

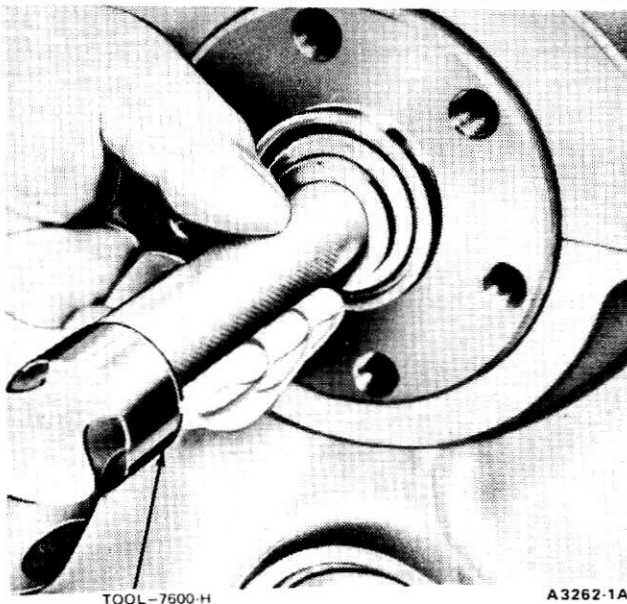


FIG. 33 Installing Clutch Pilot Bearing

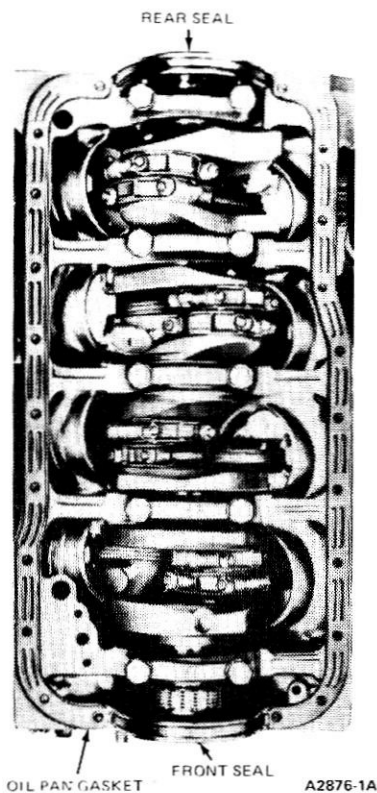


FIG. 34 Oil Pan Gaskets and Seals Installed

3. Remove the bore plug as detailed under Core Plug in Part 21-01.

Installation

1. Install the bore plug as detailed under Core Plug in Part 21-01.
2. Coat the flywheel attaching bolts with oil-resistant sealer. Position the engine rear cover plate on the cylinder block dowels. Position the flywheel on the crankshaft flange. Install and torque the attaching bolts in sequence (across from each other) to specifications.

On a vehicle with a manual transmission, install the clutch pressure plate, disc and the transmission following the procedures in Group 16.

On a vehicle with an automatic transmission, install the transmission and converter housing following the procedure in Group 17.

OIL PAN

MUSTANG II

Removal

1. Disconnect battery cable.
2. Remove 4 bolts attaching fan shroud to radiator and position shroud over fan.
3. Raise vehicle on hoist.
4. Drain crankcase.
5. Remove the 4 attaching bolts and remove the 2a crossmember.
6. Remove the attaching screw from flex joint to release steering pinion shaft. Remove 3 nuts and bolts attaching steering gear to crossmember. Remove 4 bolts attaching sway bar to chassis and move sway bar down.
7. Disconnect battery cable from starter, remove 2 starter attaching bolts and remove starter.
8. Remove oil pan attaching bolts, loosen oil pan from block and remove.

Installation

1. Clean oil pan gasket surface of cylinder block. Clean and inspect oil pan.
2. Position oil pan gasket and seals to cylinder block using contact cement (Fig. 34).
3. Position oil pan to engine and install the attaching bolts.
4. Position sway bar to chassis and install attaching bolts.
5. Position starter to clutch housing and install attaching bolts. Connect starter cable and tighten nut.
6. Position steering gear to steering shaft, install 3 attaching bolts and nuts at crossmember and torque to specification. Install flex coupling to steering gear stub shaft attaching bolt.
7. Position the 2a crossmember to the vehicle and install the 4 attaching bolts.
8. Lower the vehicle and fill the crankcase with the specified engine oil. Connect the battery cable to the battery.
9. Position the shroud to the radiator and install the 4 attaching bolts. Start the engine and check for leaks.

FAIRMONT AND ZEPHYR

Removal

1. Disconnect the battery positive cable.
2. Remove the fan shroud attaching bolts, positioning the fan shroud back over the fan.
3. Raise the vehicle on a hoist.
4. Drain the crankcase.

5. Remove two (2) bolts attaching steering gear to main crossmember and let steering gear rest on frame away from oil pan.
6. Remove the bolts attaching the engine mounts.
7. Raise the engine and place two (2) wood blocks (2" x 4") between the engine mounts and the vehicle frame.
8. Remove rear "K" braces (4 bolts).
9. Remove the oil pan attaching bolts and lower oil pan to the frame.
10. Remove oil pump attaching bolts and the inlet tube attaching nut from the No. 3 main bearing cap stud and lower the oil pump into the oil pan.
11. Remove the oil pan, rotating the crankshaft as necessary to clear the counterweights.

Installation

1. Clean oil pan gasket surface of cylinder block. Clean and inspect oil pan.
2. Position oil pan gasket and sealer to cylinder block using contact cement (Fig. 34).
3. Position oil pump and inlet tube into oil pan. Slide oil pan into position under the engine. With the oil pump intermediate shaft in position in the oil pump, position the oil pump to the cylinder block, and the inlet tube to the stud on No. 3 main bearing cap attaching bolt. Install the attaching bolts and nut and torque to specification.
4. Position the oil pan to the engine and install the attaching bolts. Torque to specification.
5. Position the steering gear to the main crossmember. Install the two (2) attaching bolts and torque to specification.
6. Position rear "K" braces and install the the attaching bolts (4).
7. Raise engine and remove wood blocks.
8. Lower the engine and install engine mount attaching bolts. Torque to specification.
9. Lower vehicle and fill crankcase with the specified engine oil. Connect the positive battery cable.
10. Position the shroud to the radiator and install the two (2) attaching bolts. Start the engine and check for leaks.

LTD II, Cougar and Thunderbird

Removal

1. Remove the oil level dipstick. Remove the bolts attaching the fan shroud to the radiator. Position the shroud over the fan.
2. Raise the vehicle.
3. Drain the crankcase.
4. Remove the stabilizer bar from the chassis.
5. Remove the engine front support through bolts.
6. Raise the engine and place wood blocks between the engine front supports and chassis brackets.
7. If equipped with an automatic transmission, disconnect the oil cooler lines at the radiator.
8. Remove the oil pan attaching bolts and lower the oil pan onto the crossmember.
9. Remove oil pump pickup tube and screen from the oil pump. Rotate the crankshaft for clearance and remove the oil pan.

Installation

1. Clean the gasket surfaces of the block and oil pan. The oil pan has a two-piece gasket.
2. Clean the oil pump pick up tube and screen.
3. Coat the block surface and the oil pan gasket with sealer. Position the oil pan gaskets on the cylinder block (Fig. 34).
4. Position the oil pan front seal on the cylinder front cover. Be sure the tabs on the seal are over the oil pan gasket.
5. Position the oil pan rear seal on the rear main bearing cap (Fig. 34). Be sure the tabs on the seal are over the oil pan gasket.
6. Position the oil pan on the crossmember. Install a new gasket on the oil pump and install the oil pump pick up tube.
7. Position the oil pan against the block and install a bolt, finger tight, on each side of the block. Install the remaining bolts. Tighten the bolts from the center outward in each direction to specifications.
8. If equipped with an automatic transmission, connect the oil cooler lines at the radiator.
9. Raise the engine and remove the wood blocks from between the engine supports and chassis brackets. Lower the engine and install the engine support through bolts. Tighten the bolts to specifications.
10. Install the stabilizer bar to the chassis.
11. Lower the vehicle.
12. Install the fan shroud.
13. Install the oil level dipstick. Fill the crankcase with the proper grade and quantity of engine oil. Start the engine and check for oil leaks.

Granada and Monarch

Removal

1. Raise the vehicle and drain the crankcase.
2. Remove the stabilizer bar from the chassis.
3. Remove the engine front support through bolts and remove the supports. If so equipped, remove the bolt and nut retaining the power steering lines to the rear side of the lower arm.
4. Remove the idler arm bracket retaining bolts and pull the linkage down and out of the way.
5. Remove the oil pan attaching bolts and remove the pan.
6. Remove the oil pump pick-up tube and screen assembly.

Installation

1. Clean the oil pan and inspect for damage. Clean the oil pump pick-up tube and screen.
2. Clean the gasket surfaces of the block and oil pan. Position the oil pump pick-up tube and screen with gasket. Install the two bolts and torque to specifications.
3. Coat the block surface and oil pan gaskets with sealer. Position the oil pan gaskets on the cylinder block (Fig. 34).
4. Position the oil pan front seal on the cylinder front cover. Be sure the tabs on the seal are over the oil pan gasket.

5. Position the oil pan rear seal on the rear main bearing cap (Fig. 34). Be sure the tabs on the seal are over the oil pan gasket.
6. Position the oil pan to the cylinder block. Install the attaching bolts and torque to specifications.
7. Position the idler arm bracket to the chassis and install the attaching bolts. Torque to specifications. Install the power steering line bracket to the lower control arm rear.
8. Position the engine supports to the chassis side rails and install the reattaching bolts. Torque to specifications.
9. Install the stabilizer bar.
10. Lower the vehicle. Fill the crankcase. Start the engine and check for oil leaks.

VERSAILLES

Removal

1. Disconnect the battery.
2. Remove the 2 fan shroud attaching screws and loosen shroud to prevent damage when raising engine.
3. Raise the vehicle and drain the crankcase.
4. Remove the stabilizer bar from the chassis.
5. Remove the RH & LH engine front support through bolts.
6. Loosen transmission oil cooler lines and move aside.
7. Raise engine 2" and block up with 2" x 4" blocks or equivalent under engine mounts.
8. Remove the oil pan attaching bolts and remove the pan.

NOTE: To ease pan removal, it will be necessary to rotate the crankshaft during the removal process so the rear throw is in a horizontal position to clear the rear oil pan flange.

9. Remove the oil pump, pick-up tube and screen assembly.

Installation

1. Clean the gasket surfaces of the block and oil pan and inspect pan and gasket rails for damage. Correct as necessary.
2. Prime the oil pump by filling either the inlet or outlet port with engine oil. Rotate the pump shaft to distribute the oil within the pump body.
3. Position the intermediate drive shaft into the distributor socket. With the shaft firmly seated in the distributor socket, the stop on the shaft should touch the roof of the crankcase. Remove the shaft and position the stop as necessary.
4. With the stop properly positioned, insert the intermediate drive shaft into the oil pump. Install the pump and shaft as an assembly. **Do not attempt to force the pump into position if it will not seat readily. The drive shaft hex may be misaligned with the distributor shaft. To align, rotate the intermediate drive shaft into a new position.**

Torque the oil pump attaching screws to specifications.

5. Clean and install the oil pump inlet tube and screen assembly (Fig. 35).
6. Position the oil pan side gaskets on the cylinder block using contact cement (Part B9AE-19B508-A or equivalent). See Fig. 34.
7. Position the oil pan front seal on the cylinder front cover. Be sure the tabs on the seal are over the oil pan gasket.
8. Position the oil pan rear seal on the rear main bearing cap (Fig. 34). Be sure the tabs on the seal are over the oil pan gasket.
9. Position the oil pan to the cylinder block. Install the attaching bolts and torque to specifications.
10. Raise the engine and remove the 2" x 4" blocks. Lower the engine and install the engine mount through bolts. Torque to specification.
11. Install the stabilizer bar to chassis.
12. Install oil cooler lines and attaching clips.
13. Lower the vehicle. Fill the crankcase with specified quality and quantity of oil.
14. Position the fan shroud and install the attaching screws.
15. Connect the battery cable.
16. Start the engine and check for leaks.

OIL PUMP (EXCEPT FAIRMONT, ZEPHYR AND VERSAILLES)

On Fairmont, Zephyr and Versailles vehicles, Oil Pump Removal is described under Oil Pan Removal.

Removal

1. Remove the oil pan and related parts as outlined under Oil Pan Removal.
2. Remove the oil pump inlet tube and screen assembly.
3. Remove the oil pump attaching bolts and remove the oil pump and intermediate drive shaft.

Installation

1. Prime the oil pump by filling either the inlet or outlet port with engine oil. Rotate the pump shaft to distribute the oil within the pump body.
2. Position the intermediate drive shaft into the distributor socket. With the shaft firmly seated in the distributor socket, the stop on the shaft should touch the roof of the crankcase. Remove the shaft and position the stop as necessary.
3. With the stop properly positioned, insert the intermediate drive shaft into the oil pump. Install the pump and shaft as an assembly. **Do not attempt to force the pump into position if it will not seat readily. The drive shaft hex may be misaligned with the distributor shaft. To align, rotate the intermediate drive shaft into a new position.**

Torque the oil pump attaching screws to specifications.

4. Clean and install the oil pump inlet tube and screen assembly (Fig. 35).
5. Install the oil pan and related parts as outlined under Oil Pan Installation.

CRANKSHAFT REAR OIL SEAL

A split-lip type crankshaft rear oil seal is used for replacement on all engines. **If replacement is necessary, this type of seal must be used.** The complete seal can be replaced without removing the crankshaft. Refer to Crankshaft Rear Oil Seal Replacement in Part 21-01 for replacement procedures.

MAIN BEARING

The main bearing inserts are selective fit. Refer to procedures under Fitting Main and Connecting Rod Bearings in Part 21-01.

Removal

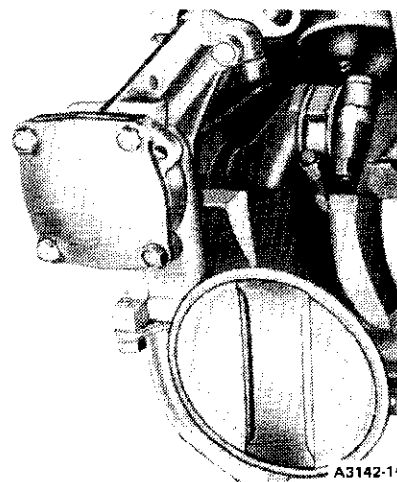
1. Drain the crankcase. Remove the oil level dipstick. Remove the oil pan and related parts by following steps under Oil Pan Removal.
2. Remove the oil pump inlet tube assembly and the oil pump.
3. Replace one bearing at a time, leaving the other bearings securely fastened.

Remove the main bearing cap to which new bearings are to be installed.

4. Insert the upper bearing removal Tool (Tool 6331) in the oil hole in the crankshaft.
5. Rotate the crankshaft in the direction of the engine rotation to force the bearing out of the block.
6. Clean the crankshaft journals. Inspect the journals and thrust faces (thrust bearing) for nicks, burrs or bearing pick-up that would cause premature bearing wear.
7. If the rear main bearing is being replaced, remove and discard the rear oil seal from the bearing cap.
8. Remove the block half of the rear oil seal following the procedures given under Crankshaft Rear Oil Seal Removal in Part 21-01.
9. Repeat Steps 3 thru 8 for the remaining bearings to be replaced.

Installation

1. If the rear main bearing is being replaced clean the rear oil seal groove in the block with a brush and the recommended solvent (Part 21-01).
2. Install the block half of the rear oil seal following the procedures given under Crankshaft Rear Oil Seal Installation in Part 21-01.
3. To install the upper main bearing, place the plain end of the bearing over the shaft on the locking tang side of the block and partially install the bearing so that Tool 6331 can be inserted in the oil hole in the crankshaft. With Tool 6331 positioned in the oil hole in the crankshaft, rotate the crankshaft in the opposite direction of engine rotation until the bearing seats itself. Remove the tool.
4. Replace the bearing in the cap.
5. Select fit the bearing for proper clearance following procedures under Fitting Main and Connecting Rod Bearings in Part 21-01.
6. If the bearing is being replaced on journal number 1, 2 or 4, apply a light coat of engine oil to the



**FIG. 35 Oil Pump and Inlet Tube Installed—
Except Fairmont/Zephyr**

journal and bearings and install the bearing cap. Tighten the cap bolts to specifications.

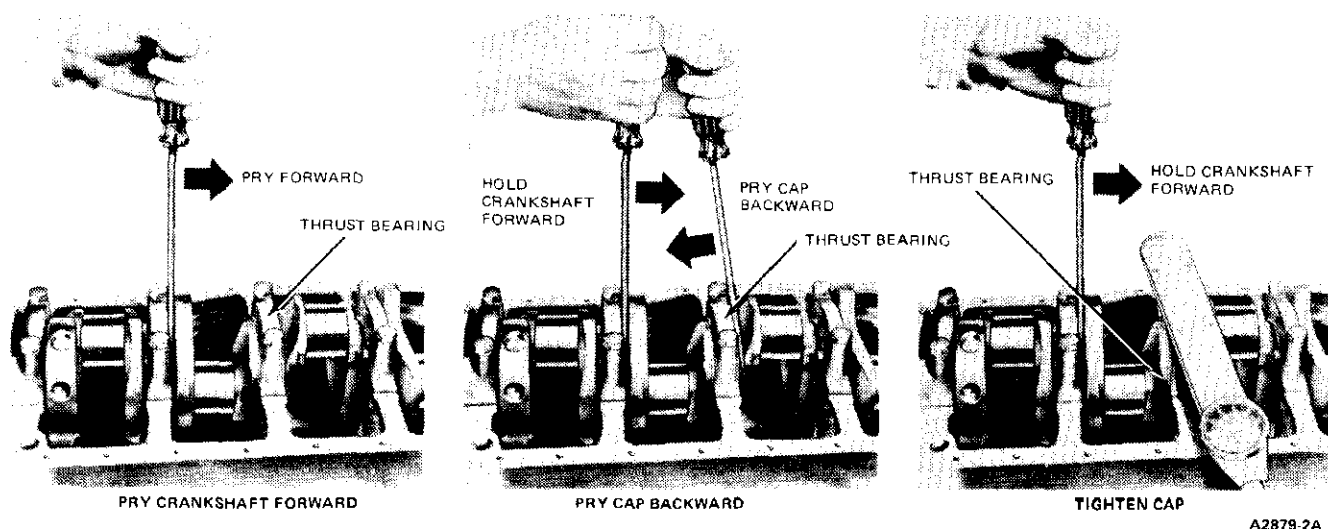
7. If the rear main bearing is being replaced, clean the oil seal groove in the cap with a brush and recommended solvent (Part 21-01).

Remove the oil seal retaining pin from the bearing cap, if so equipped. **The pin is not used with the split lip seal.**

8. Install the lower seal in the rear main bearing cap with undercut side of seal toward the FRONT of the engine; allow the seal to protrude approximately 3/8 inch above the parting surface to mate with the upper seal when the cap is installed.
9. **Refer to Crankshaft Rear Oil Seal Installation for instructions on use of sealer in installing the main bearing cap.** Lubricate the journal with engine oil and install the rear main bearing cap. Torque the cap bolts to specifications.
10. If the thrust bearing cap (No. 3 main bearing) has been removed, install it as follows:

Lubricate the journal with engine oil and install the thrust bearing cap with the bolts finger-tight. Pry the crankshaft forward against the thrust surface of the upper half of the bearing (Fig. 36). Hold the crankshaft cap to the rear. This will align the thrust surfaces of both halves of the bearing. Retain the forward pressure on the crankshaft. Torque the cap bolts to specifications.

11. Clean the oil pump inlet tube screen. Prime by filling the inlet opening with oil and rotating the pump shaft until oil emerges from the outlet opening. On all models except Versailles, install the oil pump and the inlet tube assembly. On Versailles models, install the oil pump and oil pan following instructions under Oil Pan Installation.
12. Position the oil pan gaskets on the oil pan. Position the oil pan front seal on the cylinder front cover. Position the oil pan rear seal on the rear main bearing cap. Install the oil pan and related parts. Install the oil level dipstick.



A2879-2A

FIG. 36 Aligning Thrust Bearing

13. Fill the crankcase. Start the engine and check for oil pressure. Operate the engine at fast idle and check for oil leaks.

CONNECTING ROD BEARINGS

The connecting rod bearings are selective fit. Refer to procedures under Fitting Main and Connecting Rod Bearings in Part 21-01.

Removal

1. Drain the crankcase. Remove the oil level dipstick. Remove the oil pan and related parts following procedures under Oil Pan Removal.
2. Remove the oil pump, inlet tube assembly and the oil pump intermediate shaft.
3. Turn the crankshaft until the connecting rod to which new bearings are to be fitted is down. Remove the connecting rod cap. Remove the bearing inserts from the rod and cap.

Installation

1. Be sure the bearing inserts and the bearing bore in the connecting rod and cap are clean. Foreign material under the inserts will distort the bearing and cause a failure.
2. Clean the crankshaft journal.
3. Install the bearing inserts in the connecting rod and cap with the tangs fitting in the slots provided.
4. Pull the connecting rod assembly down firmly on the crankshaft journal.
5. Select fit the bearing following procedures under Fitting Main and Connecting Rod Bearings in Part 21-01.
6. After the bearing has been fitted, clean and apply a light coat of engine oil to the journal and bearings. Install the connecting rod cap. Tighten the nuts to specifications.

7. Clean the oil pump inlet tube screen. Prime the pump by filling the inlet opening with oil and rotate the pump shaft until oil emerges from the outlet opening. On all models except Versailles, install the oil pump and the inlet tube assembly. On Versailles models, install the oil pump, inlet tube screen and cover, intermediate shaft and oil pan following procedures under Oil Pan Installation.
8. Position the oil pan gaskets on the oil pan. Position the oil pan front seal on the cylinder front cover. Position the oil pan rear seal on the rear main bearing cap. Install the oil pan and related parts. Install the oil level dipstick.
9. Fill the crankcase. Start the engine and check for oil pressure. Operate the engine at fast idle and check for oil leaks.

PISTONS AND CONNECTING RODS

Removal

1. Drain the cooling system and the crankcase. Remove the intake manifold, cylinder heads, oil pan and oil pump, following the procedures in this Part.
2. Remove any ridges and/or deposits from the upper end of the cylinder bores as follows:
Turn the crankshaft until the piston to be removed is at the bottom of its travel and place a cloth on the piston head to collect the cuttings. Remove any ridge and/or deposits from the upper end of the cylinder bores. Remove the cylinder ridge with a ridge cutter. Follow the instructions furnished by the tool manufacturers. **Never cut into the ring travel area in excess of 1/32 inch when removing ridges.**
3. Make sure all connecting rod caps are marked so that they can be installed in their original positions.
4. Turn the crankshaft until the connecting rod being removed is down.

5. Remove the connecting rod nuts and cap.
6. Push the connecting rod and piston assembly out the top of the cylinder with the handle end of a hammer. **Avoid damage to the crankshaft journal or the cylinder wall when removing the piston and rod.**
7. Remove the bearing inserts from the connecting rod and cap.
8. Install the cap on the connecting rod from which it was removed.

Installation

1. If new piston rings are to be installed, and no visible cross-hatch marks remain on the cylinder wall, remove the cylinder wall glaze using a spring-type tool. Follow the instructions of the tool manufacturer. After honing, clean the cylinder walls with a detergent and water solution.
2. Oil the piston rings, pistons and cylinder walls with light engine oil. **Be sure to install the pistons in the same cylinders from which they were removed or to which they were fitted. The connecting rod and bearing caps are numbered from 1 to 4 in the right bank and from 5 to 8 in the left bank, beginning at the front of the engine. The numbers on the connecting rod and bearing cap must be on the same side when installed in the cylinder bore. If a connecting rod is ever transposed from one block or cylinder to another, new bearings should be fitted and the connecting rod should be numbered to correspond with the new cylinder number.**
3. Make sure the ring gaps are properly spaced around the circumference of the piston (Fig. 37).

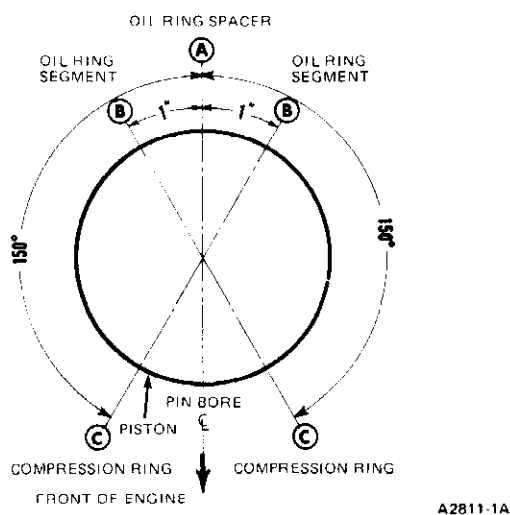


FIG. 37 Piston Ring Spacing

4. Install a piston ring compressor on the piston and push the piston in with a hammer handle until it is slightly below the top of the cylinder (Fig. 38). Be sure to guide the connecting rods to avoid damaging the crankshaft journals. **Install the piston with the indentation notch in the piston head toward the front of the engine.**

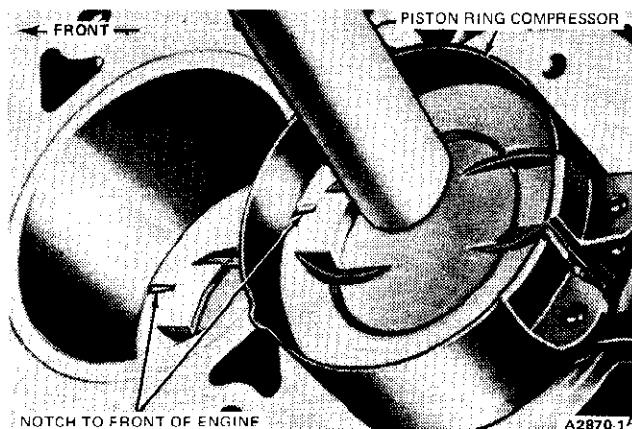


FIG. 38 Installing Piston—Typical

5. Check the clearance of each bearing following the procedure under Fitting Main and Connecting Rod Bearings in Part 21-01.
6. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings.
7. Turn the crankshaft throw to the bottom of its stroke. Push the piston all the way down until the connecting rod bearing seats on the crankshaft journal.
8. Install the connecting rod cap. Tighten the nuts to specifications.
9. After the piston and connecting rod assemblies have been installed, check the side clearance between the connecting rods on each crankshaft journal (Fig. 39).

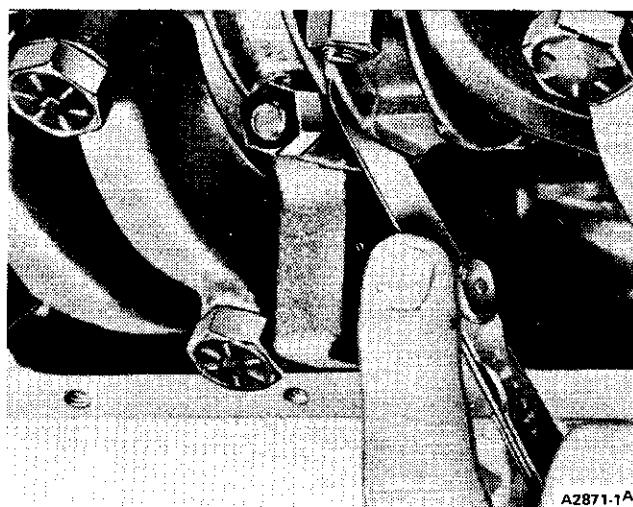
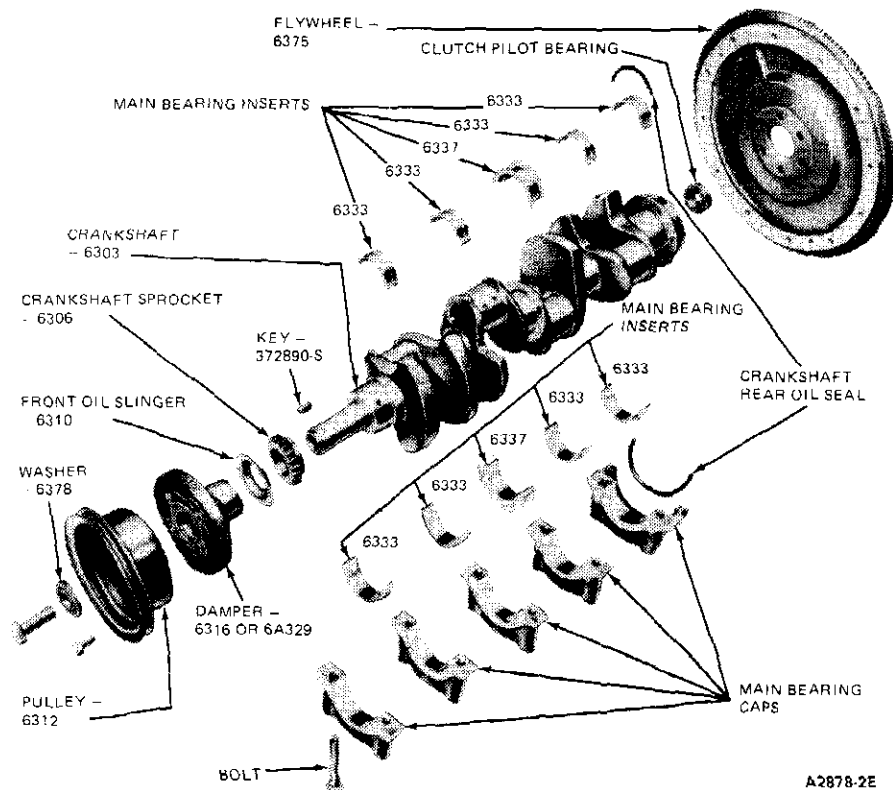


FIG. 39 Checking Connecting Rod Side Clearance

10. Disassemble, clean, and assemble the oil pump. Clean the oil pump inlet tube screen and the oil pan and block gasket surfaces.
11. Prime the oil pump by filling either the inlet port or outlet port with engine oil and rotating the pump shaft to distribute the oil within the housing. Install the oil pump, the intermediate shaft and the oil pan following instructions under Oil Pan and Oil Pump Installation.
12. Install the cylinder heads following procedures under Cylinder Head Installation.



A2878-2E

FIG. 40 Crankshaft and Related Parts

13. Install the intake manifold following procedures under *Intake Manifold Installation*.
14. Fill and bleed the cooling system. Fill the crankcase with the proper grade and quantity of engine oil.
15. Start the engine and check and adjust the ignition timing. Connect the distributor vacuum hoses.
16. Operate the engine at fast idle and check for oil and coolant leaks. When the engine temperature has stabilized adjust the engine idle speed and idle fuel mixture.
17. Install the air cleaner, air inlet tube and crankcase vent hose.
18. Connect the automatic choke heat chamber air inlet hose.

CRANKSHAFT

The crankshaft and related parts are shown in Fig. 40.

Removal

1. With engine removed from vehicle and placed on a work stand, drain the crankcase and cylinder block. Disconnect the spark plug wires at the spark plugs and remove the wires from the ignition harness brackets on the valve rocker arm covers. Disconnect the coil to distributor high tension lead at the coil. Remove the distributor cap and spark plug wire assembly. Remove the spark plugs to allow easy rotation of the crankshaft.

2. Remove the fuel pump and oil filter. Slide the water pump by-pass hose clamp toward the water pump. Remove the alternator and mounting brackets.
3. Remove the crankshaft pulley from the crankshaft vibration damper (if so equipped). Remove the cap screw and washer from the end of the crankshaft. Install the puller on the crankshaft vibration damper (Fig. 24) and remove the damper.
4. Remove the cylinder front cover and water pump as an assembly.
5. Remove the crankshaft front oil slinger. Check the timing chain deflection, then remove the timing chain and sprockets as detailed under *Cylinder Front Cover and Timing Chain Removal*.
6. Invert the engine on the work stand. Remove the clutch pressure plate and disc (manual-shift transmission). Remove the flywheel and engine rear cover plate. Remove the oil pan and gasket. Remove the oil pump.
7. Make sure all bearing caps (main and connecting rod) are marked so that they can be installed in their original locations.

Turn the crankshaft until the connecting rod from which the cap is being removed is down, and remove the bearing cap. Push the connecting rod and piston assembly up into the cylinder. Repeat this procedure until all the connecting rod bearing caps are removed.

8. Remove the main bearing caps.

9. Carefully lift the crankshaft out of the block so that the thrust bearing surfaces are not damaged. **Handle the crankshaft with care to avoid possible fracture or damage to the finished surfaces.**

To refinish journals, dress minor imperfections, etc., refer to Part 21-01.

Installation

1. Remove the rear journal oil seal from the block and rear main bearing cap.
2. Remove the main bearing inserts from the block and bearing caps.
3. Remove the connecting rod bearing inserts from the connecting rods and caps.
4. If the crankshaft main bearing journals have been refinished to a definite undersize, install the correct undersize bearings. If not, be sure the bearing inserts and bearing bores are clean. Foreign material under the inserts will distort the bearing and cause a failure.
5. Place the upper main bearing inserts in position in the bores with the tang fitting in the slot provided.
6. Install the lower main bearing inserts in the bearing caps.
7. Clean the rear journal oil seal groove and the mating surfaces of the block and rear main bearing cap. Remove the oil seal retainer pin from the rear main bearing seal groove, if so equipped. **The retainer pin is not used with a split lip seal.**
8. Dip the lip seal halves in clean engine oil. Carefully install the seal halves in the block and rear main bearing cap with the undercut sides of the seal toward the FRONT of the engine and approximately 3/8 inch protruding above the partial surface.
9. Carefully lower the crankshaft into place. **Be careful not to damage the bearing surfaces.**
10. Check the clearance of each main bearing following the procedure under Fitting Main and Connecting Rod Bearings in Part 21-01.
11. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings. Install the rear main bearing cap by following steps 7 thru 9 under Main Bearing Installation. Install all the bearing caps, except the thrust bearing cap (No. 3 bearing). **Be sure that the main bearing caps are installed in their original locations. Torque the bearing cap bolts to specifications.**
12. Install the thrust bearing cap with the bolts finger-tight.
13. Pry the crankshaft forward against the thrust surface of the upper half of the bearing (Fig. 36).
14. Hold the crankshaft forward and pry the thrust bearing cap to the rear. This will align the thrust surfaces of both halves of the bearing.
15. Retain the forward pressure on the crankshaft. Tighten the cap bolts to specifications.
16. Force the crankshaft toward the rear of the engine.
17. Check the crankshaft end play (refer to Part 21-01).
18. Install new bearing inserts in the connecting rods and caps. Check the clearance of each bearing

following the procedure under Fitting Main and Connecting Rod Bearings in Part 21-01.

19. After the connecting rod bearings have been fitted, apply a light coat of engine oil to the journals and bearings.
20. Turn the crankshaft throw to the bottom of its stroke. Push the piston all the way down until the rod bearing seats on the crankshaft journal.
21. Install the connecting rod cap. Torque the nuts to specifications.
22. After the piston and connecting rod assemblies have been installed, check the side clearance between the connecting rods and each connecting rod crankshaft journal (Fig. 39).
23. Install the timing chain and sprockets, cylinder front cover and crankshaft pulley and adapter, following Steps 1 thru 9 under Cylinder Front Cover and Timing Chain Installation.
24. Coat the threads of the flywheel attaching bolts with oil-resistant sealer. Position the flywheel on the crankshaft flange. Install and torque the bolts to specifications.
On a flywheel for a manual-shift transmission, use Tool 6392-N or equivalent to align the clutch disc. Install the pressure plate. Tighten the attaching bolts.
25. Clean the oil pan, oil pump and oil pump screen. Prime the oil pump by filling either the inlet or outlet port with engine oil and rotating the pump shaft to distribute oil within the housing. Install the oil pump and oil pan by following the procedures under Oil Pan and Oil Pump Installation.
26. Install the oil filter, fuel pump and connect the fuel lines. Install the alternator, shield and mounting bracket.
27. Install the spark plugs, distributor cap and spark plug wires. Connect the spark plug wires and high tension lead. See Part 23-01 for special installation instructions.
28. Install the engine in the vehicle.

CAMSHAFT BEARINGS

Removal

1. Remove the camshaft, flywheel and crankshaft, following the appropriate procedures in this Part. Push the pistons to the top of the cylinders.
2. Remove the camshaft rear bearing bore plug (see Part 21-01—Core Plugs). Remove the camshaft bearings (Fig. 41).
3. Select the proper size expanding collet and back-up nut and assemble on the expanding mandrel. With the expanding collet collapsed, install the collet assembly in the camshaft bearing, and tighten the back-up nut on the expanding mandrel until the collet fits the camshaft bearing.
4. Assemble the puller screw and extension (if necessary) as shown and install on the expanding mandrel. Wrap a cloth around the threads of the puller screw to protect the front bearing or journal. Tighten the pulling nut against the thrust bearing and pulling plate to remove the camshaft bearing.

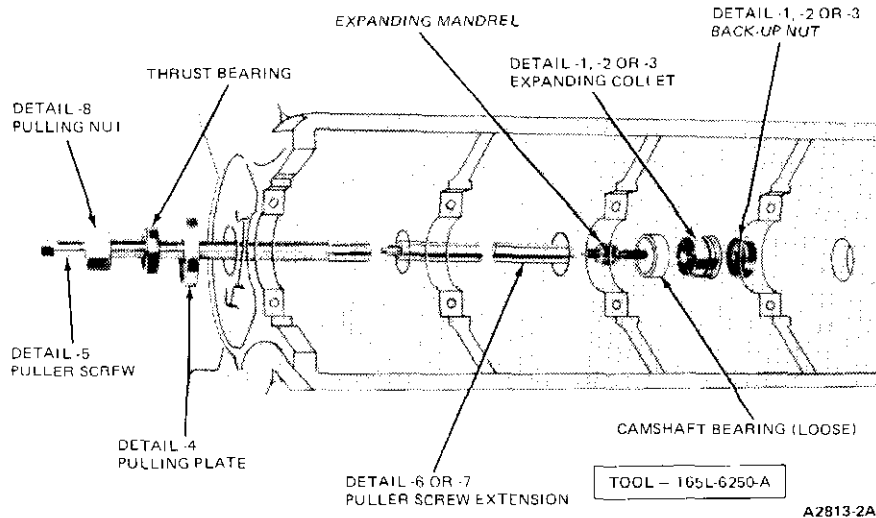


FIG. 41 Camshaft Bearing Replacement

Be sure to hold a wrench on the end of the puller screw to prevent it from turning.

5. Repeat the procedure for each bearing. To remove the front bearing, install the puller screw from the rear of the cylinder block.

Installation

Camshaft bearings are available prefinished to size for standard and 0.015-inch undersize journal diameters. The bearings are not interchangeable from one bore to another.

1. Position the new bearings at the bearing bores with the oil holes aligned with the holes in the block, and press them in place with the tool shown in Fig. 41. Be sure to center the pulling plate and puller screw to avoid damage to the bearing. **Failure to use the correct expanding collet can cause severe bearing damage. Be sure the front bearing is installed the specified distance below the front face of the cylinder block (Fig. 42).** See Specifications.
2. Install the bore plug as detailed under *Care Plugs* in Part 21-01.
3. Install the camshaft, crankshaft, flywheel and related parts, following the appropriate procedures in this Part, except do not check connecting rod and main bearing clearances as a part of Camshaft Bearing Replacement. Install the engine in the vehicle.

OIL FILTER

The oil filter assembly is shown in Fig. 43.

Removal

1. Place a drip pan under the filter. Unscrew the filter from the adapter fitting, using an oil filter wrench, and clean the adapter recess and the filter gasket sealing surface.

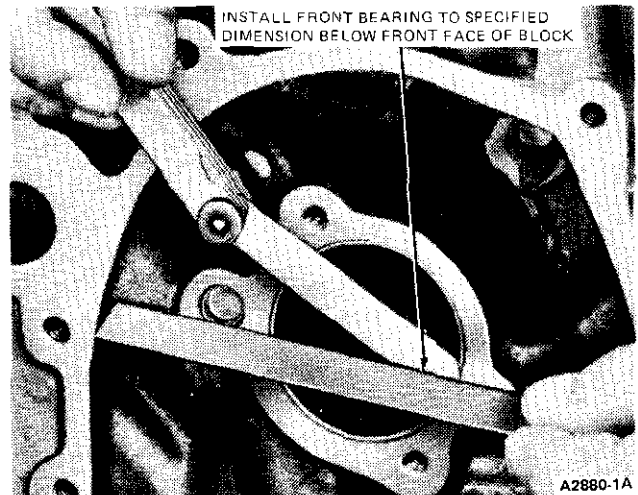


FIG. 42 Camshaft Front Bearing Measurement

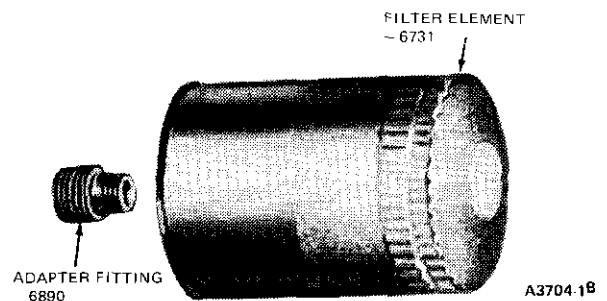


FIG. 43 Cartridge-Type Oil Filter

Installation

1. Coat the gasket on a new filter with oil. Place the new filter in position on the adapter fitting. Hand tighten the filter until the gasket contacts the sealing surface, and then advance it 1/2 turn.
2. Operate the engine at fast idle, and check for oil leaks. If oil leaks are evident, perform the necessary repairs to correct leakage. Check the oil level and add oil as required to bring to specified level.

DISASSEMBLY AND ASSEMBLY

When installing nuts or bolts that must be torqued (refer to Specifications), oil the threads with light weight engine oil. **Do not oil threads that require oil-resistant or water-resistant sealer.**

Refer to Part 21-01 for Cleaning and Inspection procedures.

HYDRAULIC TAPPET

The internal parts of each hydraulic tappet assembly are matched sets. Do not intermix the parts. Keep the assemblies intact until they are to be cleaned. Tappets should always be tested after assembly; refer to the cleaning, inspection and test procedures covered in Part 21-01.

Disassembly

Disassemble and assemble each tappet separately. Identify the tappet assemblies so they can be installed in their original bores.

1. Grasp the lock ring with needle nose pliers to release it from the groove. It may be necessary to depress the plunger to fully release lock ring.
2. Remove the push rod cup, metering valve (disc), plunger and spring.
3. Remove the plunger assembly, the check valve and the check valve retainer and plunger spring. Carefully remove the plunger spring, the check valve retainer and, the check valve disc from the plunger.

Assembly

Hydraulic tappet assembly is shown in Fig. 44.

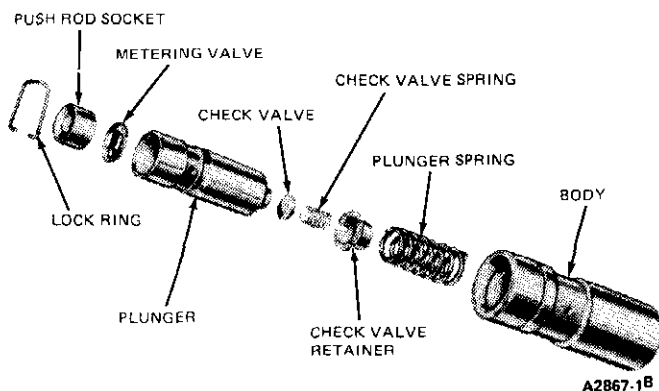


FIG. 44 Hydraulic Tappet Assembly

1. Place the plunger upside down on a clean work bench.
2. Place the check valve (disc or ball check) in position over the oil hole on the bottom of the plunger. Set the check valve spring on top of the check valve (disc or ball check).
3. Position the check valve retainer over the check valve and spring and push the retainer down into place on the plunger.
4. Place the plunger spring, and then the plunger (open end up) into the tappet body.
5. Position the metering valve (disc) in the plunger, and then place the push rod cup in the plunger.

6. Depress the plunger, and position the closed end of the lock ring in the groove of the tappet body. With the plunger still depressed, position the open ends of the lock ring in the groove. Release the plunger, and then depress it again to fully seat the lock ring.
7. Use the hydraulic tappet leakdown tester (Part 21-01) to fill the tappets with test fluid.

CYLINDER HEAD

Disassembly

1. Remove the exhaust valve stem caps.
2. Remove the exhaust manifolds (if required) and the spark plugs.
3. Clean the carbon out of the cylinder head combustion chambers before removing the valves.
4. Compress the valve springs (Fig. 45). Remove the spring retainer locks and release the spring.

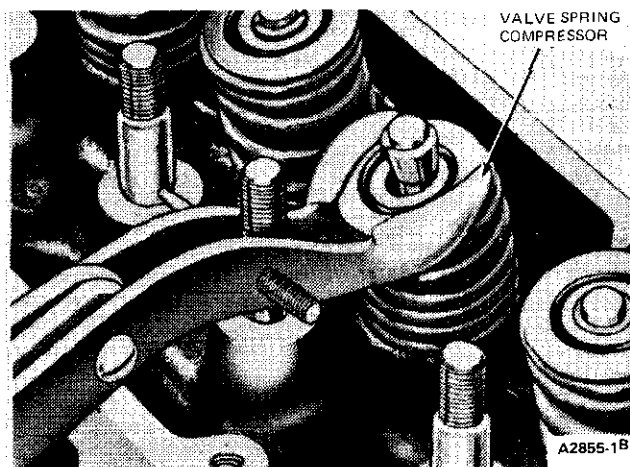


FIG. 45 Compressing Valve Spring—On Bench

5. Remove the sleeve, spring retainer, spring, stem seal and valve. Discard the valve stem seals. Identify all valve part as to which cylinder they were removed from and whether intake or exhaust.
6. Clean, inspect and repair the cylinder head as required, or prepare to transfer all usable parts to a new cylinder head.

Assembly

All valves, valve stems and valve guides are to be lubricated with heavy oil SE. The valve tips are to have Lubriplate or equivalent applied before installation.

1. Install each valve (Fig. 46) in the port from which it was removed or to which it was fitted.
2. Install the valve stem seal. Use a 5/8-inch deep wall socket and a light mallet or hammer to seat the seal on the valve stem. Install the valve spring over the valve and then install the spring retainer (and rotator, on 5.8L (351 CID) exhaust valves). Compress the spring and install the sleeve, if so equipped, and retainer locks (Fig. 46).
3. Measure the assembled height of the valve spring from the surface of the cylinder head spring pad to the underside of the spring retainer with dividers

(Fig. 47). Check the dividers against a scale. If the assembled height is greater than specifications, install the necessary 0.030 inch thick spacer(s) between the cylinder head spring pad and the valve spring to bring the assembled height to the recommended height.

Do not install the spacers unless necessary. Use of spacers in excess of recommendations will result in overstressing the valve springs and overloading the camshaft lobes which could lead to spring breakage and/or worn camshaft lobes.

4. Install the exhaust manifolds (if removed) and the spark plugs.

PISTONS AND CONNECTING RODS

Disassembly

1. Remove the bearing inserts from the connecting rod and cap.
2. Mark the pistons to assure assembly with the same rod and installation in the same cylinders from which they were removed.
3. Remove the piston rings. Using an Arbor Press and the tool shown in Fig. 48, press the piston pin from the piston and connecting rod.

Assembly

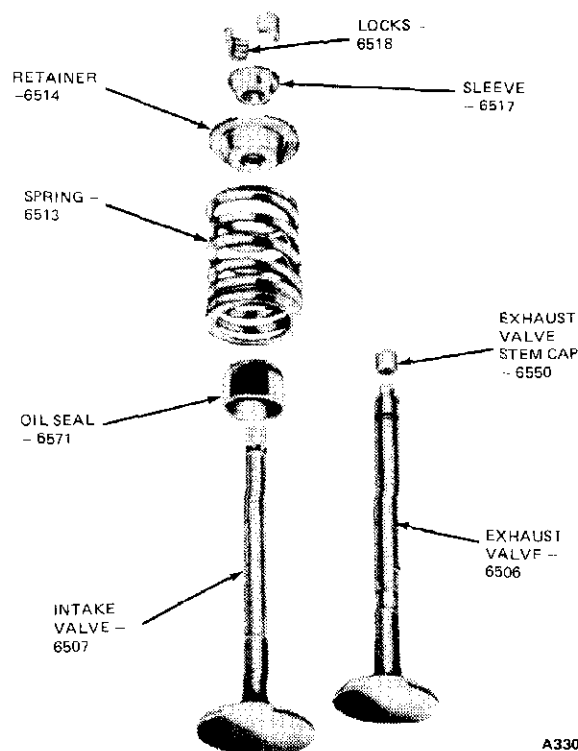
The piston, connecting rod and related parts are shown in Fig. 49. **Check the fit of a new piston in the cylinder bore before assembling the piston and piston pin to the connecting rod.**

The piston pin bore of a connecting rod and the diameter of the piston pin must be within specifications. Refer to specification at end of this part.

1. Apply a light coat of engine oil to all parts. **Assemble the piston to the connecting rod with the cylinder number side of the connecting rod and the indentation notch in the piston positioned as shown in Fig. 50.**

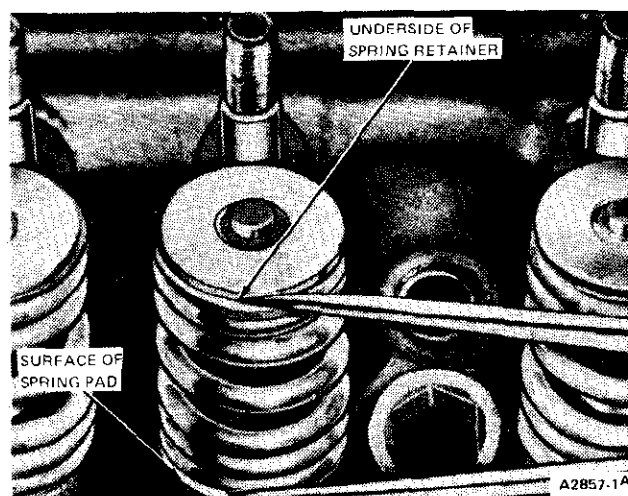
On replacement connecting rods, install the large chamfered side of the connecting rod bearing bore towards the crankshaft check; facing towards front of engine on right bank rods, and facing towards rear of engine on left bank rods.

2. Start the piston pin in the piston and connecting rod (this may require a very light tap with a mallet). Using an arbor press, press the piston pin through the piston and connecting rod until the pin is centered in the piston (Fig. 48).
3. Check the end gap of all piston rings (Part 21-01). It must be within specifications. Follow the instructions contained on the piston ring package and install the piston rings.
4. Check the ring side clearance of the compression rings with a feeler gauge inserted between the ring and its lower land (Part 21-01). The gauge should slide freely around the entire ring circumference without binding. Any wear that occurs will form a step at the inner portion of the lower land. **If the lower lands have high steps, the piston should be replaced.**
5. Be sure the bearing inserts and the bearing bore in the connecting rod and cap are clean. Foreign



A3307-1A

FIG. 46 Valve Assembly



A2857-1A

FIG. 47 Measuring Valve Spring Assembled Height

material under the inserts will distort the bearing and cause a failure. Install the bearing inserts in the connecting rod and cap with the tangs fitting in the slots provided.

CYLINDER ASSEMBLY

Disassembly

1. Mount the engine in a work stand and remove all parts not furnished with the new cylinder assembly, following the procedures given in the Removal and Installation Section of this Part.
2. Remove the 4 cylinder head locating dowels and the block drain plugs.
3. Remove the used cylinder assembly from the work stand.

Assembly

1. Clean the gasket and seal surfaces of all serviceable parts and assemblies.

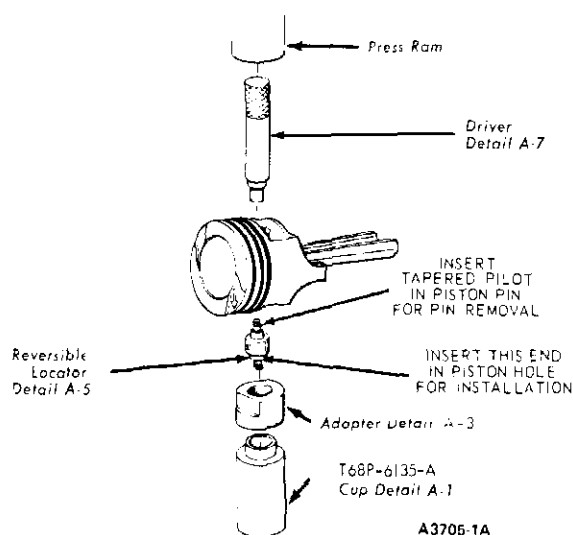


FIG. 48 Removing or Installing Piston Pin

2. Position the new cylinder assembly in a work stand and install the cylinder head locating dowels and block drain plugs.
3. Transfer all serviceable parts removed from the used cylinder assembly, following the procedures given in the Removal and Installation Section of this Part.
4. Check all assembly clearances and correct as necessary.

CYLINDER BLOCK

Before replacing a cylinder block, determine if it is repairable. If so, make necessary repairs, following the procedures given in Part 21-01.

Disassembly

1. Completely disassemble the used engine, following the procedures given in the Removal and Installation Section of this Part.
2. Remember to ridge-ream the cylinder bores before removing piston assemblies.
3. Remove the cylinder head locating dowels and the block drain plugs.

Assembly

1. Clean the gasket and seal surfaces of all serviceable parts and assemblies.

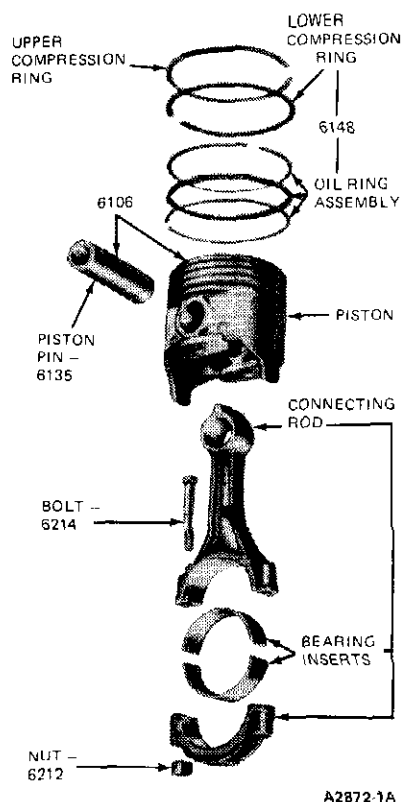


FIG. 49 Piston, Connecting Rod and Related Parts

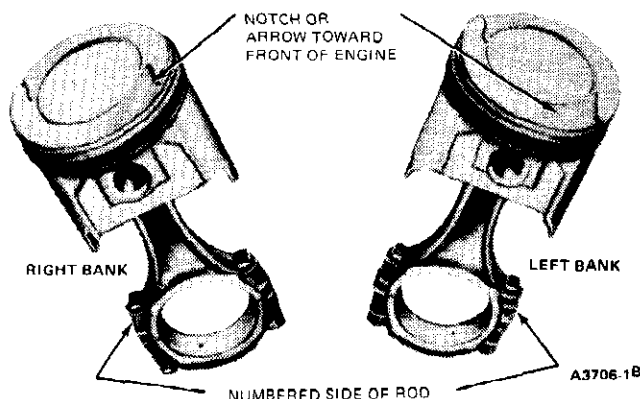


FIG. 50 Correct Piston and Rod Positions

2. Position the new cylinder block in a work stand and install the cylinder head locating dowels and the block drain plugs.
3. Transfer all serviceable parts removed from the used cylinder block, following the procedures given in the Removal and Installation Section of this Part.
4. Check all assembly clearances and correct as necessary.

SPECIFICATIONS

GENERAL SPECIFICATIONS	
DISPLACEMENT	5.0L/5.8L (302 CID/351 CID)
NUMBER OF CYLINDERS	8
BORE AND STROKE	4.00 x 3.00 5.0L (302 CID) 4.00 x 3.50 5.8L (351 CID)
FIRING ORDER	1-5-4-2-6-3-7-8 5.0L (302 CID) 1-3-7-2-6-5-4-8 5.8L (351 CID)
OIL PRESSURE (Hot @ 2000 RPM)	40-65
DRIVE BELT TENSION	①
CYLINDER HEAD AND VALVE TRAIN	
COMBUSTION CHAMBER VOLUME (cc)	67.5-70.5
VALVE GUIDE BORE DIAMETER	0.3433-0.3443
VALVE SEATS	
Width - Intake	0.060-0.080
Width - Exhaust	0.060-0.080
Angle	45°
Runout Limit (T. I. R. Max)	0.002
VALVE ARRANGEMENT (Front to Rear)	(L. H.) I-E-I-E-I-E-I-E (R. H.) I-E-I-E-I-E-I-E
VALVE STEM TO GUIDE CLEARANCE	
Intake	0.0010-0.0027
Exhaust	0.0015-0.0032
Service Clearance	0.0055
VALVE HEAD DIAMETER	
Intake	1.770-1.794
Exhaust	1.439-1.463 5.0L (302 CID) 1.468-1.493 5.8L (351 CID)
VALVE FACE RUNOUT LIMIT	0.002 Max.
VALVE FACE ANGLE	44°
VALVE STEM DIAMETER (Std)	
Intake	0.3416-0.3423
Exhaust	0.3411-0.3418 (0.003 Oversize)
Intake	0.3446-0.3453
Exhaust	0.3441-0.3448 (0.015 Oversize)
Intake	0.3566-0.3575
Exhaust	0.3561-0.3568 (0.030 Oversize)
Intake	0.3716-0.3723
Exhaust	0.3711-0.3718
VALVE SPRINGS	
Compression Pressure (Lb @ Spec. Length)	
Intake	76-84 @ 1.69 5.0L (302 CID) 190-210 @ 1.31 5.0L (302 CID) 71-79 @ 1.79 5.8L (351 CID) 190-210 @ 1.34 5.8L (351 CID)
Exhaust	76-84 @ 1.60 5.0L (302 CID) 190-210 @ 1.20 5.0L (302 CID) 76-84 @ 1.60 5.8L (351 CID) 190-210 @ 1.20 5.8L (351 CID)
Free Length (Approximate)	
Intake	1.94 5.0L (302 CID) 2.08 5.8L (351 CID)
Exhaust	1.87 5.0L (302 CID) 1.87 5.8L (351 CID)
Assembled Height	
Intake	1.21/32-1.23/32 5.0L (302 CID) 1.49/64-1.13/16 5.8L (351 CID)
Exhaust	1.19/32-1.5/8 5.0L (302 CID) 1.19/32-1.5/8 5.8L (351 CID)
Service Limit	10% Pressure Loss @ Spec. Length
Out-Of-Square Limit	5/64 (0.078) 5.0L/5.8L (302 CID/351 CID)
ROCKER ARM	
Stud Bore Diameter	0.3780-0.3795
Ratio	1.61:1
PUSH ROD RUNOUT (T. I. R. Max)	0.015
VALVE TAPPET, LIFTER OR ADJUSTER	
Diameter (Std)	0.8740-0.8745
Clearance To Bore	0.0007-0.0027
Service Limit	0.005
Hydraulic Leakdown Rate	5-60 Seconds ②
Collapsed Tappet Gap - Allowable	0.071-0.193
Collapsed Tappet Gap - Desired	0.098-0.168

CAMSHAFT	
LOBE LIFT	
Intake	0.2373 5.0L (302 CID) 0.2600 5.8L (351 CID)
Exhaust	0.2474 5.0L (302 CID) 0.2600 5.8L (351 CID)
Allowable Lobe Lift Loss	0.005 Max.
THEORETICAL VALVE LIFT @ ZERO LASH	
Intake	0.3823 5.0L (302 CID) 0.4186 5.8L (351 CID)
Exhaust	0.3980 5.0L (302 CID) 0.4186 5.8L (351 CID)
END PLAY	0.001-0.007
Service Limit	0.009
JOURNAL TO BEARING CLEARANCE	0.001-0.003
Service Limit	0.006
CAMSHAFT GEAR BACKLASH	0.006-0.010
JOURNAL DIAMETER	
# 1	2.0805-2.0815
# 2	2.0655-2.0665
# 3	2.0505-2.0515
# 4	2.0355-2.0365
# 5	2.0205-2.0215
Runout Limit	0.005 Max. T. I. R.
Out-Of-Round Limit	0.0005 Max. T. I. R.
BEARING INSIDE DIAMETER	
# 1	2.0825-2.0835
# 2	2.0675-2.0685
# 3	2.0525-2.0535
# 4	2.0375-2.0385
# 5	2.0225-2.0235
FRONT BEARING LOCATION ③	0.005-0.020
CYLINDER BLOCK	
HEAD GASKET SURFACE FLATNESS	④
HEAD GASKET SURFACE FINISH (RMS)	60-150
CYLINDER BORE	
Diameter	4.0004-4.0052 5.0L (302 CID) 4.0000-4.0048 5.8L (351 CID)
Surface Finish (RMS)	18-38
Out-Of-Round Limit	0.0015
Out-Of-Round Service Limit	0.005
Taper Service Limit	0.010
TAPPET BORE DIAMETER	0.8752-0.8767
MAIN BEARING BORE DIAMETER	2.4412-2.4420 5.0L (302 CID) 3.1922-3.1930 5.8L (351 CID)
DISTRIBUTOR SHAFT BEARING BORE DIAMETER	0.4525-0.4541 5.0L (302 CID) 0.5155-0.5171 5.8L (351 CID)

(1) DRIVE BELT TENSION (Lbs.)

Size	Newly Installed (a)	Used (b)	
		Up to 10 Min.	Over 10 Min.
1/4"	50-80	40-80 (a)	40-80 (a)
Exc. 1/4"	120-160	90-160 (c)	75-120 (d)

(a) If less than 40 lbs., readjust to 40-60 lbs.
 (b) A used belt is any in operation for 10 minutes.
 (c) If less than 90 lbs., readjust to 90-120 lbs.
 (d) If less than 75 lbs., readjust to 90-120 lbs.
 (e) Read tension immediately after belt is installed, before it stretches or seats in pulley grooves.

- (2) Time required for plunger to leak down 1/16" with 50 lb. load and leakdown fluid in tappet.
- (3) Distance front edge of bearing is below front face of cylinder block.
- (4) 0.003 in any 8 inches - 0.006 overall.

CRANKSHAFT AND FLYWHEEL

MAIN BEARING JOURNAL DIAMETER	2.2482-2.2490 5.0L (302 CID)
	2.9994-3.0002 5.8L (351 CID)
Out-Of-Round Limit	0.0006 Max.
Taper Limit	0.0006 Max.
Journal Runout Limit	0.002 Max.
Surface Finish (RMS)	12 Max.
Runout Service Limit	0.005
THRUST BEARING JOURNAL	
Length	1.137-1.139
CONNECTING ROD JOURNAL	
Diameter	2.1228-2.1236 5.0L (302 CID)
	2.3103-2.3111 5.8L (351 CID)
Out-Of-Round Limit	0.0006
Taper Limit	0.0006 per inch Max.
Surface Finish (RMS)	12 Max.
MAIN BEARING THRUST FACE	
Surface Finish (RMS)	35 Front/25 Rear
Runout Limit	0.001 Max.
FLYWHEEL CLUTCH FACE	
Runout Limit (T, I, R.)	0.010
FLYWHEEL RING GEAR LATERAL RUNOUT (T, I, R.)	
Standard Transmission	0.030
Automatic Transmission	0.060
CRANKSHAFT FREE END PLAY	0.004-0.008
Service Limit	0.012
CRANKSHAFT RUNOUT TO REAR FACE OF BLOCK (T, I, R. Max.)	0.005
CONNECTING ROD BEARINGS	
Clearance To Crankshaft	Desired 0.0008-0.0015
	Allowable 0.0007-0.0024 5.0L (302 CID)
	0.0008-0.0025 5.8L (351 CID)
Bearing Wall Thickness (Std) (5)	0.0572-0.0577
MAIN BEARINGS	
Clearance To Crankshaft	Desired No. 1 = 0.0001-0.0015 5.0L (302 CID)
	All others 0.0005-0.0015 5.0L (302 CID)
	0.0008-0.0015 5.8L (351 CID)
	Allowable No. 7 = 0.0001-0.0020 5.0L (302 CID)
	Others 0.0005-0.0024 5.0L (302 CID)
	0.0008-0.0026 5.8L (351 CID)
Bearing Wall Thickness (Std) (5)	No. 1 = 0.0961-0.0966 5.0L (302 CID)
	All others 0.0957-0.0962 5.0L (302 CID)
	0.0957-0.0960 5.8L (351 CID)

(5) For 0.002 undersize, add 0.001 to standard thickness.

(6) Pin bore and crank bearing bore must be parallel and in same vertical plane within the specified total difference when measured at the ends of an 8" bar, 4" on each side of rod centerline.

(7) Measured at the piston pin bore centerline, at 90° to the pin.

CONNECTING ROD, PISTON AND RINGS

CONNECTING ROD

Piston Pin Bore Diameter	0.9096-0.9112
Crankshaft Bearing Bore Diameter	2.2390-2.2398 5.0L (302 CID)
	2.4265-2.9273 5.8L (351 CID)
Out-Of-Round Limit	0.004 Max.
Taper Limit	0.004 Max.
Length (Center-to-Center)	5.0885-5.0915 5.0L (302 CID)
	5.9545-5.9575 5.8L (351 CID)
Alignment (Bore-to-Bore Max Diff) (6)	
Twist	0.024
Bend	0.012
Side Clearance (Assembled to Crank)	
Standard	0.010-0.020
Service Limit	0.023

PISTON

Diameter (7)	
Coded Red	3.9984-3.9990 5.0L (302 CID)
	3.9978-3.9984 5.8L (351 CID)
Coded Blue	3.9996-4.0002 5.0L (302 CID)
	3.9990-3.9996 5.8L (351 CID)
0.003 Oversize	4.0008-4.0014 5.0L (302 CID)
	4.0002-4.0008 5.8L (351 CID)
Coded Yellow	4.0020-4.0026 5.0L (302 CID)
	4.0014-4.0020 5.8L (351 CID)
Piston To-Bore Clearance	0.0018-0.0026
Pin Bore Diameter	0.9122-0.9127 5.0L (302 CID)
	0.9124-0.9127 5.8L (351 CID)

Ring Groove Width

Compression (Top)	0.080-0.091
Compression (Bottom)	0.080-0.091
Oil	0.188-0.189

PISTON PIN

Length	3.010-3.040
Diameter	
Standard	0.9119-0.9124
0.001 Oversize	0.9130-0.9133
0.002 Oversize	0.9140-0.9143
Pin-To-Piston Clearance	0.0002-0.0004 5.0L (302 CID)
	0.0003-0.0005 5.8L (351 CID)

Pin-To-Rod Clearance

PISTON RINGS

Ring Width	
Compression (Top)	0.077-0.078
Compression (Bottom)	0.077-0.078
Side Clearance	
Compression (Top)	0.002-0.004
Compression (Bottom)	0.002-0.004
Oil Ring	Snug Fit
Service Limit	0.006
Ring Gap	
Compression (Top)	0.010-0.020
Compression (Bottom)	0.010-0.020
Oil Ring (Steel Rail)	0.015-0.055

LUBRICATION SYSTEM

OIL PUMP

Relief Valve Spring Tension (Lbs at Spec. Length)	10.6-12.2 @ 1.704 5.0L (302 CID) 18.2-20.2 @ 2.49 5.8L (351 CID)
Drive Shaft-To-Housing Bearing Clearance	0.0015-0.0030
Relief Valve-To-Bore Clearance	0.0015-0.0030
Rotor Assembly End Clearance (Assembled)	0.004 Max.
Outer Race-To-Housing Clearance	0.001-0.013
OIL CAPACITY (Quarts U. S.)	4 (8)

FUEL PUMP

STATIC PRESSURE (P. S. I.) (9)	6.0-8.0
MINIMUM VOLUME FLOW (9) (10)	1 pt./20 sec.
ECCENTRIC TOTAL LIFT (inches)	0.690-0.710

TORQUE SPECIFICATIONS - SPECIAL APPLICATIONS

CAMSHAFT SPROCKET TO CAMSHAFT	40-45
CAMSHAFT THRUST PLAT TO BLOCK	9-12
CONNECTING ROD NUTS OR BOLTS	19-24 5.0L (302 CID) 40-45 5.8L (351 CID)
CYLINDER FRONT COVER BOLTS	12-18
CYLINDER HEAD BOLTS	5.0L (302) (11) 5.8L (351) (12)
DAMPER OR PULLEY TO CRANKSHAFT	70-90
DISTRIBUTOR VACUUM CONTROL VALVE	15-18
EGR VALVE TO CARBURETOR SPACER OR INT MANIFOLD	12-18
FUEL PUMP TO CYLINDER BLOCK OR FRONT COVER	19-27
FLYWHEEL TO CRANKSHAFT	75-85
MAIN BEARING CAP BOLTS	60-70 5.0L (302 CID) 95-105 5.8L (351 CID)
MANIFOLD TO CYLINDER HEAD (Intake)	23-25 (15)
MANIFOLD TO CYLINDER HEAD (Exhaust)	18-24
OIL FILTER INSERT TO CYLINDER BLOCK	20-30
OIL FILTER TO BLOCK OR ADAPTER	(13)
OIL INLET TUBE TO OIL PUMP	10-15
OIL PAN DRAIN PLUG	15-25
OIL PAN TO CYLINDER BLOCK	5/16 - 11-13/14 - 7-9
OIL PUMP TO CYLINDER BLOCK	22-32
PULLEY TO DAMPER (Bolt)	35-50
ROCKER ARM STUD NUT	17-23 (14)
ROCKER ARM STUD OR BOLT TO CYLINDER HEAD	Press Fit
SPARK PLUG TO CYLINDER HEAD	10-15
VALVE ROCKER ARM COVER	3-5
ALTERNATOR BRACKET TO CYLINDER BLOCK (Bolt)	12-18
ALTERNATOR PIVOT BOLT	45-57
ALTERNATOR ADJUSTING ARM TO CYLINDER BLOCK	15-20
THERMACTOR PUMP BRACKET TO CYLINDER BLOCK	12-18
THERMACTOR PUMP PIVOT BOLT	22-32
THERMACTOR PUMP ADJUSTING ARM TO PUMP	22-32
THERMACTOR PUMP ADJUSTING ARM TO CYLINDER BLOCK	12-18
THERMACTOR PUMP TO SHAFT	130-180 In.-Lb.
POWER STEERING PUMP PULLEY TO DAMPER (Bolt)	35-50
FAN TO WATER PUMP HUB (Bolt)	12-18
CARBURETOR MOUNTING NUTS	12-15
CARBURETOR MOUNTING STUD	15 Max.
FUEL FILTER TO CARBURETOR	80-100 In.-Lb.
ALTERNATOR ADJUSTING ARM TO ALTERNATOR	24-40

TORQUE SPECIFICATIONS - General Application

U. S. THREAD SIZES	TORQUE
1/4-20	6-9
5/16-18	12-18
5/16-24	14-20
3/8-16	22-32
3/8-24	27-38
7/16-14	40-55
7/16-20	40-60
1/2-13	55-80

PIPE THREAD SIZES	TORQUE
1/8	5-8
1/4	12-18
3/8	22-33
1/2	25-35

- o All values are in ft.-lb. unless otherwise noted
o Oil threads with engine oil unless fasteners require sealers.

- (8) Add 1 quart with filter change.
- (9) On engine, at normal operating temperature, with transmission in neutral.
- (10) No restriction in test circuit smaller than 0.220".
- (11) Torque in sequence: Step 1 = 55-65; Step 2 = 65-72
- (12) Torque in sequence: Step 1 = 95-105; Step 2 = 105-112
- (13) Advance 1/2 turn after gasket contacts sealing surface; with oiled gasket.
- (14) After contact with shoulder.
- (15) Retorque to specifications after engine is hot.

5.8L/6.6L (351 "M"/400 CID) V-8 Engines

PART
21-22

Ford, Mercury, LTD II, Cougar, Thunderbird, Lincoln Continental, Continental Mark V

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION		REMOVAL AND INSTALLATION (Cont'd.)	
Crankcase Ventilation System	22-1	Cylinder Heads	22-9
Engine	22-1	Engine	22-2
Exhaust Emission Control System	22-1	Engine Front Supports	22-3
DISASSEMBLY AND ASSEMBLY		Engine Rear Support	22-4
Cylinder Assembly	22-24	Exhaust Manifold	22-9
Cylinder Block	22-24	Flywheel	22-14
Cylinder Head	22-21	Front Oil Seal	22-13
Piston and Connecting Rod	22-23	Intake Manifold	22-7
Tappet	22-22	Main Bearing Inserts	22-16
REMOVAL AND INSTALLATION		Oil Filter	22-21
Camshaft	22-13	Oil Pan	22-14
Camshaft Bearing	22-20	Oil Pump	22-15
Camshaft Rear Bearing Bore Plug	22-14	Pistons and Connecting Rods	22-17
Connecting Rod Bearings	22-16	Tappets	22-8
Crankcase Ventilation System	22-5	Valve Rocker Arm Cover and	
Crankshaft	22-18	Rocker Arm	22-5
Crankshaft Rear Oil Seal	22-16	Valve Spring, Retainer and Stem Seal	22-6
Cylinder Front Cover Plate		Water Pump	22-10
and Timing Chain	22-11	SPECIFICATIONS	22-25

CA4287-2B

DESCRIPTION

ENGINE

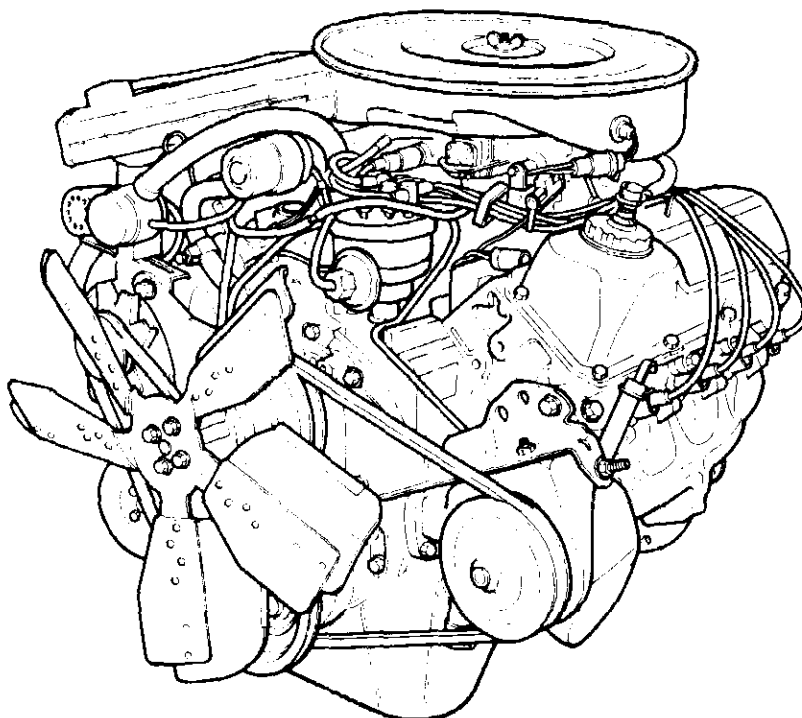
The 5.8L (351M CID) and 6.6L (400 CID) V-8 engines are basically of the same design and structure. Except for a revised crankshaft damper, the difference between the 2 engines is internal and consists of the following: the 5.8L (351M CID) V-8 engine has a shorter stroke, accomplished by using a revised crankshaft and a piston with an increased compression height (piston pin to top of piston). It also uses a revised camshaft for proper valve timing. Both engines are equipped with a thermactor air injection system for reduced engine emissions (Fig. 1).

EXHAUST EMISSION CONTROL SYSTEM

Operation, removal, installation and required maintenance of the exhaust emission control devices used on these engines are covered in Group 29 and Group 50 of this Manual.

CRANKCASE VENTILATION SYSTEM

The engine is equipped with a positive closed-type crankcase ventilation system re-cycling the crankcase vapors to the intake manifold.



A4071-2C

FIG. 1 Right Front View—(Typical)

REMOVAL AND INSTALLATION

Caution: Do not operate engine with hood open until fan has been first examined for possible cracks and separation.

When installing nuts or bolts that must be torqued (see Specifications), oil the threads with light weight engine oil. **Do not oil threads that require oil-resistant or water-resistant sealer.**

ENGINE

Removal

Remove or disconnect Thermactor system parts that will interfere with removal or installation of the engine.

1. Disconnect the battery, drain the cooling system and remove the hood.
2. Remove the air cleaner and air intake tube assembly.
3. Disconnect the radiator upper hose at the engine and the lower hose at the radiator. Disconnect the transmission oil cooler lines at the radiator.
4. Remove the fan shroud attaching bolts and position the shroud over the fan. Remove the radiator and shroud.
5. Remove the fan and spacer.
6. On vehicles equipped with air conditioning, loosen the idler pulley and remove the drive belt.
7. Loosen the alternator and remove the drive belt.
8. Loosen and remove the power steering pump drive belt.
9. Remove the water pump pulley.
10. Remove the power steering pump brackets and position the pump out of the way in an upright position to prevent fluid loss.
11. On vehicles equipped with air conditioning, isolate and remove the compressor as outlined in Group 36.
12. Remove the alternator and bracket. Position the alternator out of the way. Disconnect the alternator ground wire from the cylinder block.
13. Disconnect the heater hoses at the block and water pump.
14. Remove the ground wires from the cylinder block and right cylinder head.
15. Disconnect the fuel line at the fuel pump. Plug the fuel tank line. Disconnect the vacuum lines at the rear of the intake manifold. Disconnect vacuum control valve hoses and wires on engines so equipped.
16. Disconnect the accelerator cable or linkage at the carburetor and intake manifold. Disconnect transmission downshift linkage, if so equipped.
17. Disconnect the engine wire harness at the ignition coil, water temperature sending unit and oil pressure sending unit. Remove the wire harness from the hold down clips.
18. Raise the vehicle and secure with safety stands.
19. Disconnect the exhaust system at the exhaust manifolds and remove the exhaust heat control valve (if so equipped) or the exhaust manifold-to-pipe spacer.
20. Disconnect the starter cable and remove the starter.

21. Remove the engine front support through bolts and the starter cable clamp at the engine right front support.

22. Remove the converter inspection cover and disconnect the flexplate from the converter. Remove the downshift rod.

Remove the four converter lower housing-to-engine block bolts and the adapter plate-to-converter housing bolt.

23. Lower the vehicle.
24. Remove the two converter housing upper bolts.
25. Attach engine lifting sling (Tool No. T53L-300-A or equivalent), and hoist, to lifting brackets at exhaust manifolds.
26. Position a jack under the transmission.
27. Raise the engine slightly and carefully pull it from the transmission. Carefully lift the engine out of the engine compartment so that the rear cover plate is not bent or components damaged. Install the engine on a work stand.

Installation

1. Attach an engine lifting sling, Tool No. T53L-300-A or equivalent, and hoist to lifting brackets at exhaust manifolds. Remove engine from work stand.
2. Lower the engine carefully into the engine compartment.

Start the converter pilot into the crankshaft.

3. Install the converter housing upper bolts, making sure that the dowels in the cylinder block engage the flywheel housing. Remove the jack from under the transmission.
4. Remove the lifting sling.
5. Position the downshift rod on the transmission and engine.
6. Raise the vehicle and secure with safety stands.
7. Position the transmission linkage bracket and install the remaining converter housing bolts. Install the adapter plate-to-converter housing bolts. Install the converter-to-flywheel nuts and install the inspection cover. Connect the downshift rod to the transmission.
8. Install the starter and connect the cable.
9. Install the exhaust heat control valve (if so equipped) or manifold-to-pipe spacer and connect the exhaust system to the exhaust manifolds.
10. Install the engine front support through bolts and install the starter cable clamp at the engine right front support.
11. Lower the vehicle.
12. Connect the ground wire at the right cylinder head. Install the engine wire harness and connect it to the ignition coil, then install the water temperature sending unit and oil pressure sending unit.
13. Install the accelerator linkage and connect the downshift rod.
14. Connect the vacuum lines at the rear of the intake manifold. Connect the fuel tank line at the fuel pump.

15. Connect the battery ground wire to the right front of cylinder block. Connect the heater hoses to the water pump and cylinder block.
16. Install the alternator and bracket. Connect the alternator ground wire to the cylinder block.
17. On a vehicle with air conditioning, install the air conditioning compressor and brackets as outlined in Group 36.
18. Install the power steering pump and brackets. Install all parts of the Thermactor system that were disconnected and/or removed.
19. Install the water pump pulley, fan and spacer. Install the drive belts on their respective pulleys and adjust the belt tension to specification.
20. Position the fan shroud over the fan. Install the radiator and connect the radiator upper and lower hoses. Install the fan shroud attaching bolts.
21. Fill and bleed the cooling system. Fill the crankcase with the proper grade and quantity of oil. Adjust the transmission downshift linkage. Connect the battery.
22. Operate the engine at fast idle until it reaches normal operating temperature and check all gaskets and hose connections for leaks. Adjust ignition timing and idle speed.
23. Install the air cleaner and air inlet tube. Install and adjust the hood.

ENGINE FRONT SUPPORTS

Whenever self-locking mounting bolts and nuts are removed, they must be replaced with new self-locking fasteners. (Marked * in Figs. 2, 3 and 4).

The front supports are located on each side of the cylinder block (Figs. 2, 3 and 4). The procedures given apply to either a right or left installation.

INSULATOR ASSEMBLY

6C060 L.H.

6C010 R.H.

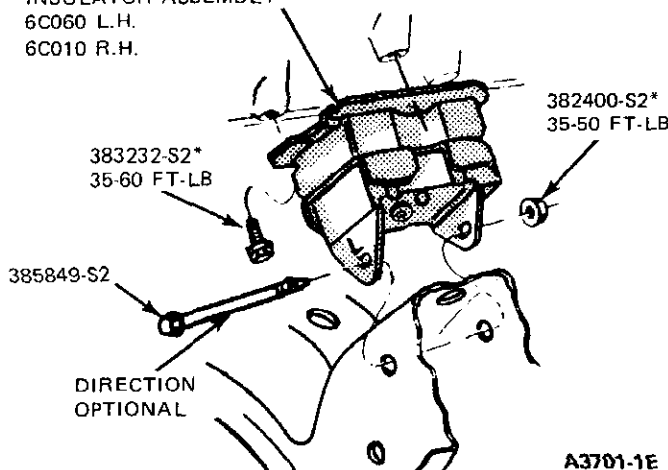


FIG. 2 Engine Front Supports—LTD II, Cougar, Thunderbird and Continental Mark V

Removal

1. Remove the fan shroud attaching bolts. On Ford, Mercury and Lincoln Continental, remove the transmission oil cooler inlet and outlet lines from the retaining bracket on the block.
2. Remove the through bolt and lock nut attaching the insulator to the insulator support bracket (No. 2 crossmember on LTD II, Cougar, Thunderbird and Continental Mark V). On Ford, Mercury, remove the

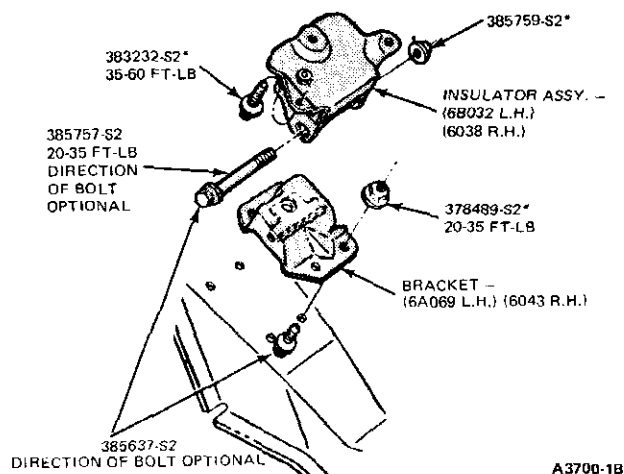


FIG. 3 Engine Front Support—Ford and Mercury

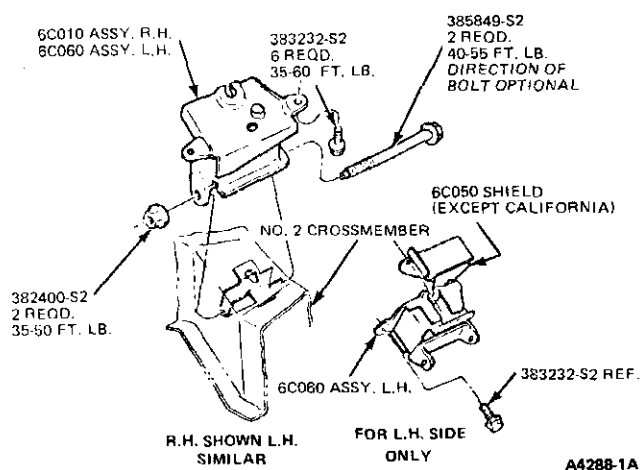


FIG. 4 Engine Front Support—Lincoln Continental

nut and through bolt on the opposite mount to prevent distortion of the insulator.

3. Raise the engine slightly with a jack and a wood block placed under the oil pan.
4. Remove the engine insulator assembly to cylinder block attaching bolts. Remove the engine insulator assembly and heat shield, if so equipped.

Installation

1. Position the engine insulator assembly and heat shield, if so equipped, to the cylinder block and install the attaching bolts. Tighten the bolts to specification.
2. Lower the engine into position, install the engine insulator assembly to the support bracket (No. 2 crossmember on LTD II, Cougar, Thunderbird and Continental Mark V). Install the through bolt and remove the jack and wood block.
3. Install the engine insulator assembly. Tighten the nut to specification. On Ford and Mercury, install the transmission oil cooler lines in the retaining bracket on the cylinder block.

4. Install the fan shroud attaching bolts.

ENGINE REAR SUPPORT

The rear support is located at the transmission extension housing (Figs. 5, 6 and 7). **Whenever self-locking mounting bolts and nuts are removed, they must be replaced with new self-locking bolts and nuts.** (Marked * in Figs. 5, 6 and 7).

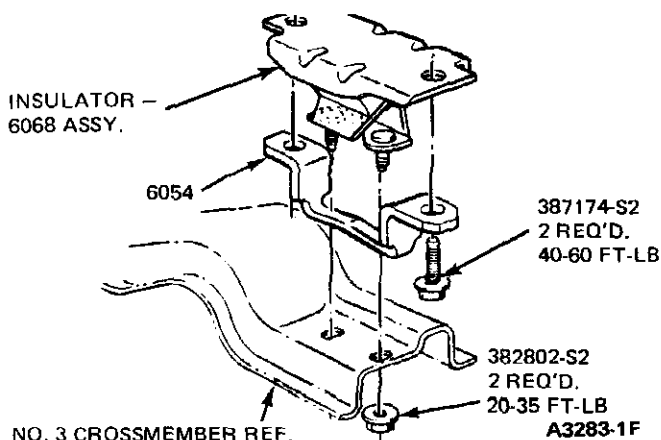


FIG. 5 Engine Rear Support—LTD II, Cougar and Thunderbird

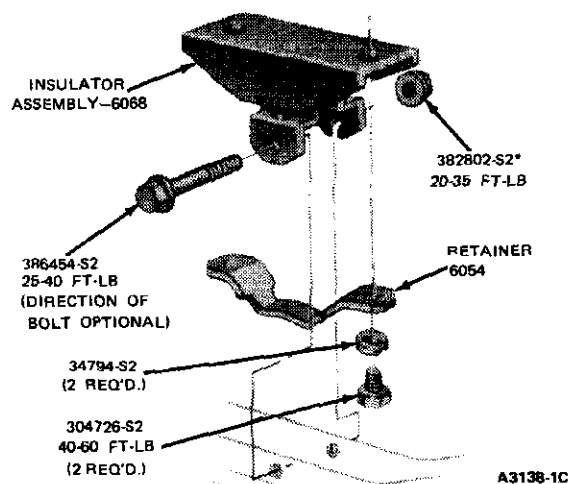


FIG. 6 Engine Rear Support—Ford and Mercury

Removal

1. Support the transmission with a floor jack to remove weight from the supporting crossmember.
2. Remove the nuts attaching the insulator assembly to the crossmember.
3. On LTD II, Cougar and Thunderbird, remove or loosen the bolts attaching the supporting crossmember for repositioning or removal as necessary to remove the insulator assembly.
4. Remove the bolts and washers that attach the engine rear insulator to the transmission.
5. Remove the insulator assembly.

Installation

1. Position the engine rear insulator assembly in place beneath the transmission. Install the attaching bolts and washers and torque to specification.

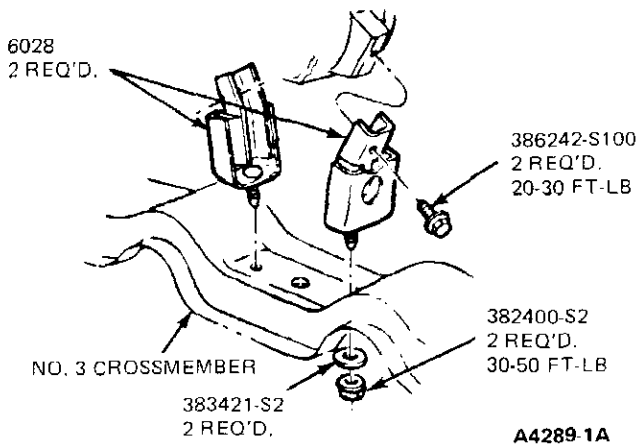
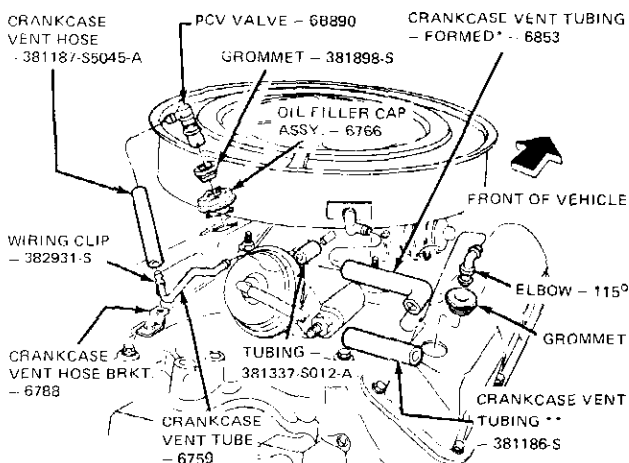


FIG. 7 Engine Rear Support—Lincoln Continental and Continental Mark V

- On LTD II, Cougar and Thunderbird, position the supporting crossmember. Install/tighten the bolts to proper torque specification.
- Install the nuts attaching the insulator assembly to the crossmember.
- Remove the floor jack.

CRANKCASE VENTILATION SYSTEM

The crankcase ventilation system components are shown in Fig. 8.



* LTD II, COUGAR AND THUNDERBIRD WITH A/C
** ALL OTHER APPLICATIONS

A4070-1C

FIG. 8 Typical Crankcase Ventilation System Components

Removal

- Remove the ventilation system air intake hose from the air cleaner.
- Remove the crankcase vent hose from the PCV valve located in oil fill cap.

- Remove the air cleaner and intake duct assembly.
- Disconnect the crankcase vent hose from the carburetor.
- Pull the PCV valve out of the oil fill cap.
- Remove the crankcase ventilation filter from the air cleaner body.

Installation

- Install the crankcase ventilation filter in the air cleaner body.
- Insert the PCV valve into the oil fill cap mounting grommet.
- Connect the vent hose to the carburetor.
- Install the air cleaner and intake duct assembly.
- Install the ventilation system air intake hose to the air cleaner and the PCV valve.
- Start the engine and check for leaks.

VALVE ROCKER ARM COVER AND ROCKER ARM

The valve rocker arm is shown in Fig. 9.

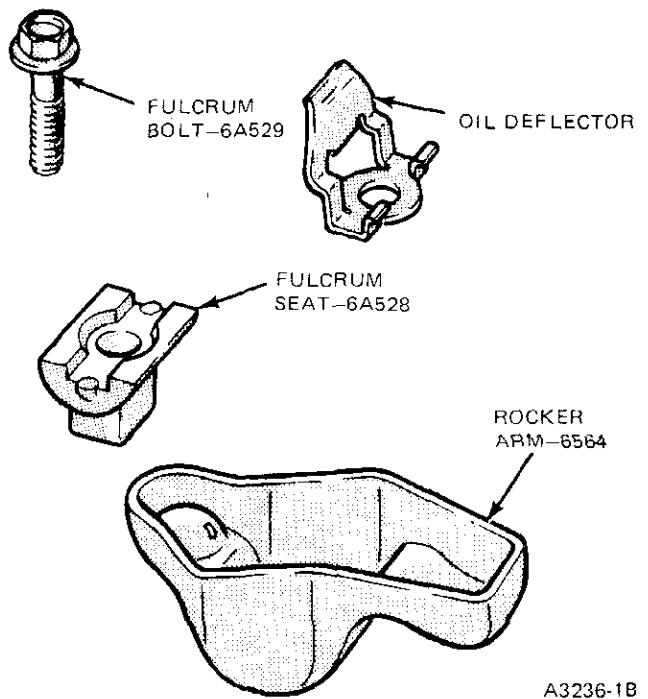


FIG. 9 Rocker Arm and Related Parts

Removal

- Remove the air cleaner and air inlet tube assembly. Remove appropriate crankcase ventilation hose(s) at the valve rocker arm cover(s).
- Disconnect the spark plug wires from the spark plugs by grasping, twisting and pulling the molded cap only with the proper tool. Remove the wires from the bracket on the valve rocker arm cover(s) and position the wires out of the way.
- Remove the valve rocker arm cover(s).
- Remove the valve rocker arm bolt, oil deflector, fulcrum seat and rocker arm.

Installation

All rocker arms and fulcrum seats are to be lubricated with heavy engine oil SE before installation.

1. Apply Lubriplate or equivalent to the top of the valve stem. Lubricate the rocker arm and fulcrum seat with heavy engine oil SE.
2. Position the No. 1 piston on TDC at the end of the compression stroke, POSITION 1 in Fig. 10, and install the rocker arm, fulcrum seat, oil deflector, and fulcrum bolts on the following valves:

No. 1 Intake No. 1 Exhaust

No. 4 Intake No. 3 Exhaust

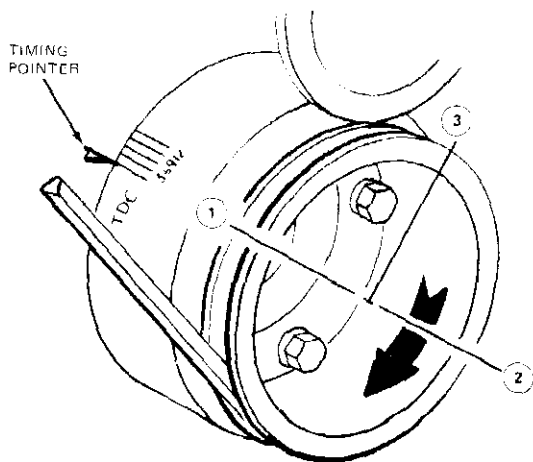
No. 8 Intake No. 7 Exhaust

Position the crankshaft in POSITION 2 in Fig. 10 and install the rocker arm, fulcrum seat, oil deflector and fulcrum bolts on the following valves:

No. 3 Intake No. 2 Exhaust

No. 7 Intake No. 6 Exhaust

With No. 1 at TDC at end of compression stroke make a chalk mark at points 2 and 3 approximately 90 degrees apart.



- POSITION 1 - No. 1 at TDC at end of compression stroke
- POSITION 2 - Rotate the crankshaft 180 degrees (one half revolution) clockwise from POSITION 1.
- POSITION 3 - Rotate the crankshaft 270 degrees (three quarter revolution clockwise) from POSITION 2.

A3234-1D

FIG. 10 Position of Crankshaft for Installing Rocker Arms

Position the crankshaft in POSITION 3 in Fig. 10 and install the rocker arm, fulcrum seat, oil deflector and fulcrum bolts on the following valves:

No. 2 Intake No. 4 Exhaust

No. 5 Intake No. 5 Exhaust

No. 6 Intake No. 8 Exhaust

Be sure that the fulcrum seat base is seated in its slot on the cylinder head before tightening the fulcrum bolts. Tighten the fulcrum bolt to specification. Check the valve clearance following the procedures under Valve Clearance Adjustment in Part 21-01.

3. Clean the valve rocker arm cover(s) and the cylinder head gasket surface(s). Apply oil-resistant sealer to one side of new cover gasket(s). Lay the cemented side of the gasket(s) in place in the cover(s).

4. Position the cover(s) on the cylinder head(s). Make sure the gasket seats evenly all around the head. Install the bolts. The cover is tightened in two steps. Tighten the bolts to specification. Two minutes later, tighten the bolts to the same specification.

Reconnect the crankcase ventilation hose(s).

Install the air cleaner and intake duct assembly.

5. Install the spark plug wires in the bracket on the valve rocker arm cover(s). Connect the spark plug wires. See Part 23-01 for special installation instructions.

6. Start the engine and check for leaks.

VALVE SPRING, RETAINER AND STEM SEAL

Broken valve springs or damaged valve stem seals and retainers may be replaced without removing the cylinder head, provided damage to the valve or valve seat has not occurred.

Removal

1. Remove the required rocker arm(s) following the instructions given in Rocker Arm Removal.
2. Install an air line with an adapter in the spark plug hole and turn on the air supply.
3. Install the compressor tool as shown in Fig. 11. Compress the valve spring and remove the retainer locks, spring retainer and valve spring.
4. Remove and discard the valve stem seal (Fig. 17).

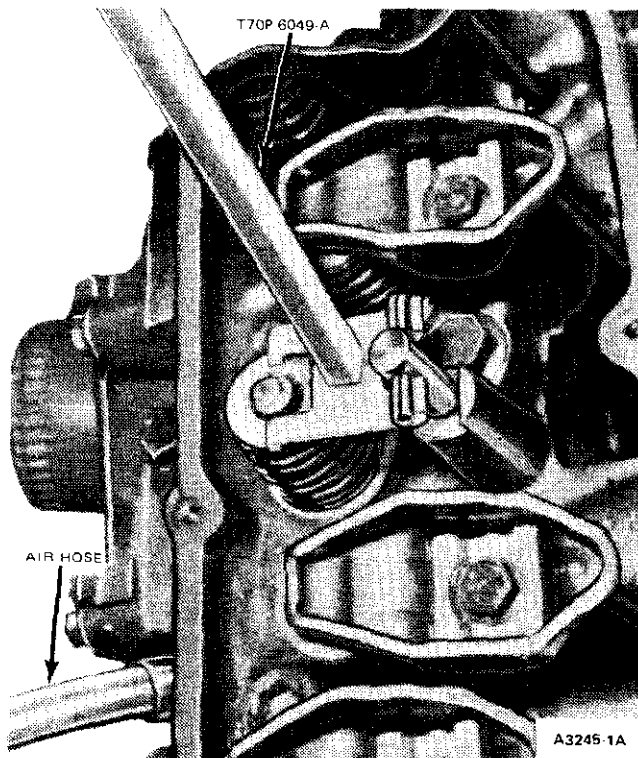
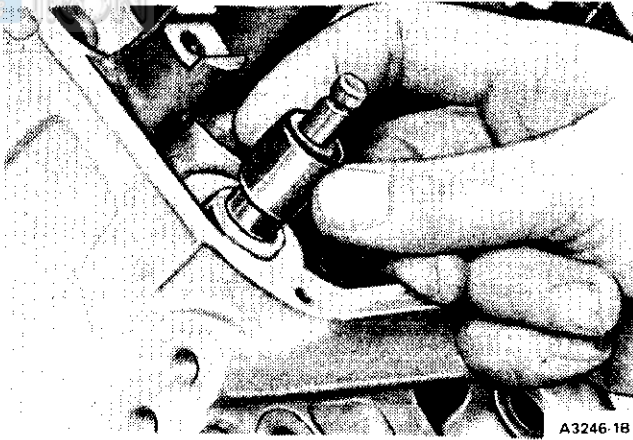


FIG. 11 Compressing Valve Spring in Chassis

5. If air pressure has forced the piston to the bottom of the cylinder, any removal of air pressure will allow the valve(s) to fall into the cylinder. A rubber band, tape or string wrapped around the end of the valve stem will prevent this condition and will still allow enough travel to check the valve for binds.



A3246-1B

FIG. 12 Removing or Installing Valve Stem Seal

Installation

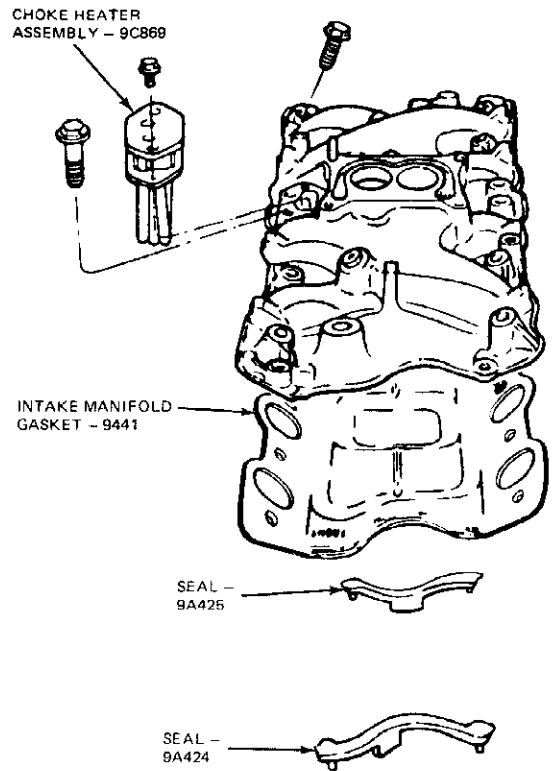
1. Inspect the valve stem for damage. Rotate the valve and check the valve stem tip for eccentric movement during rotation. Move the valve up and down through normal travel in the valve guide and check the stem for binds. **If the valve has been damaged, it will be necessary to remove the cylinder head for repairs as outlined in Part 21-01.**
2. If the condition of the valve proves satisfactory, hold the valve in the closed position and apply the air pressure within the cylinder.
3. Lubricate the valve stem with heavy engine oil SE.
4. Install a new valve stem seal (Fig. 11). Place the spring in position over the valve and install the valve spring retainer. Compress the valve spring and install the valve spring retainer locks. Remove the compressor tool and stud nut. Turn off the air and remove the air line adapter.
5. Lubricate and install the push rod. Apply Lubriplate or equivalent to the tip of the valve stem.
6. Install the required rocker arm(s) following the instructions given in Rocker Arm Installation.
7. Check the rocker arm to valve stem clearance and install the related parts as outlined in Valve Rocker Arm Cover and Rocker Arm Installation.

INTAKE MANIFOLD

A typical intake manifold assembly is shown in Fig. 13.

Removal

1. Remove the air cleaner and intake duct. On Ford and Mercury vehicles, with Frigidaire A/C compressor, isolate and remove the compressor, following procedure in Group 36.
2. Disconnect the high tension lead and wires from the coil. Disconnect the engine wiring harness and position it out of the way.
3. Disconnect the spark plug wires from the spark plugs by grasping, twisting and pulling the molded cap only. (Use Tool T75P-6666-A.) Remove the wires from the harness brackets on the valve rocker arm covers. Remove the distributor cap and spark plug wire assembly. Remove the Thermactor bypass valve and hose from the check valve.



A3238-1D

FIG. 13 Intake Manifold Assembly

4. Remove the carburetor fuel inlet line.
5. Remove the heater hoses from the retainers and position the hoses out of the way.
6. Remove the ignition coil, vacuum solenoid valve, and bracket.
7. Disconnect the crankcase emission hose at the left rocker arm cover.
8. Disconnect the vacuum lines from the intake manifold.
9. Disconnect the distributor vacuum hoses from the distributor. Disconnect the distributor wiring harness. Remove the distributor hold down bolt and clamp and remove the distributor. Block the distributor hole with a rag to prevent entry of foreign material into the crankcase.
10. Disconnect the accelerator linkage and position out of the way.
11. Remove the carburetor.
12. Remove the manifold attaching bolts. Remove the manifold. Remove and discard the intake manifold gasket and seals.
13. If the manifold assembly is to be disassembled, disconnect vacuum hoses.

Installation

1. Clean the mating surfaces of the intake manifold, cylinder heads and cylinder block. Use a solvent such as lacquer thinner, chlorothane or tri-chlor-ethylene. Apply a 1/8 inch bead of silicone rubber sealer at the points shown in Fig. 14. **Caution: Do not apply sealer to waffle section of end seals as the sealer will rupture the seal material.**

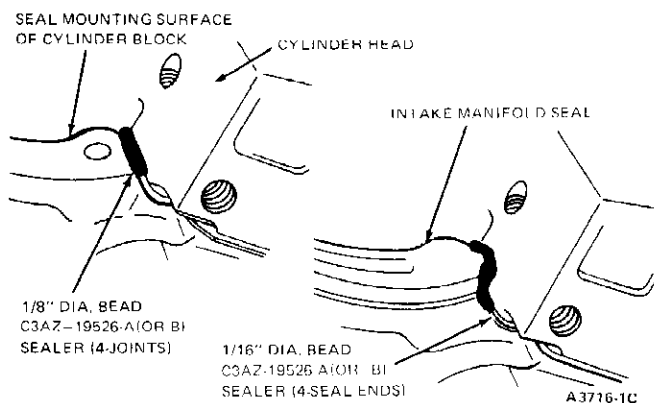


FIG. 14 Typical RTV Sealer Installation—Intake Manifold

2. Position new seals on the cylinder block and press the seal locating extensions into the holes in the mating surface.
3. Apply a 1/16 inch bead of the above sealer to the outer end of each intake manifold seal for the full width of the seal (4 places). See Fig. 14. **Caution:** Do not apply sealer to waffle section of end seals as the sealer will rupture the seal material. **NOTE:** This sealer sets up in 15 minutes, so it is important that assembly be completed promptly. Do not drip any sealer into the engine valley. **Position the intake manifold gasket onto the block and cylinder heads with the alignment notches under the dowels on the cylinder heads. Be sure the holes in the gasket are aligned with the holes in the cylinder head.**
4. Carefully lower the intake manifold into position on the cylinder block and cylinder heads.
5. Be sure the holes in the manifold gaskets and manifold are in alignment. Install the intake manifold attaching bolts. Tighten the intake manifold bolts in three steps (Fig. 15).

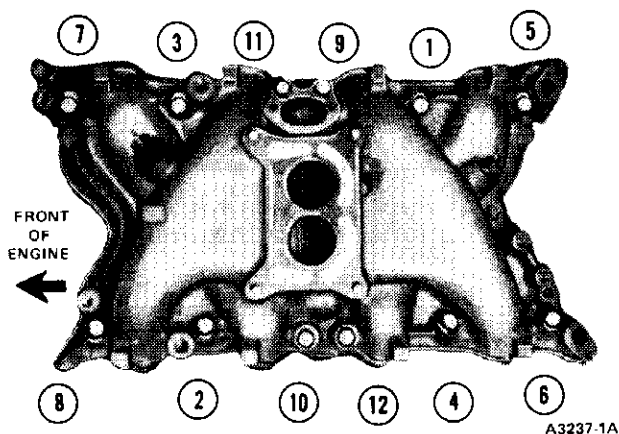


FIG. 15 Intake Manifold Torque Sequence

Tighten all bolts in sequence to specification.

After completing the remaining assembly steps, operate the engine until it reaches normal operating temperature then re-tighten the manifold bolts in sequence to specification.

6. Install the carburetor and gasket.

7. Rotate the crankshaft damper until the No. 1 piston is on TDC at the end of the compression stroke. Position the distributor in the block with the rotor at the No. 1 firing position. Install the hold down clamp and connect the distributor wiring harness.
8. Install the accelerator linkage.
9. Install the vacuum solenoid valve and the ignition coil.
10. Connect the vacuum lines at the manifold. Install the Thermactor by-pass air supply hose.
11. Position the engine wiring harness under the hold down clips on the left rocker arm cover and connect the wires at the ignition coil, water temperature sending unit and throttle solenoid (if equipped).
12. Connect the crankcase emission hose at the left hand rocker arm cover.
13. Install the heater hoses in the retainers.
14. Connect the fuel pump to carburetor fuel line at the carburetor.
15. Install the distributor cap. Position the spark plug wires in the harness brackets on the valve rocker arm covers and connect the wires to the spark plugs. See Part 23-01 for special installation instructions. On Ford and Mercury vehicles equipped with Frigidaire A/C compressor, install compressor following procedure in Group 36.
16. Start the engine and check for leaks. Adjust the ignition timing and connect the distributor vacuum lines.
17. When engine temperature has stabilized, adjust idle mixture and speed. Retorque the intake manifold to specification.
18. Install the air cleaner and re-check idle speed.

HYDRAULIC TAPPETS

Before replacing a tappet for noisy operation, be sure the noise is not caused by improperly adjusted valve clearance (collapsed tappet clearance) or by worn rocker arms or push rods.

The following procedure applies to the removal of one or all tappets. **NOTE:** Since not all pushrod holes are large enough to permit the removal of the associated lifter, it may be necessary to remove the adjacent rocker arm and pushrod and use that pushrod hole for access.

Removal

1. Remove the valve rocker arm covers.
2. Remove the valve necessary rocker arm(s) push rod(s) and identify them so that they can be installed in their original positions.
3. Using tool T70P-14151, remove the tappet(s) and place them in a rack so that they can be installed in their original bores (Fig. 16). If removing tappet through adjacent pushrod hole, use a small light to aid in transferring tappet into position for lifting out with T70P-14151 Tool.
4. Instructions for disassembling and assembling the tappets are given in Hydraulic Tappet—Disassembly and Assembly.

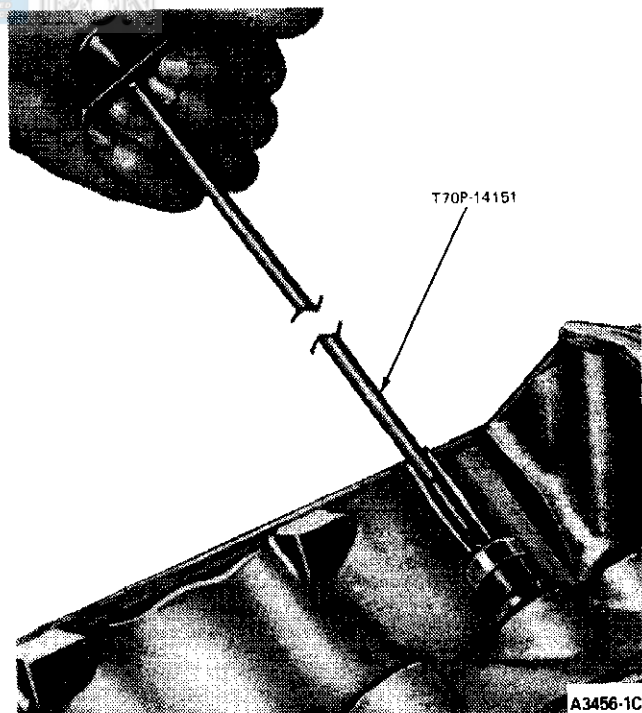


FIG. 16 Removing Hydraulic Tappets
Installation

Tappets and bores are to be lubricated with heavy engine oil SE before installation.

1. Clean the external surfaces of the tappets and install in the bores from which they were removed. If a tappet is being installed, check the new tappet(s) for a free fit in the bore in which it is to be installed. Lubricate the tappet(s) and bore(s) with heavy engine oil SE before inserting it in the bore.
2. Install the push rods in their original position. Apply Lubriplate or equivalent to the valve stem tips.
3. Install the rocker arm(s) following the instructions given in Rocker Arm Installation.
4. Check the rocker arm to valve stem tip clearance (collapsed tappet clearance), and install the related parts as outlined in Valve Rocker Arm Cover and Rocker Arm Installation.

EXHAUST MANIFOLD

Removal

1. If a right exhaust manifold is being removed, remove the air cleaner, intake duct and heat stove. If a left-hand exhaust manifold is being removed, first remove the oil filter.
2. On vehicles equipped with a column selector and automatic transmission, disconnect the selector lever cross shaft for clearance.
3. Disconnect the muffler inlet pipe or catalytic converter inlet pipe at the exhaust manifold. Remove the spark plug heat shields.
4. Remove the exhaust manifold attaching bolts and remove the manifold.

Installation

1. Clean the mating surfaces of the exhaust manifold and cylinder head. Clean the mounting flange of the exhaust manifold and muffler inlet pipe or catalytic converter inlet pipe.

2. Apply graphite grease to the mating surface of the exhaust manifold.
3. Position the exhaust manifold on the head and install the attaching bolts. Working from the center to the ends, tighten the bolts to specification. Install the spark plug heat shields.
4. Install the spacer between the inlet pipe and the exhaust manifold.
5. Connect the muffler inlet pipe or catalytic converter inlet pipe at the exhaust manifold. Tighten the attaching nuts to specification.
6. If a left exhaust manifold is being installed, install the oil filter.
On a vehicle with an automatic transmission and column selector, connect the selector cross shaft at the chassis and cylinder block.
7. If a right exhaust manifold is being replaced, install the air cleaner heat stove. Install the air cleaner and intake duct.
8. Start the engine and check for exhaust or oil leaks.

CYLINDER HEADS

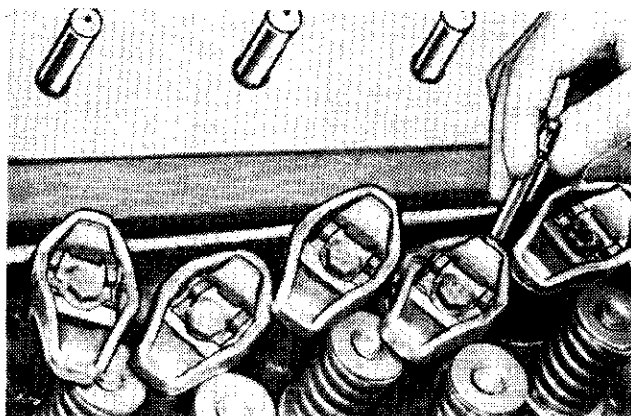
If a cylinder head is to be replaced, follow the procedures under Cylinder Head Disassembly and Assembly, and transfer all valves, springs, spark plugs, etc., to the new cylinder head. Clean and inspect all parts, reface the valves (refer to Part 21-01) and check all clearances before assembling the new or used parts to the new cylinder head.

Removal

1. Remove the intake manifold and carburetor as an assembly following the procedure under Intake Manifold Removal.
2. Remove the rocker arm cover(s).
If the left cylinder head is to be removed on a vehicle with an air conditioner, isolate and remove the compressor as outlined in Group 36.
If the left cylinder head is to be removed, disconnect the power steering pump bracket from the left cylinder head and remove the drive belt from the pump pulley. Position the power steering pump out of the way and in a position that will prevent the oil from draining out.
3. If the right cylinder head is to be removed, remove the alternator mounting bracket through bolt and air cleaner inlet duct from the right cylinder head assembly. Remove the ground wire at the rear of the cylinder head.
4. Disconnect the exhaust manifold(s) from the muffler inlet pipe(s) or catalytic converter inlet pipe(s).
5. Remove the rocker arm bolts, oil deflectors, rocker arms, and push rods in sequence (Fig. 17) so that they may be installed in their original positions.
6. Remove the cylinder head attaching bolts and lift the cylinder head off the block. Remove and discard the cylinder head gasket.

Installation

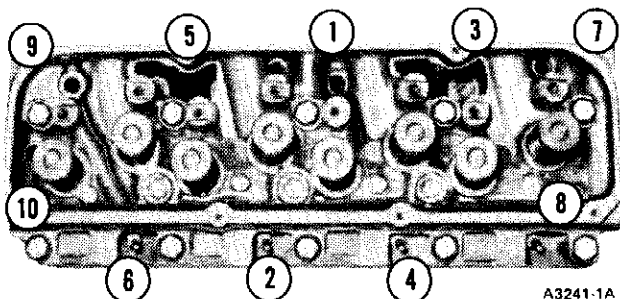
1. Clean the cylinder head, intake manifold, valve rocker arm cover and cylinder head gasket surfaces. If the cylinder head was removed for a cylinder head gasket replacement, check the flatness of the cylinder head and block gasket surfaces (see Part 21-01).



A3240-1B

FIG. 17 Removing Valve Push Rod

2. Position the new cylinder head gasket over the cylinder dowels on the block. Position the cylinder head on the block and install the attaching bolts.
3. The cylinder head bolts are tightened in three progressive steps. Tighten all the bolts in sequence (Fig. 18) to 75 ft-lbs, then to specification. When cylinder head bolts have been tightened following this procedure, it is not necessary to retorque the bolts after extended operation. However, the bolts may be checked and retorqued if desired.



A3241-1A

FIG. 18 Cylinder Head Bolt Torque Sequence

4. Clean the push rods in a suitable solvent. Blow out the oil passage in the push rod with compressed air. Check the ends of the push rods for nicks, grooves, roughness or excessive wear. Visually check the push rods for straightness or check push rod runout with a dial indicator. If runout exceeds the maximum limit at any point, discard the rod. **Do not attempt to straighten push rods.**
5. Lubricate and install the push rods in their original positions. Apply Lubriplate or equivalent to the valve stem tips.
6. Lubricate and install the rocker arms following procedures under Valve Rocker Arm Installation.
7. Connect the exhaust manifold(s) at the muffler inlet pipe(s) or catalytic converter inlet pipe(s). Tighten the nuts to specification.
8. If the right cylinder head was removed, install the alternator mounting bracket through bolt and air cleaner inlet duct on the right cylinder head assembly. Connect the ground wire at the rear of the cylinder head. Adjust the drive belt tension to specification.
9. Apply sealer to the rocker cover and cover gasket to hold gasket in place. Position gasket on cover aligning the holes in cover and gasket. Install the valve rocker arm cover(s).

If the left cylinder head was removed on a vehicle with an air conditioner, install the compressor as outlined in Group 36.

If the left cylinder head was removed, install the drive belt and power steering pump bracket. Install the bracket attaching bolts. Adjust the drive belt to specification.

10. Install the intake manifold and related parts following the procedure under Intake Manifold Installation.

WATER PUMP

Removal

1. Drain the cooling system and disconnect the battery.
2. Remove the air inlet tube and fan shroud attaching bolts and position the shroud rearward.
3. Remove the fan and spacer from the water pump shaft.
4. Remove the air conditioner compressor drive belt lower idler pulley and compressor mount to water pump bracket, if so equipped.
5. Loosen the alternator and remove the drive belt.
6. Loosen the power steering pump and remove the drive belt.
7. Remove the water pump pulley.
8. Remove the alternator bracket from water pump and position it out of the way.
9. Remove the power steering pump bracket from the water pump and position it out of the way.
10. Remove the heater hose from the water pump.
11. Disconnect the radiator lower hose at the water pump.
12. Remove the water pump attaching bolts and remove the water pump.

Installation

1. Remove all gasket material from the mounting surfaces of the cylinder front cover and water pump. On Ford and Mercury vehicles with Frigidaire A/C compressors, remove all gasket material from the water pump spacer.
2. Position a new gasket, coated on both sides with sealer, on the cylinder front cover (on spacer for Ford and Mercury vehicles with A/C compressor); then install the pump. Coat the threads of the attaching screws with oil-resistant sealer and install the screws. Tighten the attaching screws to specification.
3. Install the air conditioner compressor to water pump bracket and lower idler pulley, if so equipped.
4. Position the alternator bracket and power steering pump bracket on the water pump and install the bracket bolts.
5. Position the water pump pulley on the water pump shaft and install the drive belts.
6. Place the fan shroud over the pulley and install the fan and spacer.
7. Install the fan shroud and air inlet tube attaching bolts.
8. Adjust the drive belts to specification.