

Run In Procedure without Dynamometer

1. Run the engine on a test stand with no load for approximately 15 minutes in both low speed (1400 rpm) and high speed (2400 rpm). Check the engine for abnormal noises, coolant, fuel, or oil leaks.

CAUTION: *DO NOT run a newly rebuilt engine without a load for a long period of time. This can cause the engine's oil consumption to be higher than normal.*

2. Mount the engine in a unit and run the unit on high speed heat for 2 hours. Occasionally place the unit in low speed heat to vary the compression pressures and engine temperatures.
3. Mount the unit on a truck and run the unit in high speed heat with truck doors open for 2 to 10 hours.

Valve Clearance Adjustment

The valve clearance should be checked after every 2000 operating hours, maximum. It is important that valves be adjusted to the correct specifications for satisfactory engine operation. Insufficient valve clearance will result in compression loss and misfiring of cylinders resulting in burned valves and seats. Excessive valve clearance will result in noisy valve operation and abnormal wear of the valves and rocker arms. The intake and exhaust valves are adjusted with the valve in the closed position.

Two Cylinder Procedure

NOTE: *The cylinders these engines are numbered from the flywheel end to the water pump end. The number 1 cylinder is next to the flywheel. The number 2 cylinder is next to the water pump. The timing marks on the flywheel are also numbered this way.*

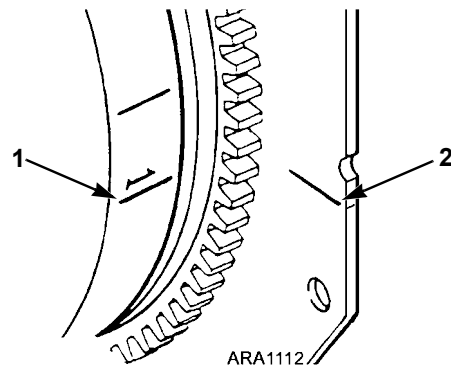
The timing marks on the flywheel of the two cylinder engines are stamped 180 degrees apart. The top dead center marks have the cylinder number stamped next to them. The injection timing marks have no identification marks (see Figure 208).

The index timing mark is stamped on the side of the starter mounting plate that faces the flywheel. This index timing mark is on the intake side of the engine.

1. Remove the cylinder head cover.

CAUTION: *Loosen all of the injection lines at the injection nozzles to prevent the possibility of the engine firing while it is being rotated.*

2. Place the engine at top dead center of the compression stroke for the number 1 cylinder.
 - a. Rotate the engine in the normal direction of rotation (counterclockwise viewed from the flywheel end) until the top dead center timing mark for the number 1 cylinder on the flywheel lines up with the index timing mark on the starter mounting plate.



1.	Top Dead Center Mark for Number 1 Cylinder
2.	Index Timing Mark on Starter Mounting Plate

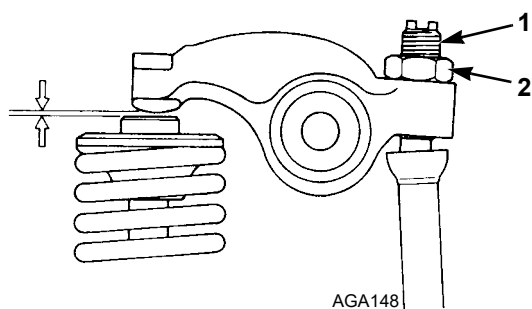
Figure 208: Timing Marks

- b. Check the rocker arms on the number 1 cylinder to see if they are loose.
- c. If the rocker arms are loose, the engine is at top dead center of the compression stroke for the number 1 cylinder.
- d. If the rocker arms are tight, the engine is at top dead center of the exhaust stroke for the number 1 cylinder. Rotate the engine 360 degrees to place the engine at top dead center of the compression stroke for the number 1 cylinder.

- Use a feeler gauge to check the valve clearance on both valves for the number 1 cylinder. The valve clearance for both the intake valves and the exhaust valves should be 0.006 to 0.010 in. (0.15 to 0.25 mm).

NOTE: Check to make sure that the valve stem cap is in good condition and is positioned squarely on the top of the valve stem. Replace the valve stem cap if it shows significant wear.

- Adjust the valves if necessary by loosening the lock nut and turning the adjustment screw until the valve clearance is correct.



1.	Adjustment Screw
2.	Lock Nut

Figure 209: Valve Clearance

- Hold the adjustment screw in place and tighten the lock nut.

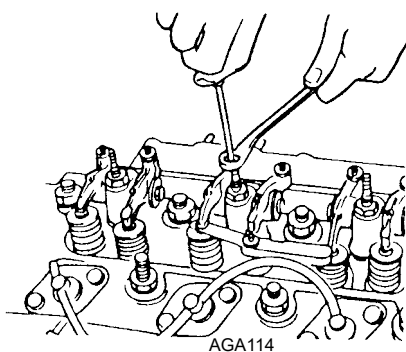


Figure 210: Adjusting Valves

- Recheck the valve clearance.

- Place the engine at top dead center of the compression stroke for the number 2 cylinder.
 - Rotate the engine in the normal direction of rotation (counterclockwise viewed from the flywheel end) until the top dead center timing mark for the number 2 cylinder on the flywheel lines up with the index timing mark on the starter mounting plate.
 - Check the rocker arms on the number 2 cylinder to see if they are loose.
 - If the rocker arms are loose, the engine is at top dead center of the compression stroke for the number 2 cylinder.
 - If the rocker arms are tight, the engine is at top dead center of the exhaust stroke for the number 2 cylinder. Rotate the engine 360 degrees to place the engine at top dead center of the compression stroke for the number 2 cylinder.
- Check and adjust both valves for the number 2 cylinder.
- Replace the cylinder head cover.

Three Cylinder Procedure

NOTE: The cylinders on these engines are numbered from the flywheel end to the water pump end. The number 1 cylinder is next to the flywheel. The number 2 cylinder is in the middle and the number 3 cylinder is next to the water pump. The timing marks on the flywheel are also numbered this way.

The timing marks on the flywheel of the three cylinder engines are stamped 120 degrees apart. The top dead center marks have the cylinder number stamped next to them. The injection timing marks have no identification marks (see Figure 212).

The index timing mark is stamped on the side of the starter mounting plate that faces the flywheel. This index timing mark is on the intake side of the engine.

On the three cylinder engines the order for the flywheel timing marks is 1, 2, 3, but the firing order is 1, 3, 2. The reason for this is that the engine fires every 240 degrees of crankshaft rotation. Therefore, when adjusting the valves, check the number 1 cylinder first. Then rotate the engine past the number 2 cylinder timing marks to the number 3 cylinder timing marks and check the number 3 cylinder. Finally, rotate the engine past the number 1 cylinder timing marks to the number 2 cylinder timing marks and check the number 2 cylinder.

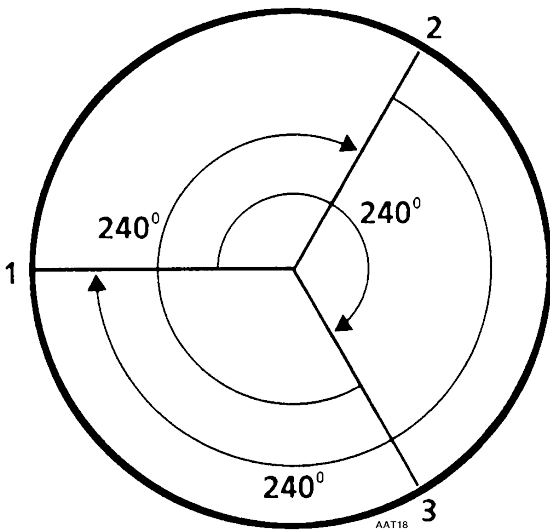
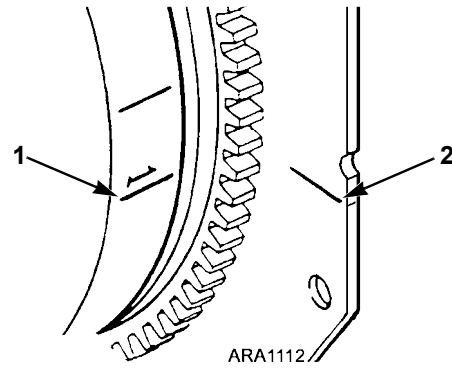


Figure 211: Valve Adjustment and Firing Order

1. Remove the cylinder head cover.

CAUTION: Loosen all of the injection lines at the injection nozzles to prevent the possibility of the engine firing while it is being rotated.

2. Place the engine at top dead center of the compression stroke for the number 1 cylinder.
 - a. Rotate the engine in the normal direction of rotation (counterclockwise viewed from the flywheel end) until the top dead center timing mark for the number 1 cylinder on the flywheel lines up with the index timing mark on the starter mounting plate.



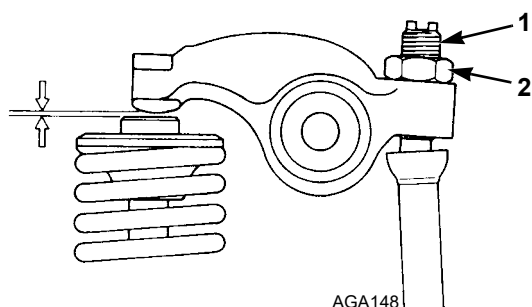
1.	Top Dead Center Timing Mark for Number 1 Cylinder
2.	Index Timing Mark on Starter Mounting Plate

Figure 212: Timing Marks

- b. Check the rocker arms on the number 1 cylinder to see if they are loose.
 - c. If the rocker arms are loose, the engine is at top dead center of the compression stroke for the number 1 cylinder.
 - d. If the rocker arms are tight, the engine is at top dead center of the exhaust stroke for the number 1 cylinder. Rotate the engine 360 degrees to place the engine at top dead center of the compression stroke for the number 1 cylinder.
3. Use a feeler gauge to check the valve clearance on both valves for the number 1 cylinder. The valve clearance for both the intake valves and the exhaust valves should be 0.006 to 0.010 in. (0.15 to 0.25 mm).

NOTE: Check to make sure that the valve stem cap is in good condition and is positioned squarely on the top of the valve stem. Replace the valve stem cap if it shows significant wear.

4. Adjust the valves if necessary by loosening the lock nut and turning the adjustment screw until the valve clearance is correct.



1.	Adjustment Screw
2.	Lock Nut

Figure 213: Valve Clearance

5. Hold the adjustment screw in place and tighten the lock nut.

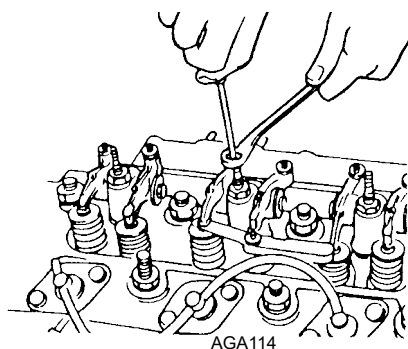


Figure 214: Adjusting Valves

6. Recheck the valve clearance.
7. Place the engine at top dead center of the compression stroke for the number 3 cylinder.
 - a. Rotate the engine in the normal direction of rotation (counterclockwise viewed from the flywheel end) until the top dead center timing mark for the number 3 cylinder on the flywheel lines up with the index timing mark on the starter mounting plate.
 - b. Check the rocker arms on the number 3 cylinder to see if they are loose.
 - c. If the rocker arms are loose, the engine is at top dead center of the compression stroke for the number 3 cylinder.
8. Check and adjust both valves for the number 3 cylinder.
9. Place the engine at top dead center of the compression stroke for the number 2 cylinder.
 - a. Rotate the engine in the normal direction of rotation (counterclockwise viewed from the flywheel end) until the top dead center timing mark for the number 2 cylinder on the flywheel lines up with the index timing mark on the starter mounting plate.
 - b. Check the rocker arms on the number 2 cylinder to see if they are loose.
 - c. If the rocker arms are loose, the engine is at top dead center of the compression stroke for the number 2 cylinder.
 - d. If the rocker arms are tight, the engine is at top dead center of the exhaust stroke for the number 2 cylinder. Rotate the engine 360 degrees to place the engine at top dead center of the compression stroke for the number 2 cylinder.
10. Check and adjust both valves for the number 2 cylinder.
11. Replace the cylinder head cover.