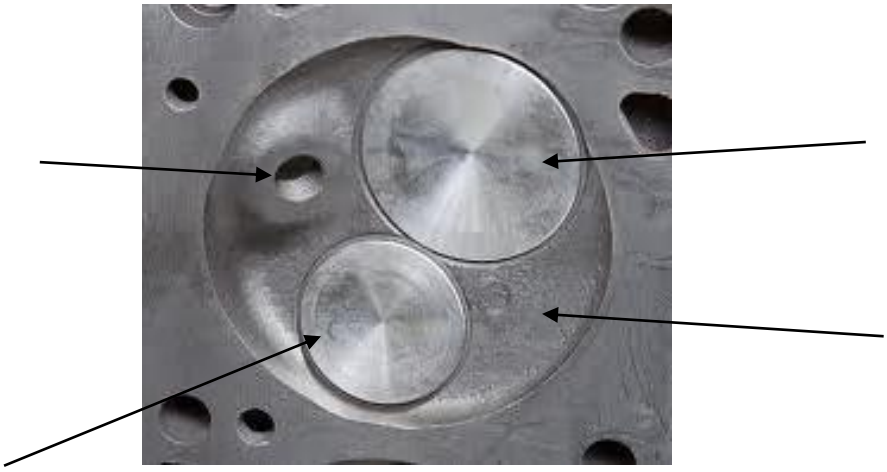
_____

_____

6. Remove the cylinder head bolts. Be certain that all the bolts have been loosened. Remove the cylinder head. DO NOT use a hammer or pry bar to remove the cylinder head. See the teacher if the cylinder head does not come off easily. When loosening the bolts, use the reverse order of the tightening sequence listed in the service manual.

What type of valvetrain configuration is used in this engine? _OHV _SOHC _DOHC (1 mark)

7. Label the diagram; include the combustion chamber, the spark plug, and intake/exhaust valves. (4 marks)



Which valve is the exhaust valve? Large Valve _____ Small Valve ____ (1 mark)

Which valve is the intake valve? Large Valve _____ Small Valve ____ (1 mark)

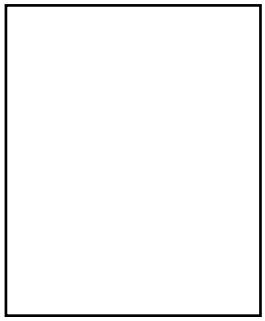
8. Look at the top of the pistons; do you notice any type of markings? YES / NO (1 mark)

If so what are these markings used for?
_____ (1 mark)

9. Remove the valve lifters; label them with a felt marker to keep them in order for reassembly. Are they flat tappets or rollers? Flat tappets _____ Rollers _____ (1 mark)

10. Remove the timing cover.

11. Draw and label a sketch of how the crankshaft and camshaft are timed below: (4 marks)



12. Remove the cam and crankshaft drive sprocket assembly (but not the cam).

This engine uses: (check one) ____chain and sprockets ___gears ____belt (1 mark)

13. Count the teeth on the crankshaft and camshaft gears. (2 marks)

Number of teeth on the cam gear ____ Number of teeth on the crank gear ____

14. How many times does the camshaft turn to complete a cycle in a 4 stroke engine?
_____ (2 marks)

Measure the bore and stroke of one cylinder using the appropriate tools. See teacher. (4 marks)

Your Measurement: Bore: _____ Stroke: _____

Manufacturer's Specifications: Bore: _____ Stroke: _____

Use your measurements to find engine displacement. Compare to your displacement to the manufacturer's displacement. (Show all work) (4 marks)
Formula: .7854 x Bore x Bore x Stroke x Number of Cylinders

_____
_____

Manufacturer's Displacement: _____

REMOVE ENGINE OIL PAN

15. Turn the engine over and remove the oil pan.

16. What main engine component is located under the oil pan? (1 mark)

_____

17. Check the connecting rods and caps for proper labeling. Are they marked? YES / NO (1 mark)

Mark if required. See the teacher.

Why does the connecting rod and cap have to be marked?
_____ (1 mark)

18. Remove ONE rod cap. Be careful not to let the rod bolts damage the crank journal. Install rod bolt protectors on the rod bolts.

19. Carefully push the piston rod assembly out the top of the bore.

Note: Be careful that the piston and rod assembly does not slip out of the cylinder and fall on the floor. Immediately re-install rod cap on rod in the proper direction.

Remove remaining piston assemblies following the above procedure.

20. Label the main journal and a rod journal in the picture below. (4 marks)

21. Install a piston and rod assembly correctly in a vise.

How many rings are on the piston? _____ (1 mark)

How many compression rings are on the piston? _____ (1 mark)

Label the compression and oil piston rings and wrist pin in proper order. (4 marks)

Reassembly of Engine

Install the crankshaft. Install main bearing caps except for one.

1. Check the repair manual for the bearing oil clearance specification. (2 marks)

2. Install Plastigage between ONE of the main bearings and the crankshaft journal.

3. Torque main bearing caps to specification using a click type torque wrench.

Specification: _____ ft. /lb. (1 mark)

4. Remove the main cap and observe the Plastigage which refers to the bearing clearance.

Main Bearing oil clearance: 0._____" (1 mark)

What happens to the Plastigage when the bearing clearances increase?
_____(1 mark)

5. Use some oil to remove the Plastigage and reinstall the main cap(s). Torque to specification.

6. Use a ring compressor and a piston hammer to install one piston and rod assembly. Start with piston number 1. Make sure the piston is facing the correct direction.

7. Lubricate the bearing inserts and install each piston assembly one at a time.

8. Install the rod cap and torque its connecting rod bolts before proceeding to the next one. Do not remove the rod bolt protectors until the cap is to be installed.

9. Torque the connecting rod to specifications.

Rod bolt torque specification: _____ ft. /lb. (1 mark)

10. Turn the crankshaft one complete turn after installing EACH rod cap. It should not bind. See your instructor to verify correct turning effort.

11. Install the camshaft, timing chain, and lifters. MAKE SURE YOU TIME THE CAM AND CRANK.

What would happen if you do not time the crankshaft and camshaft? (2 marks)

_____

12. Install the cylinder heads and torque in the proper sequence. What is the torque? _____ft/lbs (1 mark)

Draw a sketch of the cylinder head tightening sequence below: (2 marks)

13. Re-assemble the rest of the engine.

14. The engine has to be able to turn. Does it turn? YES / NO