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MINOR REPAIRS AND ADJUSTMENTS

VALVE LASH ADJUSTMENT

Start the engine and operate at a fast idle speed until operating temperature is reached. Remove the rocker arm covers from each cylinder bank.

Before adjusting the valves, torque the rocker arm stand bolts to 35 ft-lbs.

The valves are adjusted by positioning each piston at T.D.C. on the compression stroke in the firing order sequence (1-3-4-2) (Fig. 3-1). Rotate the engine manually until the timing marks on the drive pulley indicate T.D.C.

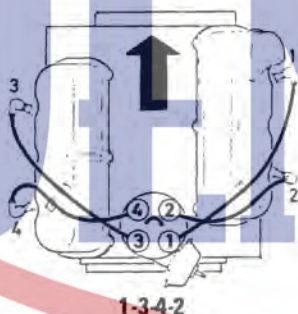


Fig. 3-1 – Cylinder Numbering and Firing Order Sequence

NOTE: The direction of engine rotation when viewed from the front is clockwise. The fan is driven by the balance shaft, resulting in a counterclockwise fan rotation. Therefore, when using the fan or belts to rotate the engine, turn counterclockwise.

Rotate the engine back and forth a few degrees in each direction and observe the valve rocker arms on No. 1 cylinder. If no rocker arm movement is observed, the engine is at the proper position for adjusting the valves on No. 1 cylinder. If movement is observed, the engine is at the proper position for adjusting the valves on No. 4 cylinder. Adjust the valve lash to .016 inch on the cylinder which is at the proper position (Fig. 3-2). The valve adjusting nuts are self-locking and will remain at the set position.



Fig. 3-2 – Adjusting Valve Lash

The most accurate method for adjusting the valves is to use a “go” and “no go” procedure. For example, use a .015 inch gauge for “go” and .017 inch for “no go”. The “go” gauge should enter and the “no go” gauge should not enter. The resultant setting will be the required setting (.016 inch). There are stepped gauges available to make this adjustment easier.

Adjust the valves in the remaining cylinders following the firing order sequence. This can be accomplished by rotating the engine in increments of 1/2 revolution (180°). After two complete revolutions, all the cylinders will have been at their T.D.C. position at the top of the compression stroke.

After the valves are adjusted, clean the rocker arm covers, inspect and replace gaskets if necessary, and install on engine. Tighten bolts to 6 to 9 ft-lbs. Recheck bolt torque after 8 hours of operation.

CYLINDER HEAD BOLT TIGHTENING PROCEDURE

To tighten the cylinder head bolts after the initial 10 hours of operation or at any other time that may be

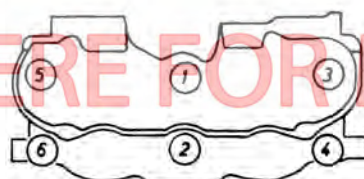


Fig. 3-3 – Cylinder Head Bolt Tightening Sequence

necessary, follow the sequence shown in Fig. 3-3.

Tighten the bolts to 60 ft-lbs using a properly calibrated torque wrench (Fig. 3-4). If the cylinder heads were removed and are to be reinstalled, follow the procedure described under “Cylinder Heads - Installation.”



Fig. 3-4 – Tightening Cylinder Head Bolts

INTAKE MANIFOLD BOLT TIGHTENING PROCEDURE

To tighten the intake manifold bolts and nuts after the initial 10 hours of operation or at any other time that may be necessary, follow the sequence shown in Fig. 3-5. Tighten the bolts to 21 ft-lbs using a properly calibrated torque wrench.

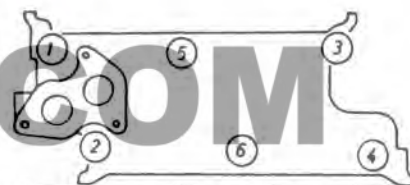


Fig. 3-5 – Intake Manifold Bolt Tightening Sequence

NOTE: If both the cylinder head and intake manifold bolts are being tightened, the intake manifold bolts and nuts must always be tightened last.

If the intake manifold was removed and is being reinstalled, follow the procedure described on page 19.

REPAIR OPERATIONS

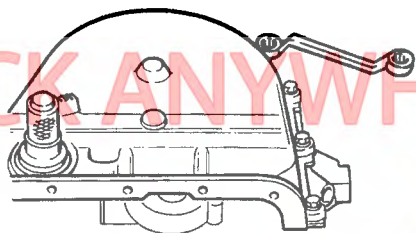


Fig. 3-26 - Aligning Front Cover

FAN BEARING

REMOVAL

1. Loosen fan belt and remove.
2. Remove fan and fan pulley.
3. Remove governor, if so equipped, and then remove fan bracket.
4. The fan bearing and shaft is removed with the use of an arbor press or other suitable device (Fig. 3-27). Support the fan bracket on the inside under the bearing opening with a tube of approximately 1-1/2 inch diameter and 2-1/2 inch length. Use a 1/2 inch diameter drift to press on the end of the shaft. Press on end of shaft until bearing is free from bracket and shaft is free from pulley hub.

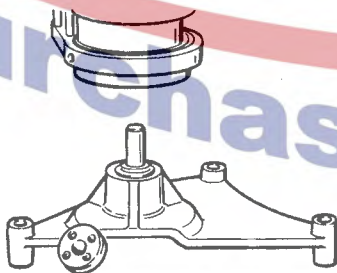


Fig. 3-27 - Fan Bearing Removal

INSTALLATION

1. Place the fan bracket in the arbor press. Position tube used at removal under bracket for support. Press in new shaft and bearing assembly (Fig. 3-28) until end of shaft is 4.62 inch from opposite edge of bracket (Fig. 3-29). Press only on outer race of bearing and not on end of shaft.
2. Remove tube from under fan bracket and support inner end of shaft with a suitable steel bar. Press fan flange on shaft to dimension shown in Fig. 3-29.

3. Assemble fan bracket to engine and install retaining screws. Tighten screws securely.

4. Install governor, fan pulley and fan.

5. Install fan belt and tighten to specifications.

CAMSHAFT

REMOVAL

1. Remove the engine from the installation and mount with holding fixture GH-6010 or equivalent to a suitable work stand. See "Engine Removal and Installation."

2. Remove distributor cap with spark plug wires as an assembly. Remove distributor vacuum line, distributor, generator, governor, rocker arm covers, fuel line and filter, carburetor and intake manifold. See "Intake Manifold - Removal."

3. Remove rocker arm and shaft assemblies. Lift out push rods and place in a marked rack so they can be reinstalled in the same location.

4. Remove oil pan. Keep engine upright while removing oil pan. See "Oil Pan - Removal."

5. Remove drive pulley retaining bolt and slide pulley off end of balance shaft.

6. Remove engine front cover as

described under "Front Cover - Removal."

7. Remove camshaft gear retaining bolt and slide gear off camshaft.

8. Remove camshaft thrust plate.

9. Using a magnet, remove the valve lifters from the vee in the block. Those lifters that cannot be removed should be held in the maximum height position with wooden clothes pins or a similar method. Removed lifters should be identified to permit installation in the same location.

10. Carefully pull the camshaft from the block, avoiding any damage to the camshaft bearings. Remove camshaft gear key and spacer ring.

INSPECTION

Clean the camshaft in solvent and wipe it dry. Inspect the camshaft lobes for scoring and signs of abnormal wear. Lobe characteristics may result in pitting in the general area of the lobe toe. This pitting is not detrimental to the operation of the camshaft.

The camshaft should be replaced if the lobe lift loss has exceeded 0.005 inch. The lift of the camshaft lobes can be checked with the camshaft installed in the engine or on centers.

Check the distributor drive gear for broken or chipped teeth. If the camshaft is replaced due to a scored, damaged or worn lobe, the lifters should also be replaced. If the camshaft is not replaced, the old lifters should always be installed in their original location. Failure to do this can result in lifter and/or cam lobe failure. If lifters are mixed up, they should be replaced.

INSTALLATION

1. Coat the entire camshaft with SE-type engine oil. If a new cam is being installed, coat the lobes with a moly-disulfide base lubricant.

2. Install the camshaft in the block, carefully avoiding damage to the bearing surfaces.

3. Install the spacer ring with the countersunk side toward the camshaft. Insert camshaft key. Install thrust plate so that it covers the main oil gallery (Fig. 3-30).

4. Check the camshaft for the specified 0.0042 inch - 0.008 inch end play. The spacer ring and thrust plate are available in two thicknesses to per-

Fig. 3-28 - Installation of Fan Bearing and Shaft

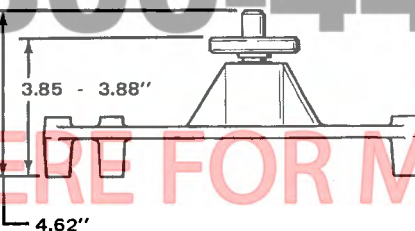


Fig. 3-29 - Installation Dimensions of Fan Bearing and Fan Mounting Flange

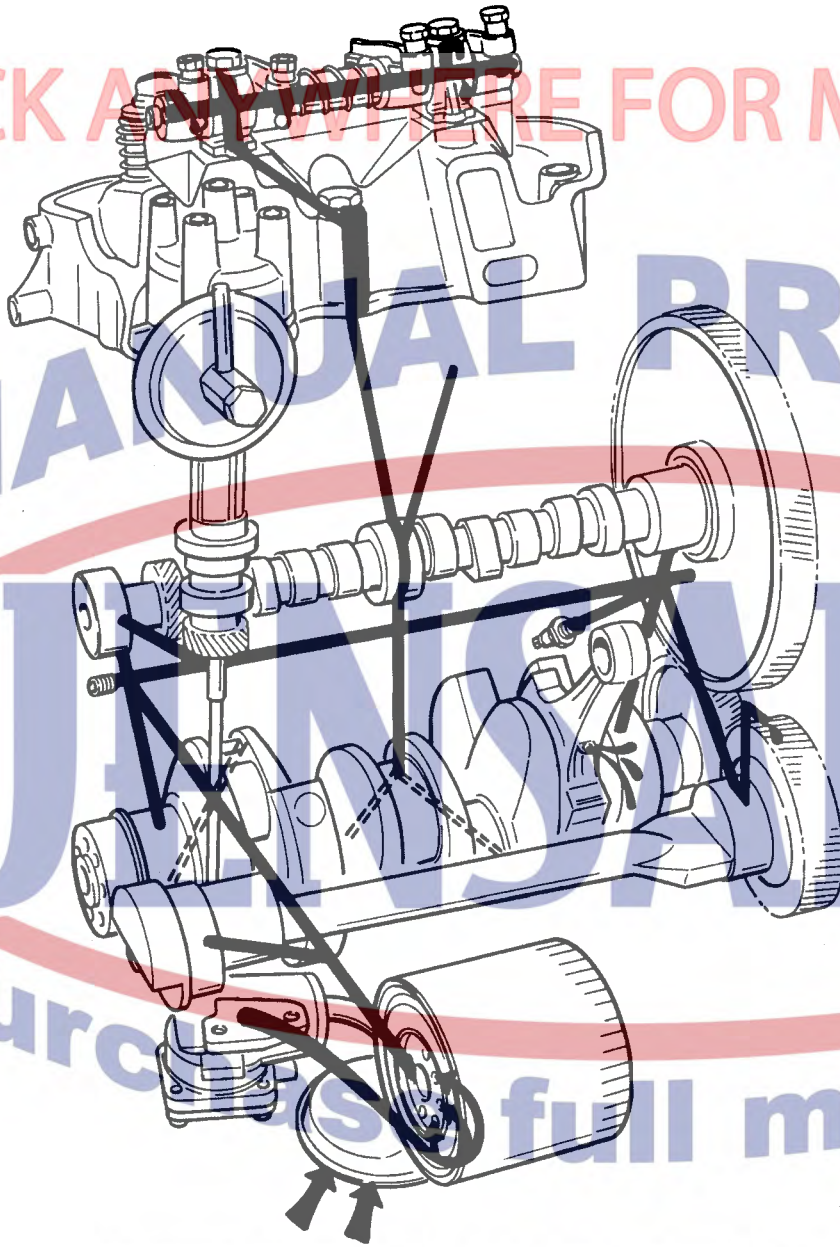


Fig. 3-51 - Oil Passages

the rear end of the main oil gallery. Drive out the camshaft cover cap toward the rear.

40. Clean all oil passages in the cylinder heads, cylinder block, crankshaft and connecting rods (Fig. 3-51).

ASSEMBLY

The following instructions describe assembling the engine. For repair operations and selection of fit of the pistons and bearings, refer to the appropriate headings under "REPAIR OPERATIONS" in this section. These operations are listed in the Index at

the beginning of this section.

1. Coat the threaded plug slightly with sealer and screw it tightly in the main oil gallery.

2. Coat the outer rim of the camshaft cover cap with sealer. Drive the cover cap into the cylinder block, its flat side facing inward.

3. Clean the main bearing inserts on both sides and the bearing bores in the block and bearing caps. Small particles of dirt can prevent complete seating of the bearings, or cause damage to the bearing surfaces after the engine is started.

4. Assemble main bearing inserts in

their correct location in bearing caps and cylinder block. Check alignment of oil holes in inserts with oil holes in block. Apply a liberal coating of SE-type engine oil to the bearing surfaces. Carefully lower crankshaft into position.

5. Install main bearing caps in their correct location. The arrows on the front and center main bearing caps must point to the front of the engine. Apply a thin even coating of sealing compound to the rear sealing surface of the rear main bearing cap. This is shown as the dark area on Fig. 3-29.

6. Install and tighten all main bearing bolts finger-tight. Then tighten all bolts, except for center thrust bearing, in steps to 72 ft-lbs.

7. Align the thrust bearing surfaces by prying the crankshaft backwards to stop, then slowly but forcefully prying it forward to stop and retaining it in this position. Tighten the thrust bearing cap bolts in equal steps to 72 ft-lbs (Fig. 3-40). (This procedure is necessary to make sure both thrust bearing inserts bear evenly on the contact surfaces.)

8. Coat the sealing lip of a new crankshaft oil seal with SE-type oil. Slide seal over end of crankshaft and drive into position using tool GC-6701-B or equivalent (Fig. 3-41). Be sure seal bottoms in groove.

9. Using a flat tool such as a large blunt end screwdriver, push the two wedge-shaped seals between the cylinder block and rear main bearing caps. Position the seals with the round side facing the main bearing cap (Fig. 3-42).

10. Apply a liberal coating of SE-type engine oil to the balance shaft bearings in the block and the balance shaft bearing surfaces. Guide the shaft carefully into the block from the rear. Apply sealing compound to the balance shaft opening cover, and drive cover into opening in cylinder block, with flat side facing out (Fig. 3-33).

11. Install engine rear cover plate and flywheel housing.

12. Clean mating-flanges on flywheel and crankshaft and mount flywheel. Install bolts and tighten to 50 ft-lbs.

13. Apply a liberal coating of SE-type engine oil to the camshaft bearings in block and camshaft bearings surfaces. Carefully insert camshaft into block.

14. Slide the thrust washer, countersunk side facing inwards, on