CAMSHAFTS 1.27. RIFF 42

When installing camshafts in an overhauled engine, the following steps should be adhered to:

1. Rotate engine until PM 1/6 on the flywheel is exactly on the pointer. Cylinder #1 should be at TDC.

2. Clean all cam bearing surfaces, and heavily lubricate them with SAE20W motor oil. Slacken or remove chain tensioner.

3. Carefully place the camshafts back in their original locations (intake-exhaust L & R) on the head. Mark or tag each cam prior to removal.

4. Place all of the cam bearing-roller assemblies on the cams*. NOTE: Each assembly should be returned to the location it was removed from. Check the numbers.

5. Finger tighten the nuts on these assemblies to hold the cam in place.

6. Align** the lightly scribed marks at the front of each camshaft (see diagram) with the arrow stamped in the center of the front cam bearing assembly.

7. Tighten each bearing-roller assembly to the prescribed torque.

8. Place chain tightly over each sprocket.

9. Adjust chain tensioner to take up the slack in the chain.

10. Check to be sure that the arrows still point to the scribed marks on the cam; correct any great error**.

11. Rotate the engines crankshaft two complete turns until PM1/6 is again at the pointer; the cam marks should be at the arrows. Adjust if necessary to correct any great error**.

* NOTE: Valves must not be actuated (loosen all lash adjustments) when aligning the cam marks for the first time.

** Used or worn chains may not line up exactly - replace chain if great error is noted.

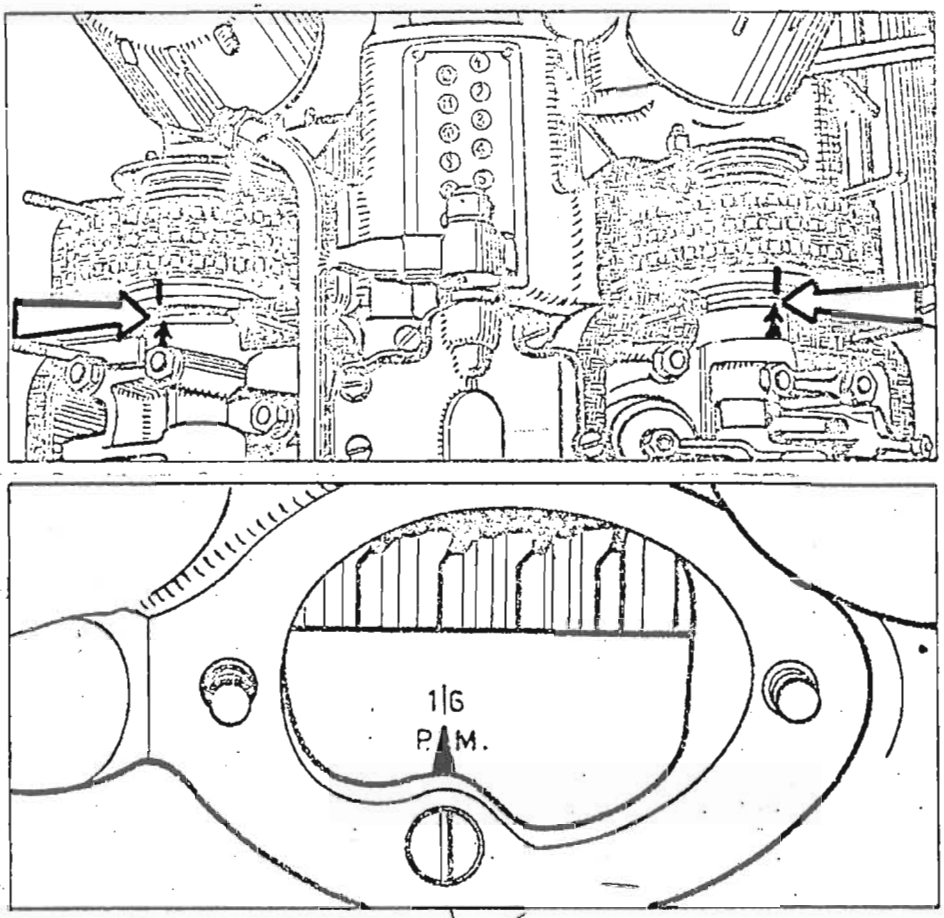
RIFF-42

CAMSHAFT - CHAIN ALIGNMENT

1.27. RIFF 43

TWO CAM

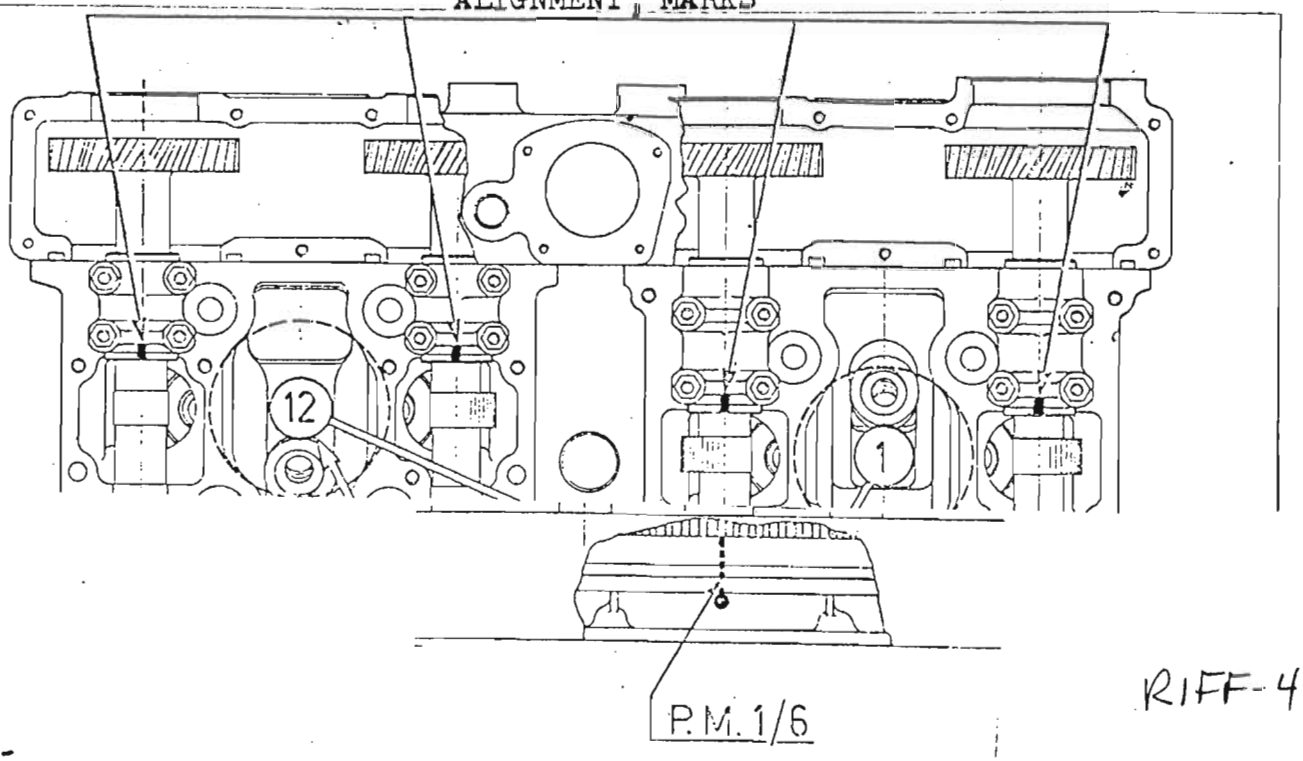
SCRIBED MARKS



SCRIBED MARKS

FOUR CAM

ALIGNMENT MARKS



RIFF-43

1 - In case of an engine which is being assembled for the first time, or one lacking reference data due to replacement of several parts, proceed as follows: 1.27. RIFF 44

Turn engine to T.D.C. 1/6 and lubricate the camshaft bearings.

Install both camshafts in such a manner that both cams of the right shaft operating the cylinder No. 6, are turned upwards at the same height, and those of the left shaft operating the cylinder No. 12, also turned upwards, (more specifically, when sitting in the car, cylinder No. 1 is the first on the right hand line closer to the radiator, and cylinder No. 7 is the last in the left hand line closer to the instrument panel).

Install the camshaft drive gears on their proper hubs without fastening the mounting bolts.

Check if the mounting bolts of the left hand gear match with those of the camshaft, in opposite case provide the adjustments as described in step 12. Proceed then by fastening the gears with only two mounting bolts and install the rocker arm support caps.

Turn crankshaft 60° rotation-wise up to T.D.C. 7/12, and repeat the same operation for the left hand gear.

Install support caps of rocker arms operating in the same manner as for the right hand shaft.

Adjust valve clearances

Adjust timing chain tension

Install the dial indicator on the mounting flange of clutch housing with the zero mark corresponding to the fixed pointer on the block.

Turn the crankshaft rotation-wise until the rocker arm of cylinder No. 1 is near the opening point of the inlet valve.

Turn gradually the flywheel and hold by hand or with the help of pliers at the exact instant in which the rocker arm roller is no more free to turn.

Read on the dial the position of the T.D.C. 1/6 in relation to the zero mark.

Turn again flywheel, helping with light blows until obtaining the instant in which the exhaust rocker arm roller is free to turn either by hand or with the help of pliers.

Read on dial the number of degrees the T.D.C. 1/6 is retarded in relation to the zero mark.

Example: Suppose the inlet valve starts to open 23° before T.D.C. 1/6, and the closing of the exhaust valve ends 20° after the same T.D.C. 1/6, it will be necessary to advance the inlet opening by 4°, which consequently will retard the exhaust closing also by 4°.

RIFF-44

The exact timing should result as follows:

1.27. RIFF 45

Inlet	Opening, start 27° before T.D.C. Closing, end 65° after T.D.C.
Exhaust	Opening, start 74° before T.D.C. Closing, end 16° after T.D.C.

- Remove therefore the gear from camshaft and hold chain upwards as high as possible so that it will not slip out of the crankshaft pinion. Rotate gear by 7 teeth in the engine rotation direction and remount gear on proper shaft.

- In case that after this operation the mounting holes will not match properly, it will be necessary to turn the engine in the opposite direction by 4°.

- Fasten gear on shaft as before with two mounting bolts and check readings. If the values obtained correspond with those indicated on table, the timing of the right hand line of cylinders is correct.

- To obtain the left hand line timing, turn engine rotation wise until the inlet rocker arm roller of cylinder 7 is in the start opening position.

- Read the position of T.D.C. 7/12, always in relation to the zero mark on the dial, and to achieve the exact timing, repeat carefully all the operations as described for the right hand line cylinders.

- In case the readings should indicate that it is necessary to retard rather than to advance the inlet opening-start, and consequently to advance the exhaust closing-end, then the positioning of the gear in relation to the timing chain should be effected on the opposite direction to the engine rotation, while that of the engine in the same direction in which it rotates.

- Terminated the timing operation, fasten gears with all mounting bolts and proceed with installing the ignition distributor supports.

The minimum deviation obtainable for the ignition timing, measured on the flywheel if 4°10', therefore the timing tolerance is plus or minus 2°.

The minimum deviation value is obtained from the difference of the angle formed by the 7 teeth of timing gear (148° 10') and that formed by the mounting holes of the same gear about the shaft (144°).

When rotating instead gear and timing shaft by 1 tooth in relation to the chain, the deviation of the flywheel is 21°10'.

RIFF-45