

2004 Cadillac SRX

2004 ENGINE Engine Mechanical - 4.6L (LH2) (Repair Instructions, 3 Of 5) - SRX

2004 ENGINE

Engine Mechanical - 4.6L (LH2) (Repair Instructions, 3 Of 5) - SRX

REPAIR INSTRUCTIONS

CYLINDER HEAD REMOVAL - LEFT

Tools Required:

J 28410 Gasket Remover

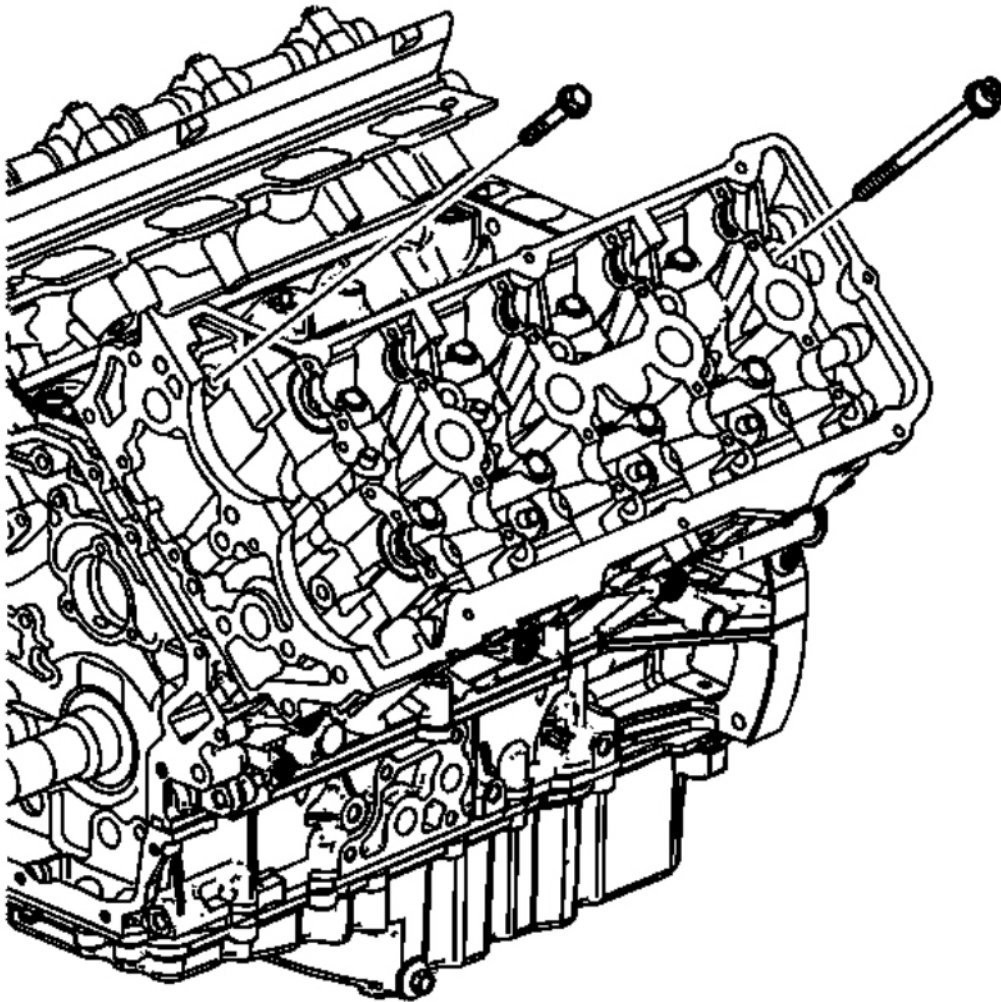


Fig. 1: View Of Left Cylinder Head M6 External Drive Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the 3 M6 external drive bolts from the front portion of the cylinder head.

IMPORTANT: DO NOT reuse the M11 cylinder head bolts.

2. Remove and discard the 10 M11 internal drive cylinder head bolts.

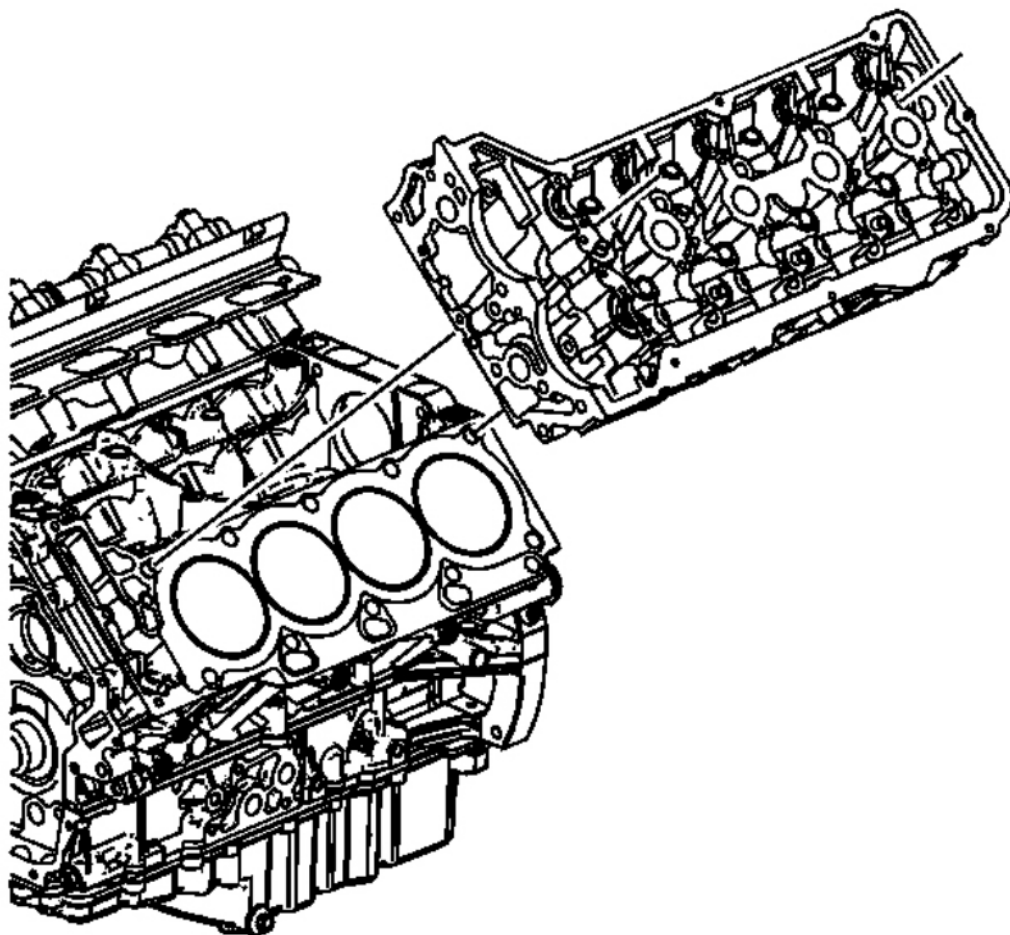


Fig. 2: View Of Left Cylinder Head
Courtesy of GENERAL MOTORS CORP.

3. Remove the left cylinder head. Ensure that no dowel guide pins are stuck in the cylinder head.

IMPORTANT: You must clean the thread sealant material from the cylinder head bolt holes in the cylinder block. Failure to do so could cause false torque readings during reassembly.

4. After removing the cylinder head, remove any remaining bolt thread sealant material from the threaded cylinder block holes.

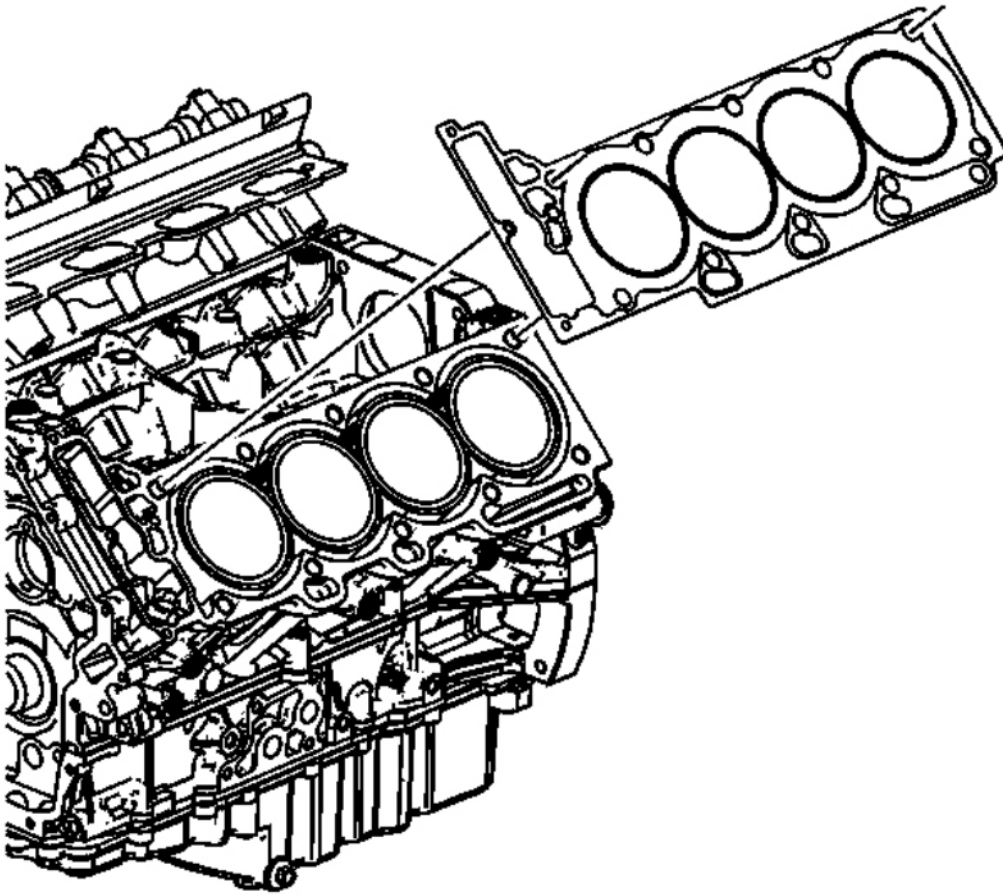


Fig. 3: View Of Left Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: DO NOT reuse the cylinder head gasket.

5. Remove the left cylinder head gasket.
6. Remove all remaining gasket material from the cylinder head and cylinder block using the **J 28410** .

CAMSHAFT REMOVAL - RIGHT EXHAUST

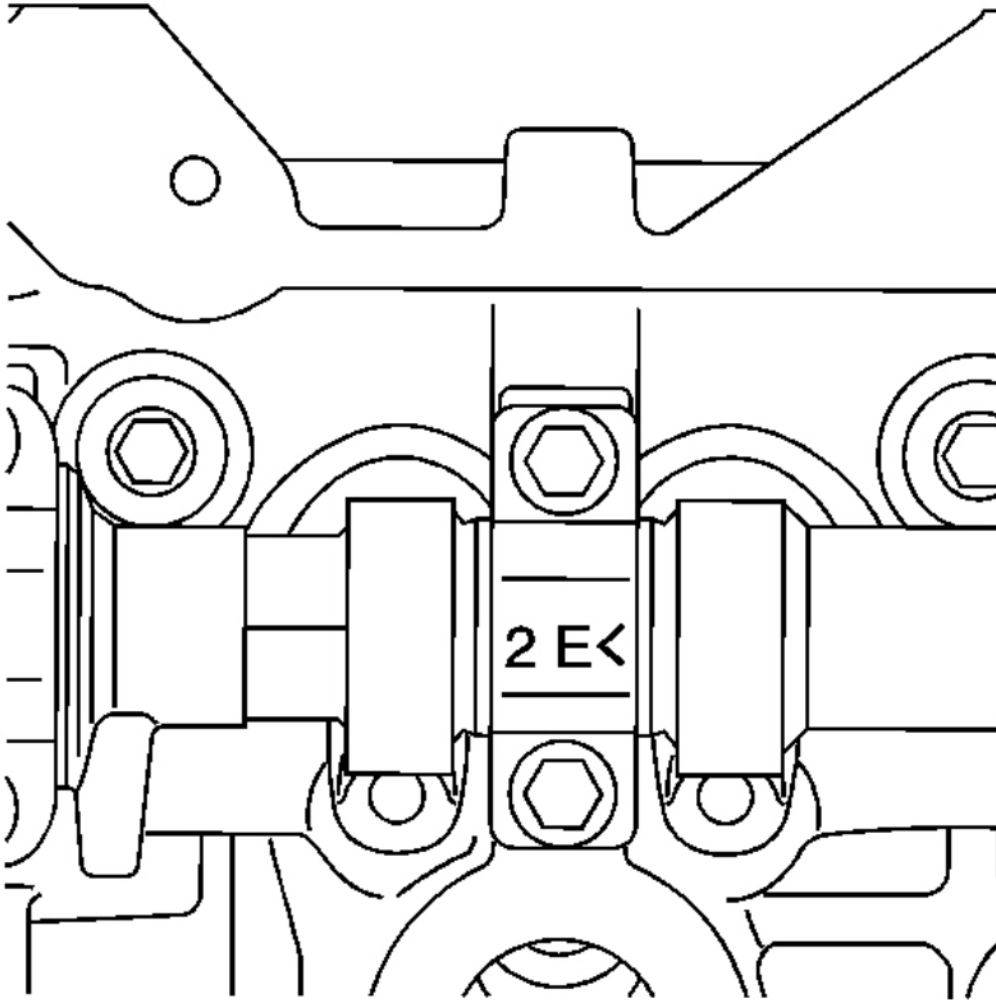


Fig. 4: View Of Exhaust Camshaft Bearing Cap Markings
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Bearing caps must remain with their original cylinder head and in their original location. Do not mix bearing caps.

1. Observe the markings on the bearing caps. Each bearing cap is marked in order to identify its location. The markings have the following meanings:
 - The arrow points toward the front of the engine.

- The "E" indicates the exhaust camshaft.
- The number indicates the journal position from the front of the engine.

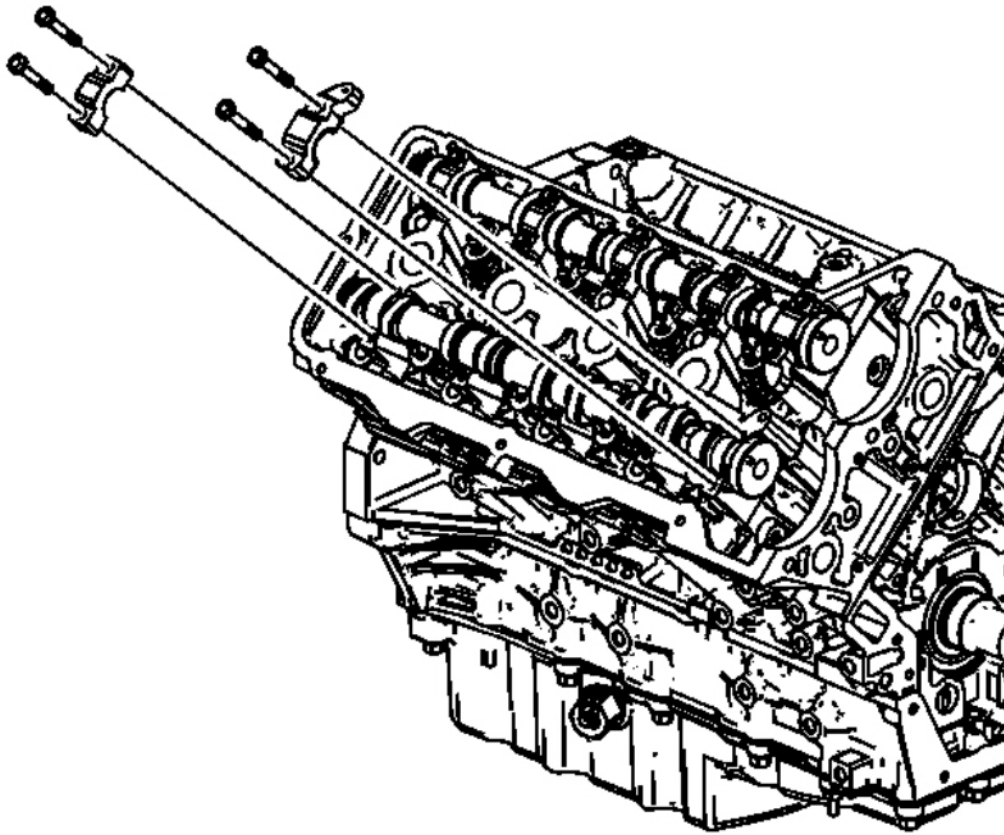


Fig. 5: View Of Right Exhaust Camshaft Bearing Caps
Courtesy of GENERAL MOTORS CORP.

2. Remove the right exhaust camshaft bearing cap bolts.
3. Remove the right exhaust camshaft bearing caps. Store the bearing caps in a clean shop towel.

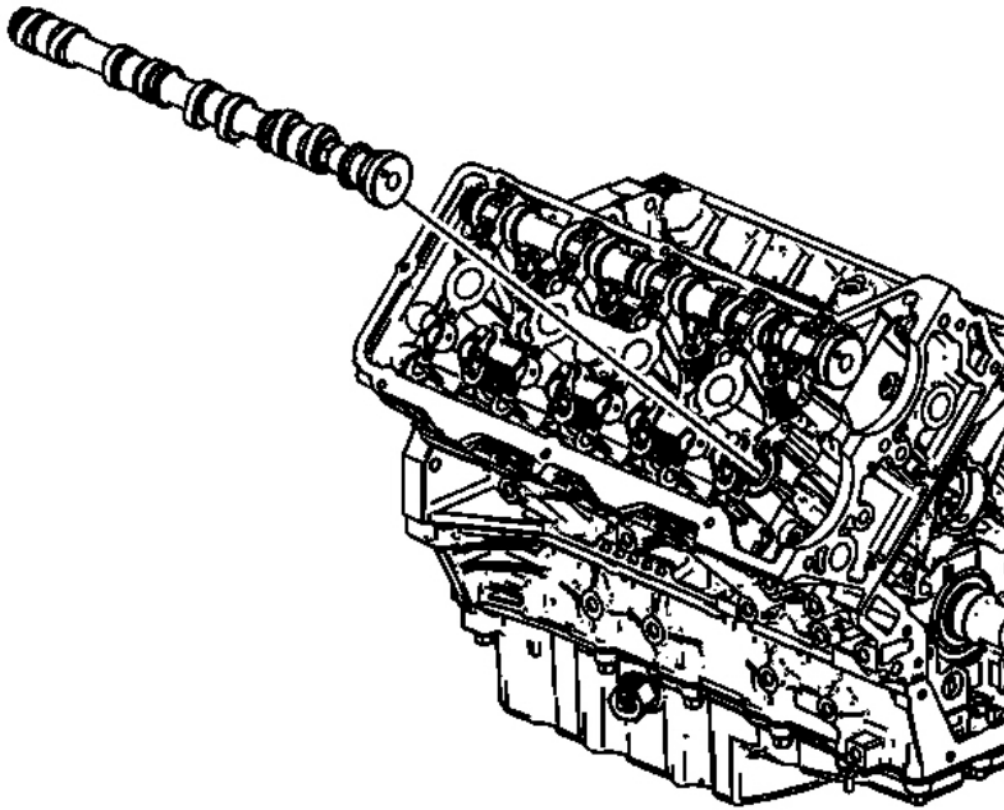


Fig. 6: View Of Right Exhaust Camshaft
Courtesy of GENERAL MOTORS CORP.

4. Remove the right exhaust camshaft. Place the camshaft in a secure location.
5. Cover the camshaft with an oil soaked towel in order to prevent corrosion.

CAMSHAFT REMOVAL - RIGHT INTAKE

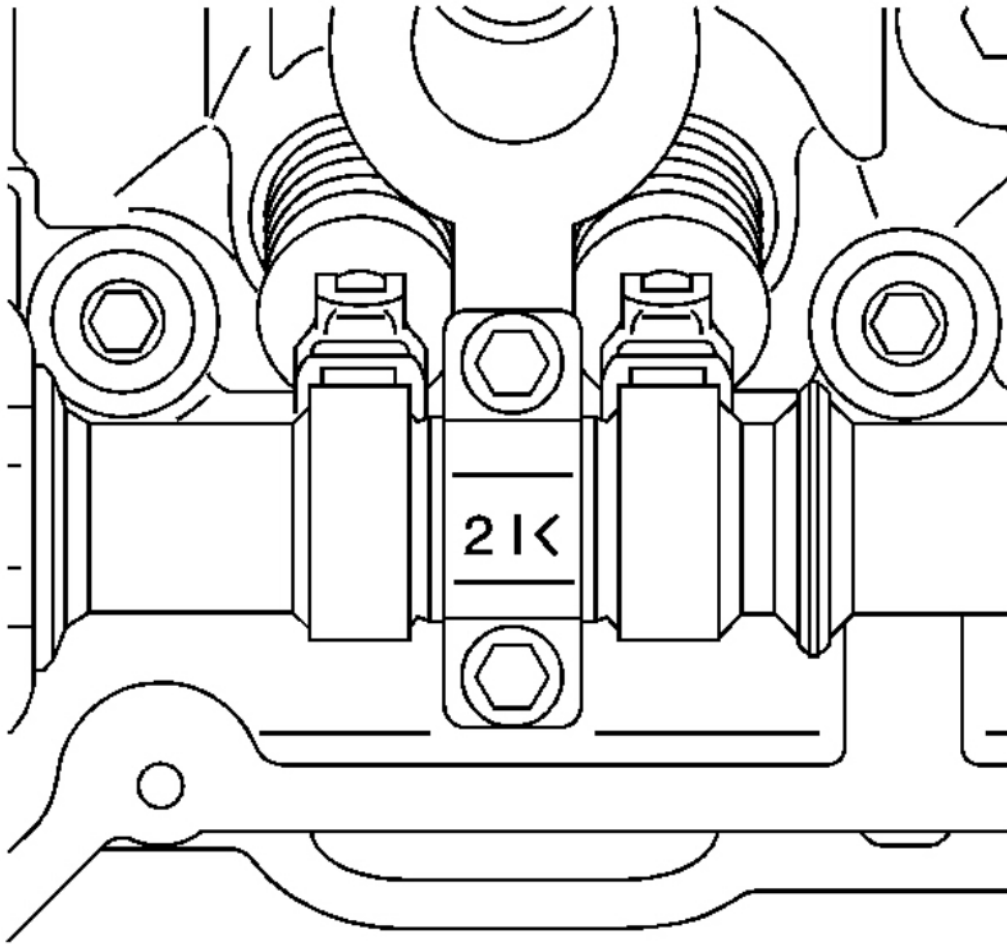


Fig. 7: View Of Intake Camshaft Bearing Cap Markings
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Bearing caps must remain with their original cylinder head and in their original location. Do not mix bearing caps.

1. Observe the markings on the bearing caps. Each bearing cap is marked in order to identify its location. The markings have the following meanings:
 - The arrow points toward the front of the engine.
 - The "I" indicates the intake camshaft.
 - The number indicates the journal position from the front of the engine.

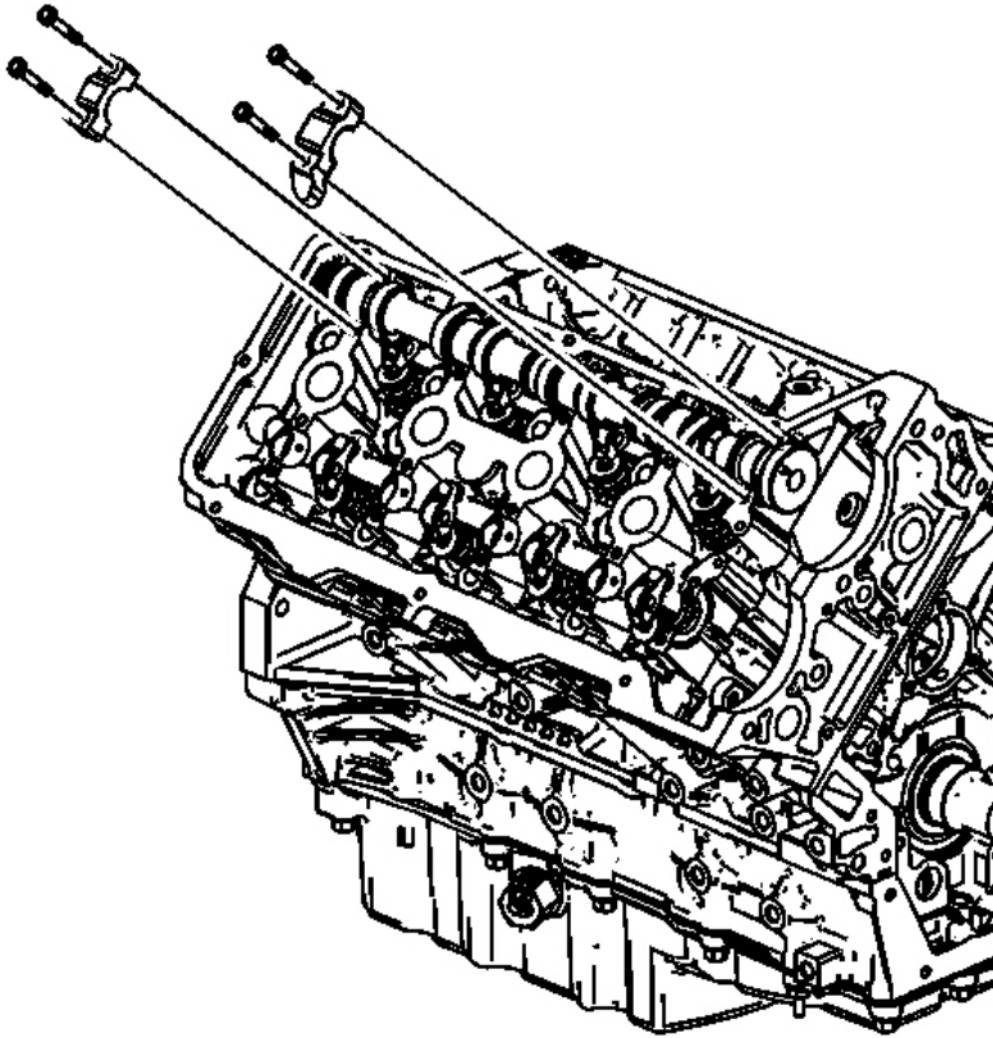


Fig. 8: View Of Right Intake Camshaft Bearing Caps
Courtesy of GENERAL MOTORS CORP.

2. Remove the right intake camshaft bearing cap bolts.
3. Remove the right intake camshaft bearing caps. Store the bearing caps in a clean shop towel.

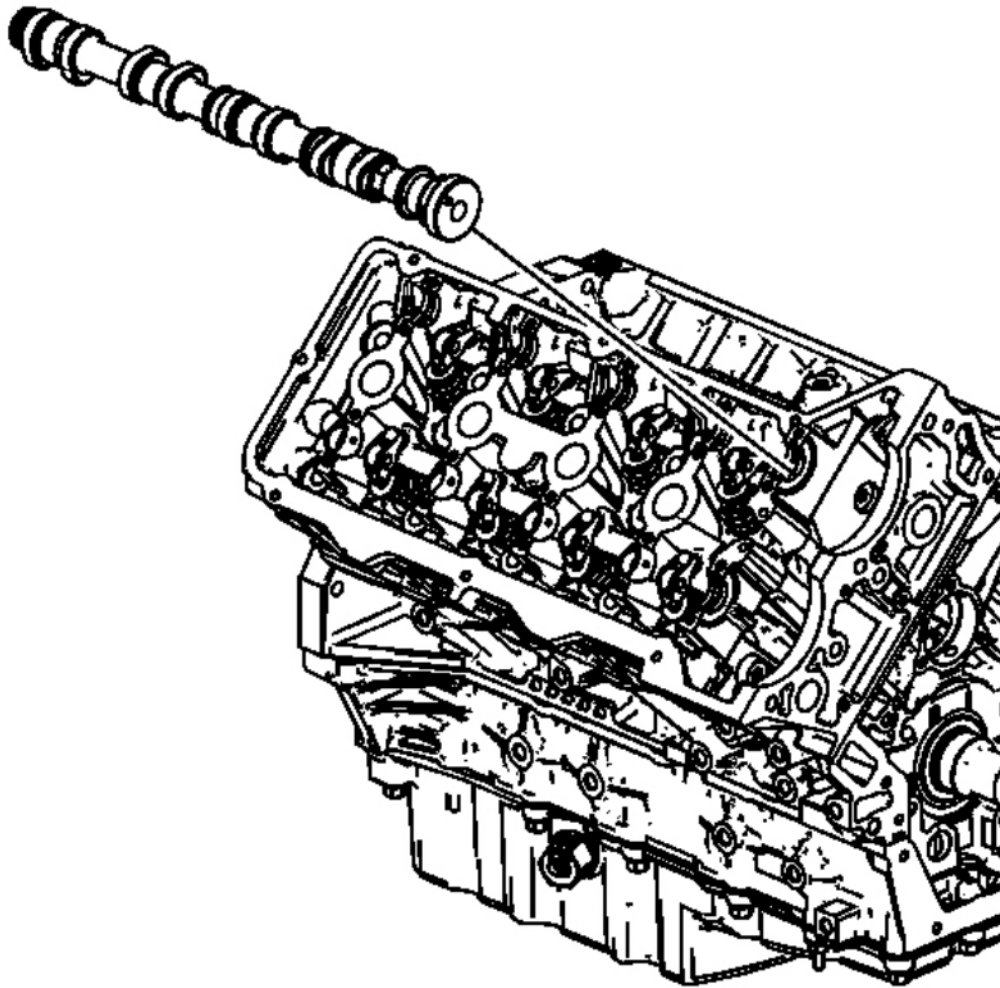


Fig. 9: View Of Right Intake Camshaft
Courtesy of GENERAL MOTORS CORP.

4. Remove the right intake camshaft. Place the camshaft in a secure location.
5. Cover the camshaft with an oil soaked towel in order to prevent corrosion.

VALVE ROCKER ARM REMOVAL - RIGHT

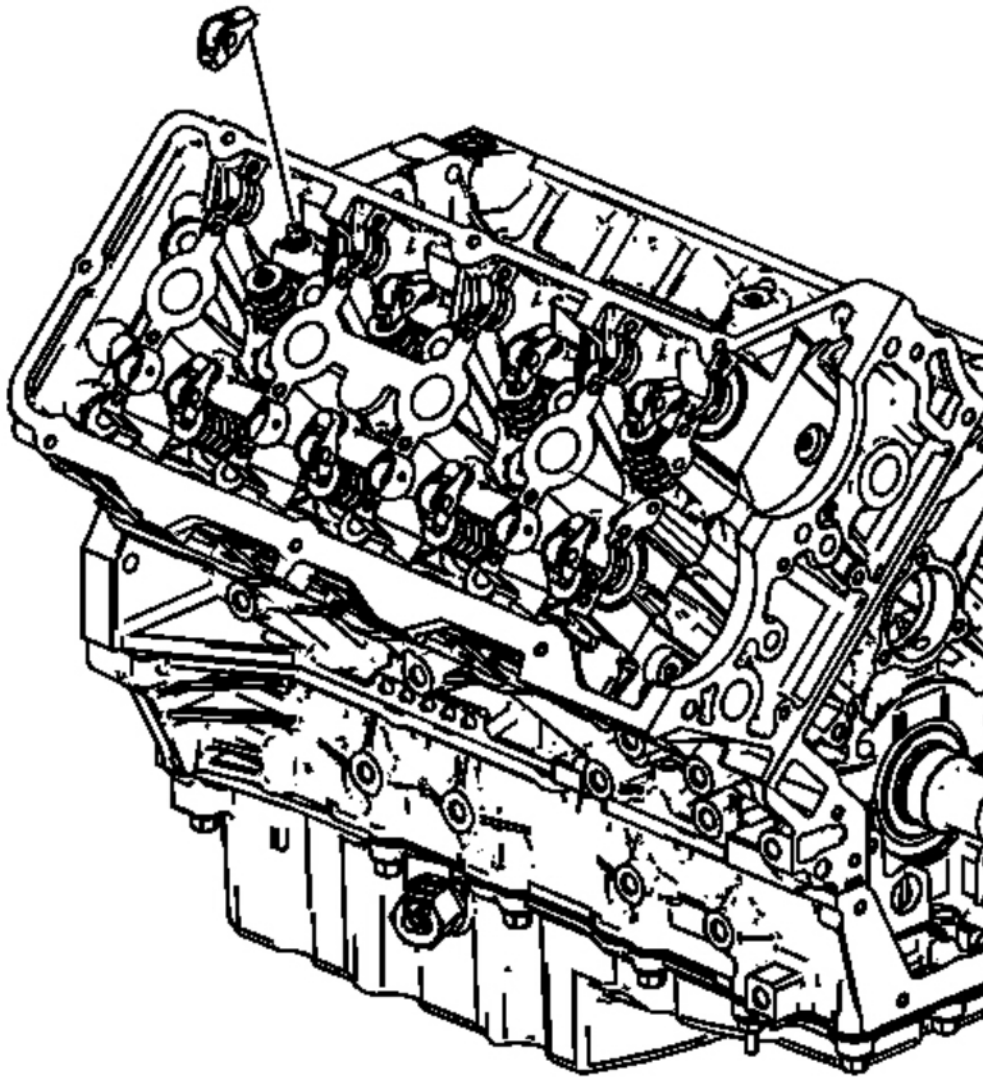


Fig. 10: View Of Right Valve Rocker Arm
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure each camshaft follower remains matched to the original stationary hydraulic lash adjuster (SHLAs) and original location the components were assembled in.

1. Remove the camshaft followers from the right cylinder head.

2. Store the camshafts, followers and SHLAs in a clean, secure location.

VALVE LIFTER REMOVAL - RIGHT

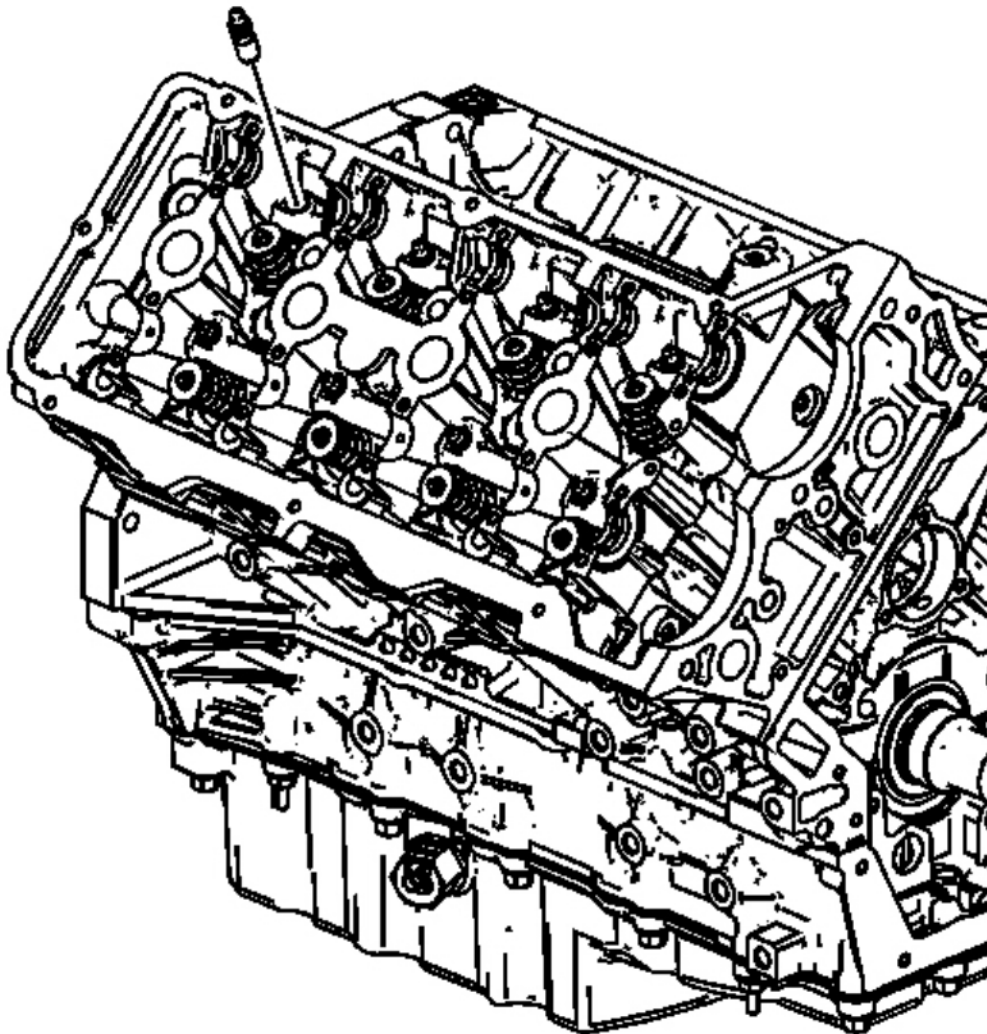


Fig. 11: View Of Right Valve Lifter
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Valve Lifter Priming Notice in Cautions and Notices.

IMPORTANT: Ensure each camshaft follower remains matched to the original stationary hydraulic lash adjuster (SHLAs) and original location the components were assembled in.

1. Remove the stationary hydraulic lash adjuster (SHLAs) from the right cylinder head lifter bores.
2. Store the camshafts, followers and SHLAs in a clean, secure location.

CYLINDER HEAD REMOVAL - RIGHT

Tools Required:

J 28410 Gasket Remover

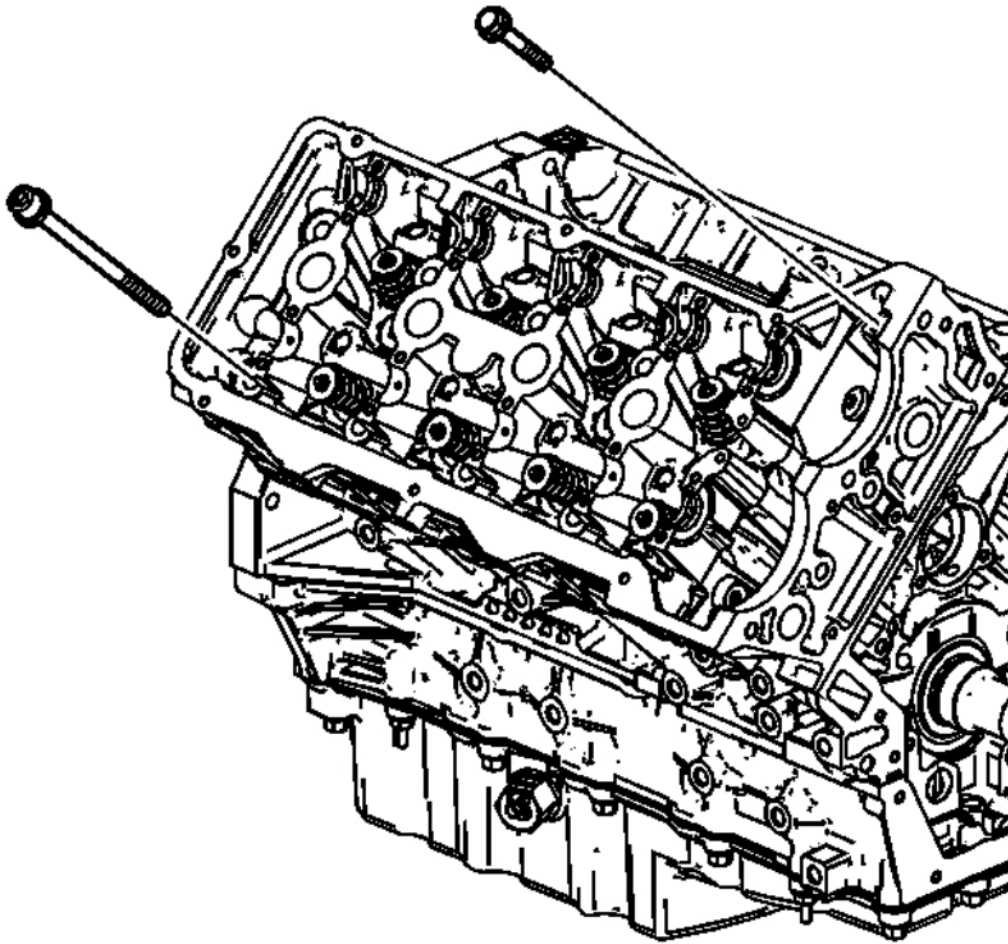


Fig. 12: View Of Right Cylinder Head M6 External Drive Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the 3 M6 external drive bolts from the front portion of the cylinder head.

IMPORTANT: DO NOT reuse the M11 cylinder head bolts.

2. Remove and discard the 10 M11 internal drive cylinder head bolts.

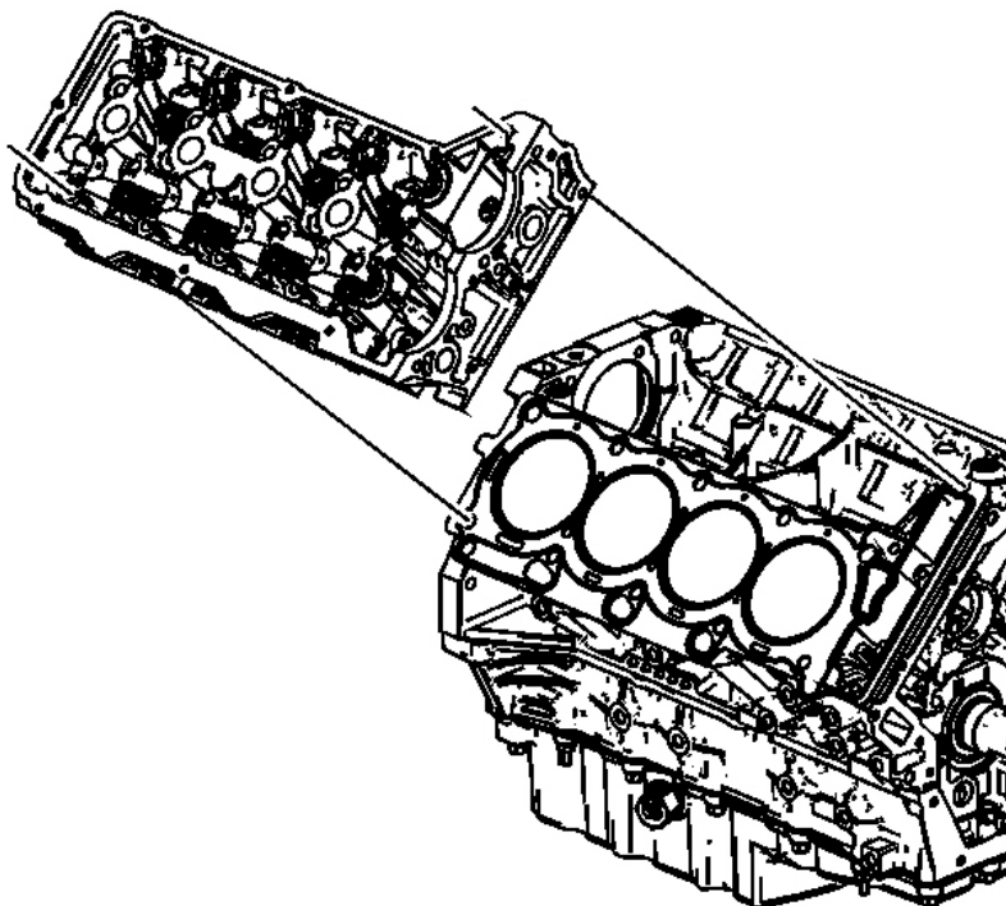


Fig. 13: View Of Right Cylinder Head
Courtesy of GENERAL MOTORS CORP.

3. Remove the right cylinder head. Ensure that no dowel guide pins are stuck in the cylinder head.

IMPORTANT: You must clean the thread sealant material from the cylinder head bolt holes in the cylinder block. Failure to do so could cause false torque readings during reassembly.

4. After removing the cylinder head, remove any remaining bolt thread sealant material from the threaded cylinder block holes.

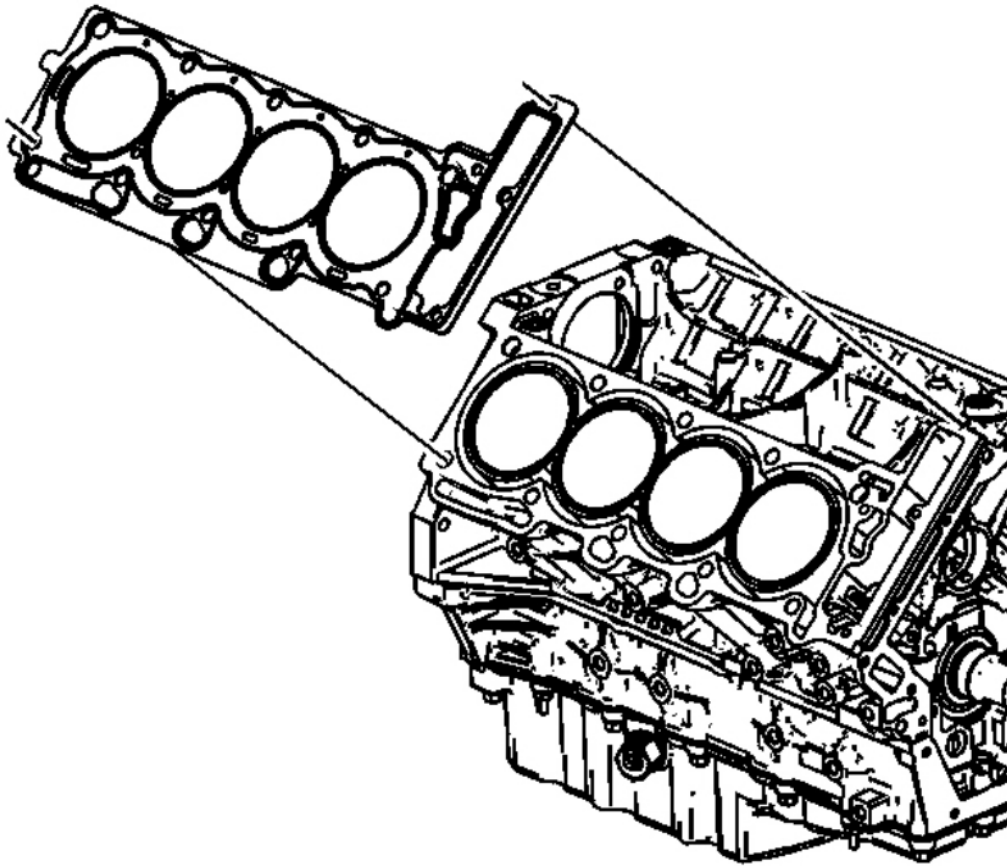


Fig. 14: View Of Right Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: DO NOT reuse the cylinder head gasket.

5. Remove the right cylinder head gasket.
6. Remove all remaining gasket material from the cylinder head and cylinder block using the **J 28410**.

OIL PAN REMOVAL

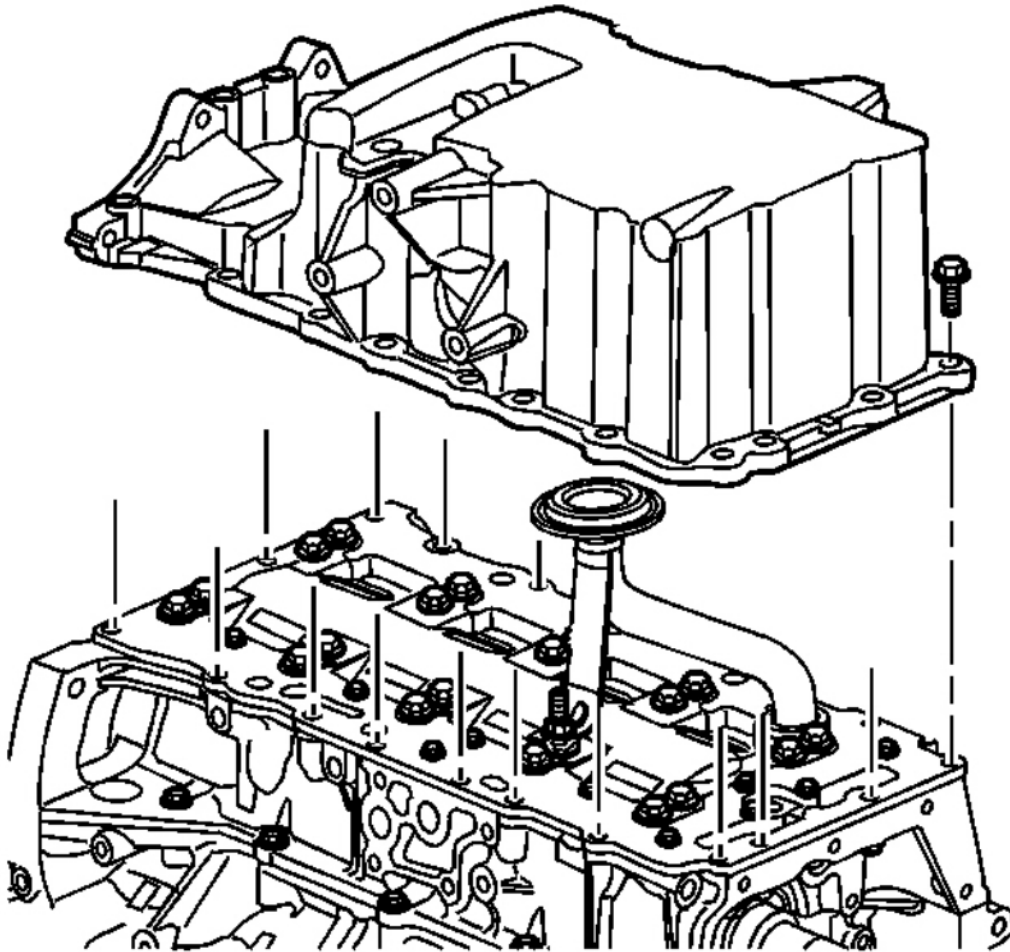


Fig. 15: View Of Oil Pan

Courtesy of GENERAL MOTORS CORP.

1. Loosen the oil pan bolts.
2. Remove the oil pan.

OIL PUMP PIPE AND SCREEN ASSEMBLY REMOVAL

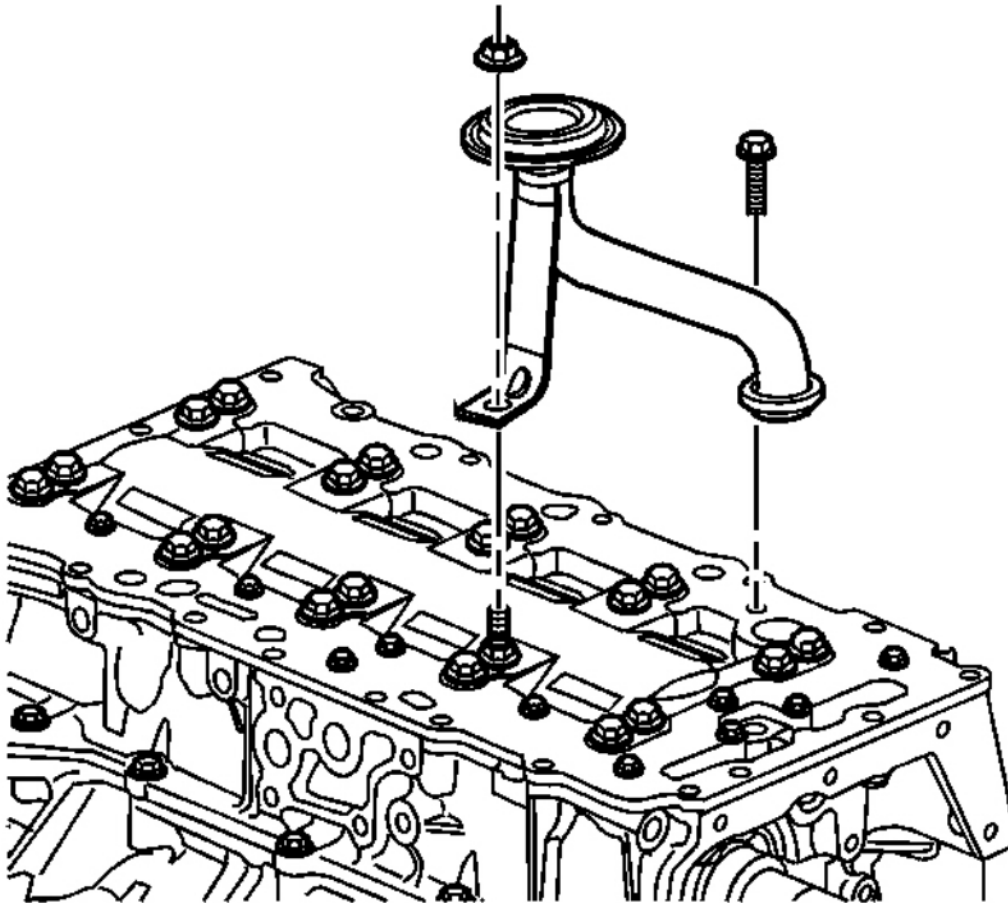


Fig. 16: View Of Oil Pump Pipe
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil pump pipe support bracket nut.
2. Remove the oil pump pipe bolt.
3. Remove the oil pump pipe and screen assembly.

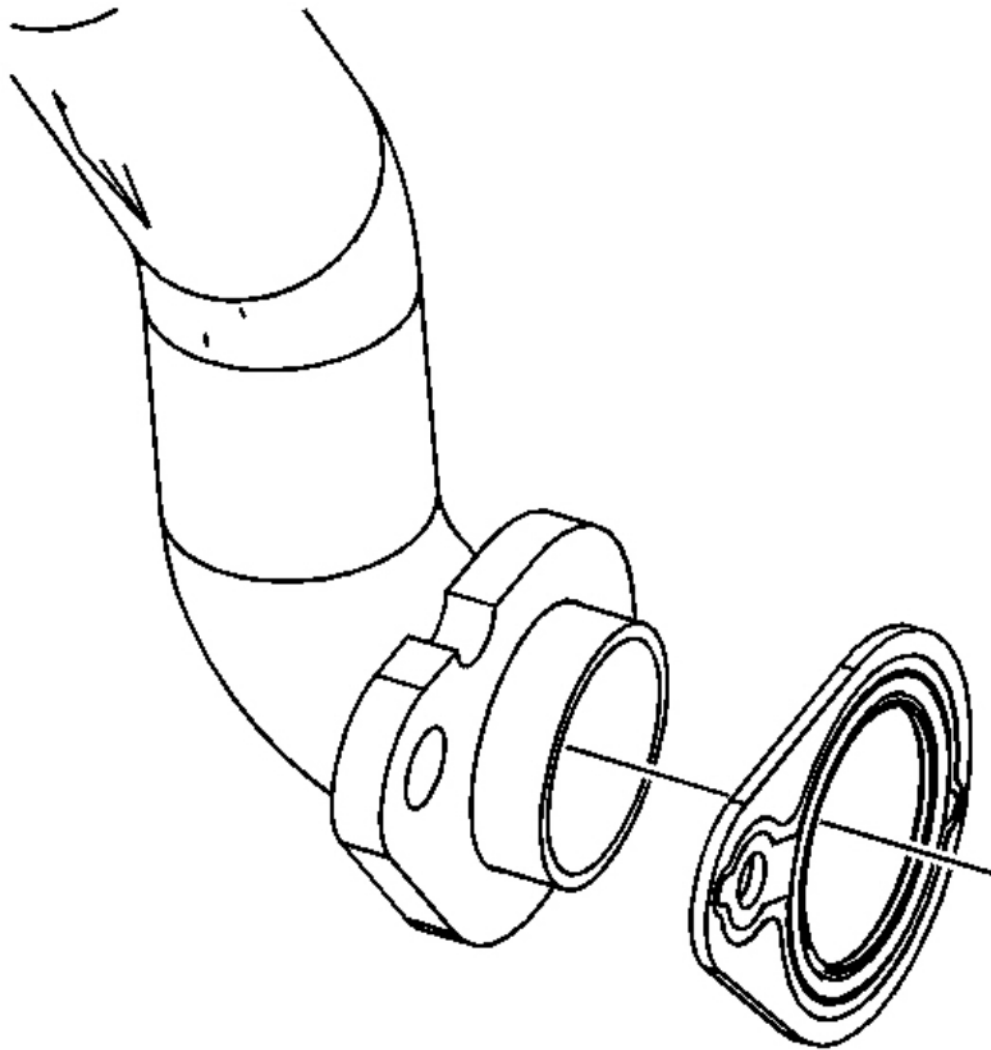


Fig. 17: View Of Oil Pump Pipe Gasket
Courtesy of GENERAL MOTORS CORP.

4. Remove and discard the oil pump pipe gasket.

LOWER CRANKCASE REMOVAL

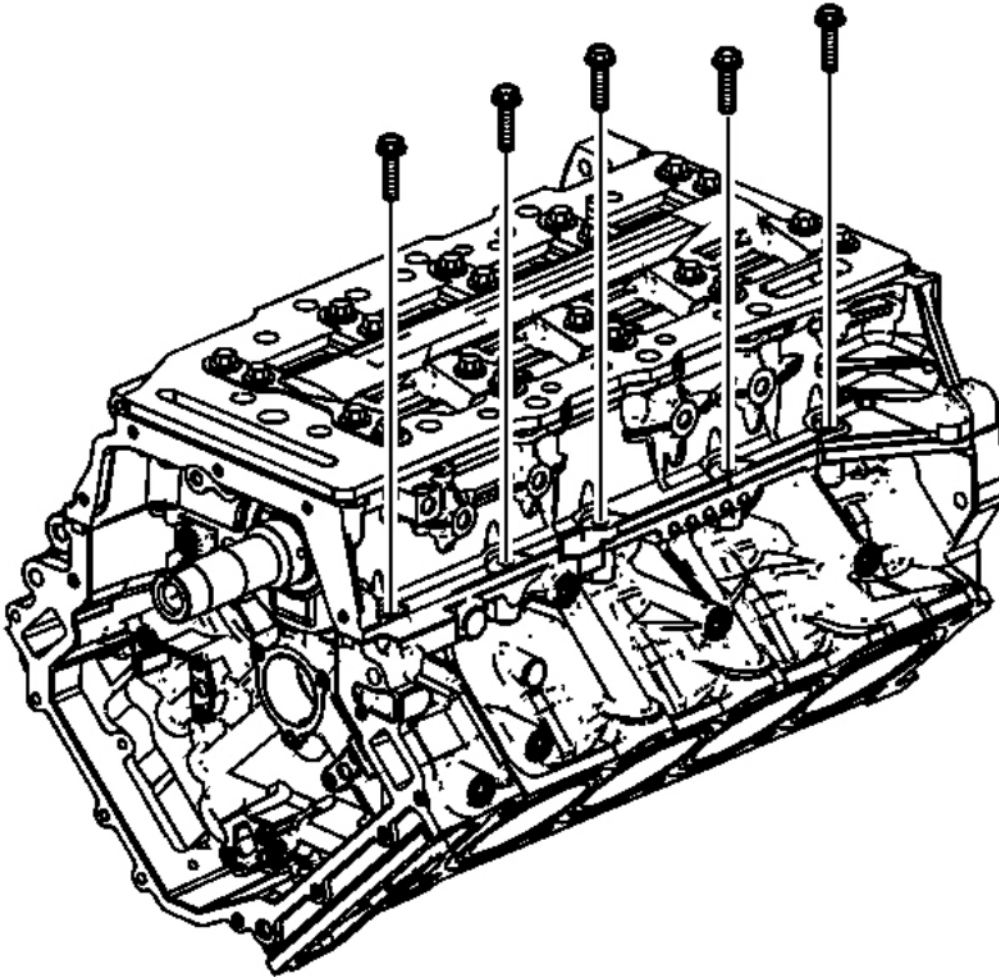


Fig. 18: View Of Right Upper-To-Lower Crankcase Perimeter Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the 4 lower crankcase perimeter retaining bolts along the right side of the engine.

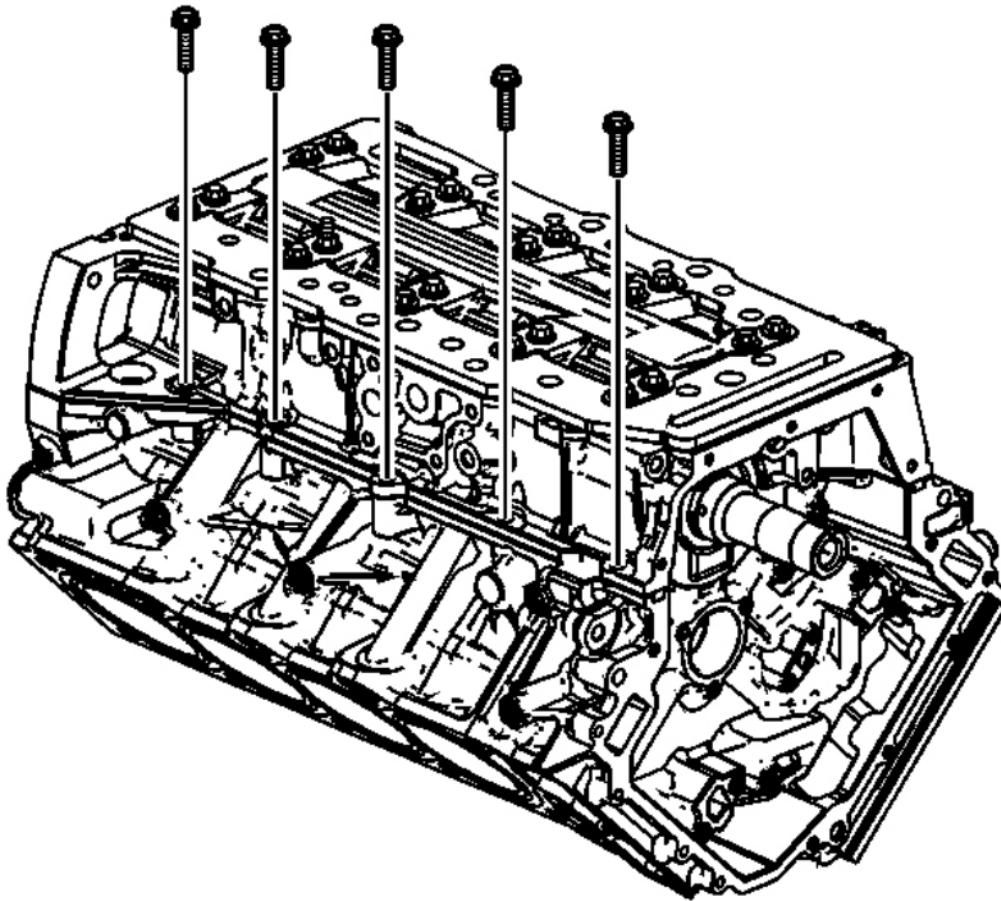


Fig. 19: View Of Lower Left Crankcase Perimeter Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

2. Remove the 4 lower crankcase perimeter retaining bolts along the left side of the engine.

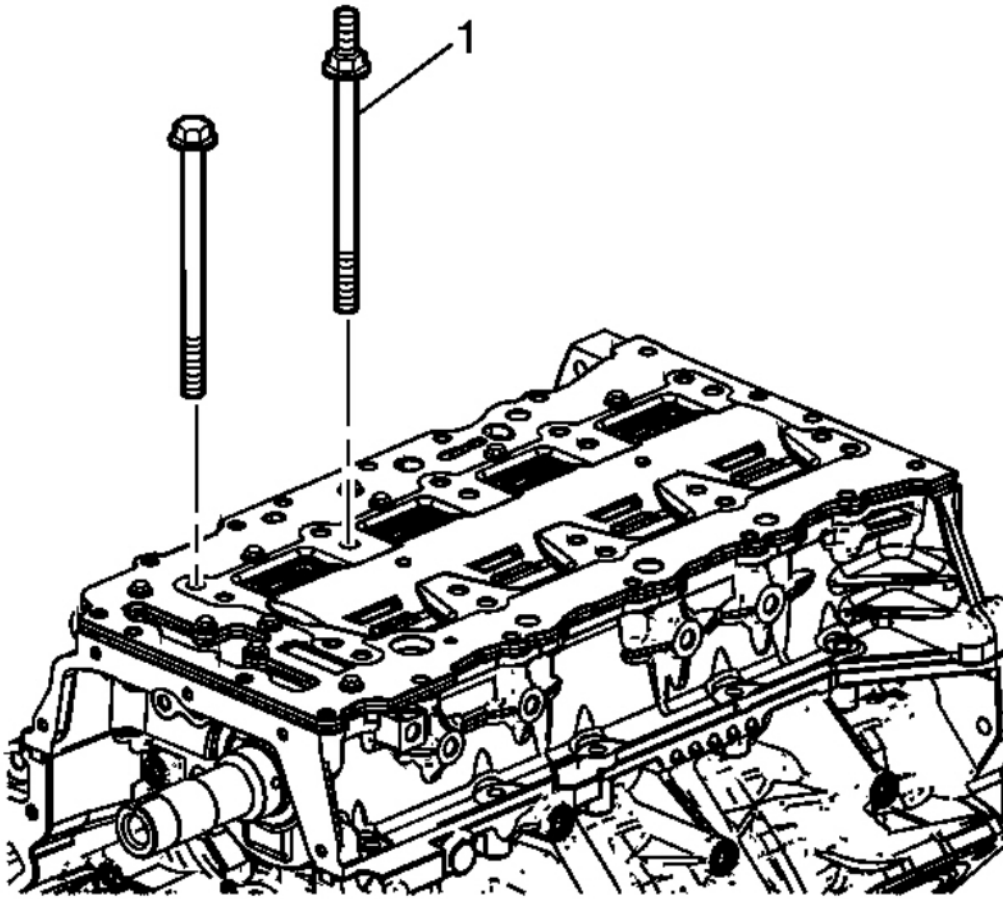


Fig. 20: View Of Main Bearing Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the main bearing bolts. Note the location of the single stud-end bolt (1) used to attach the oil pump pipe and screen assembly support bracket.

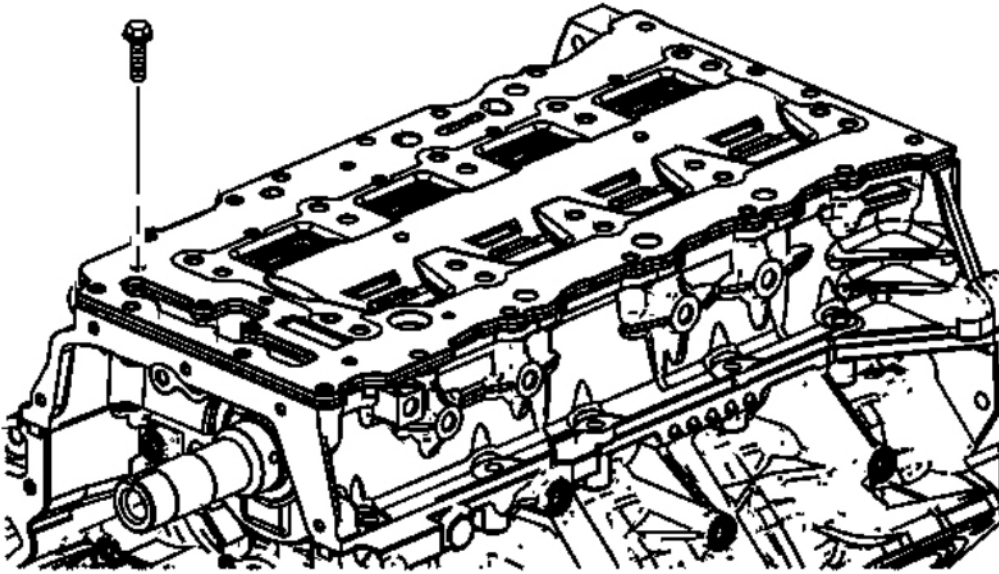


Fig. 21: View Of Oil Manifold Plate Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the oil manifold plate bolts.

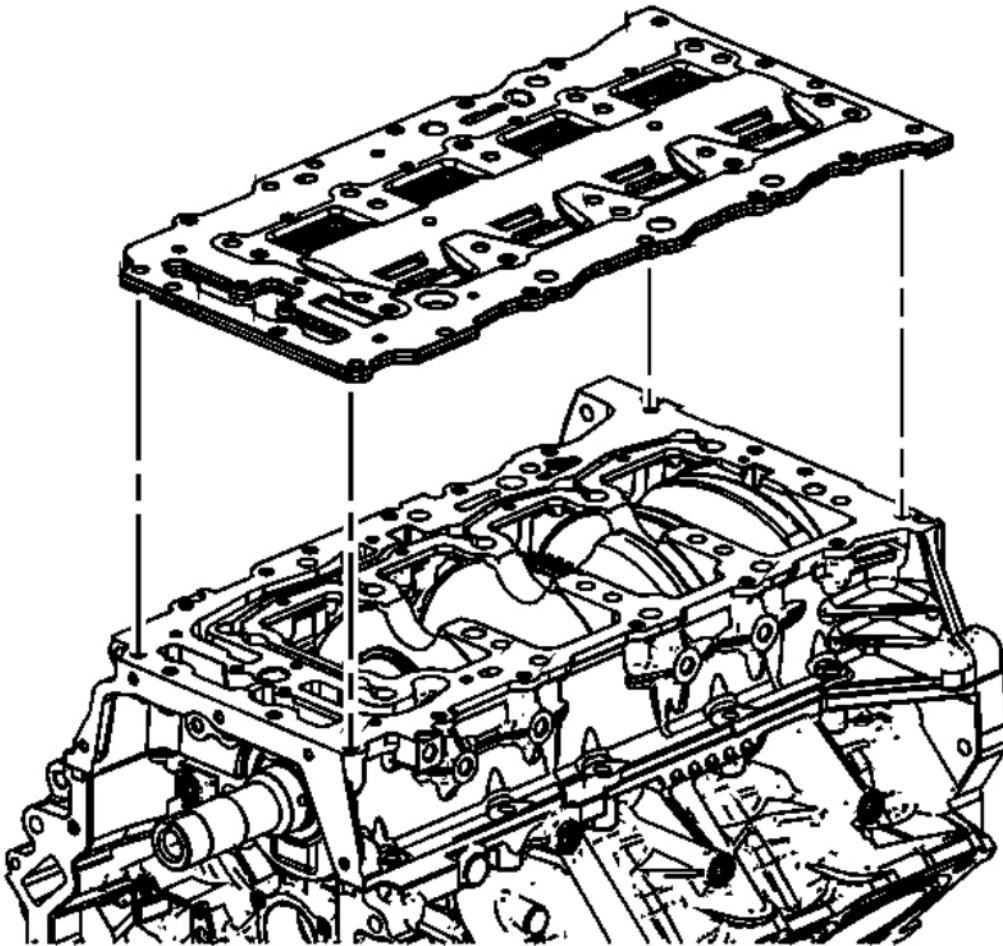


Fig. 22: View Of Oil Manifold & Oil Scraper Plate Assembly
Courtesy of GENERAL MOTORS CORP.

5. Remove the oil manifold and oil scraper plate assembly.

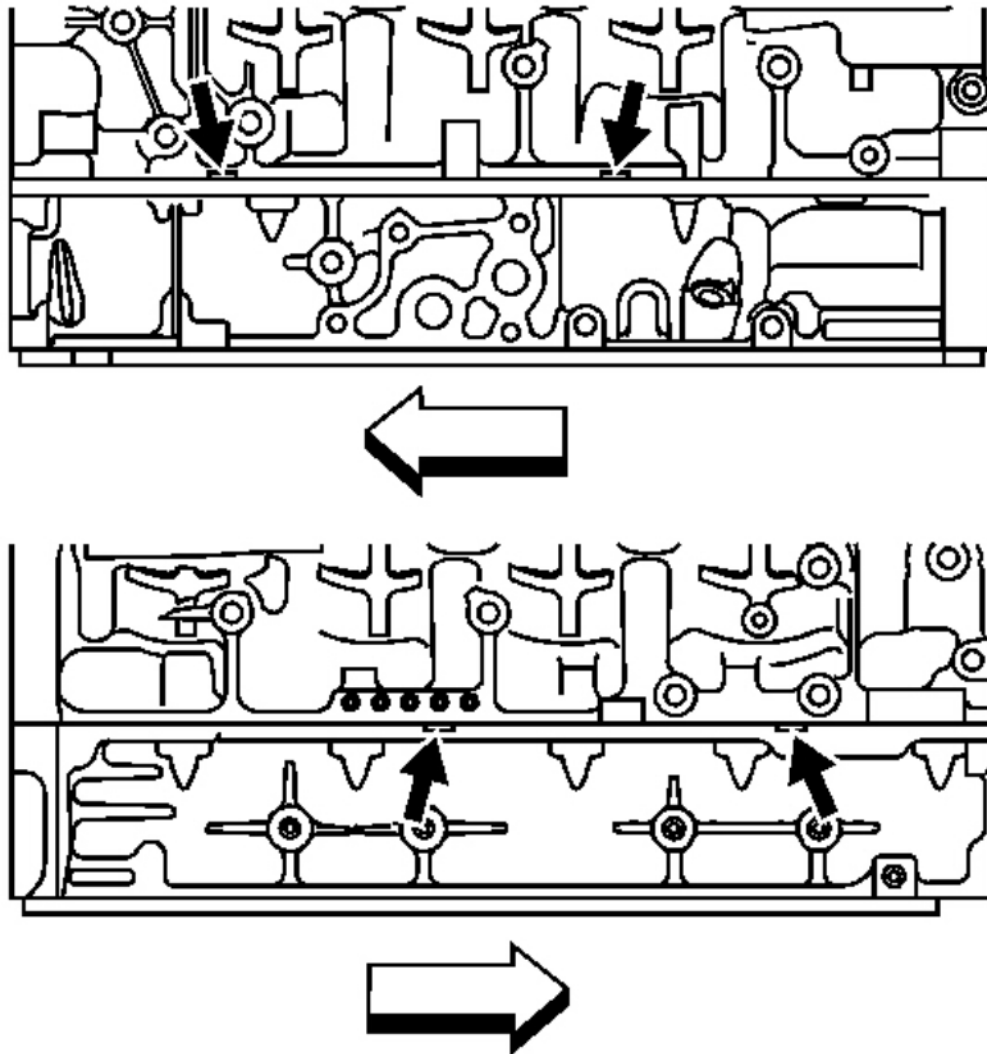


Fig. 23: Separating Crankcase Halves
Courtesy of GENERAL MOTORS CORP.

NOTE: Use a plastic pry tool when prying case halves apart to prevent damage to the Upper and Lower Crankcase surface. Do not continue to push the pry tool in the crankcase as the Upper and Lower Crankcase halves separate. This may damage the sealing surface.

6. Working on either side of the lower crankcase, separate the crankcase halves by alternately prying in the grooves provided until the lower crankcase is free of the dowel pins.

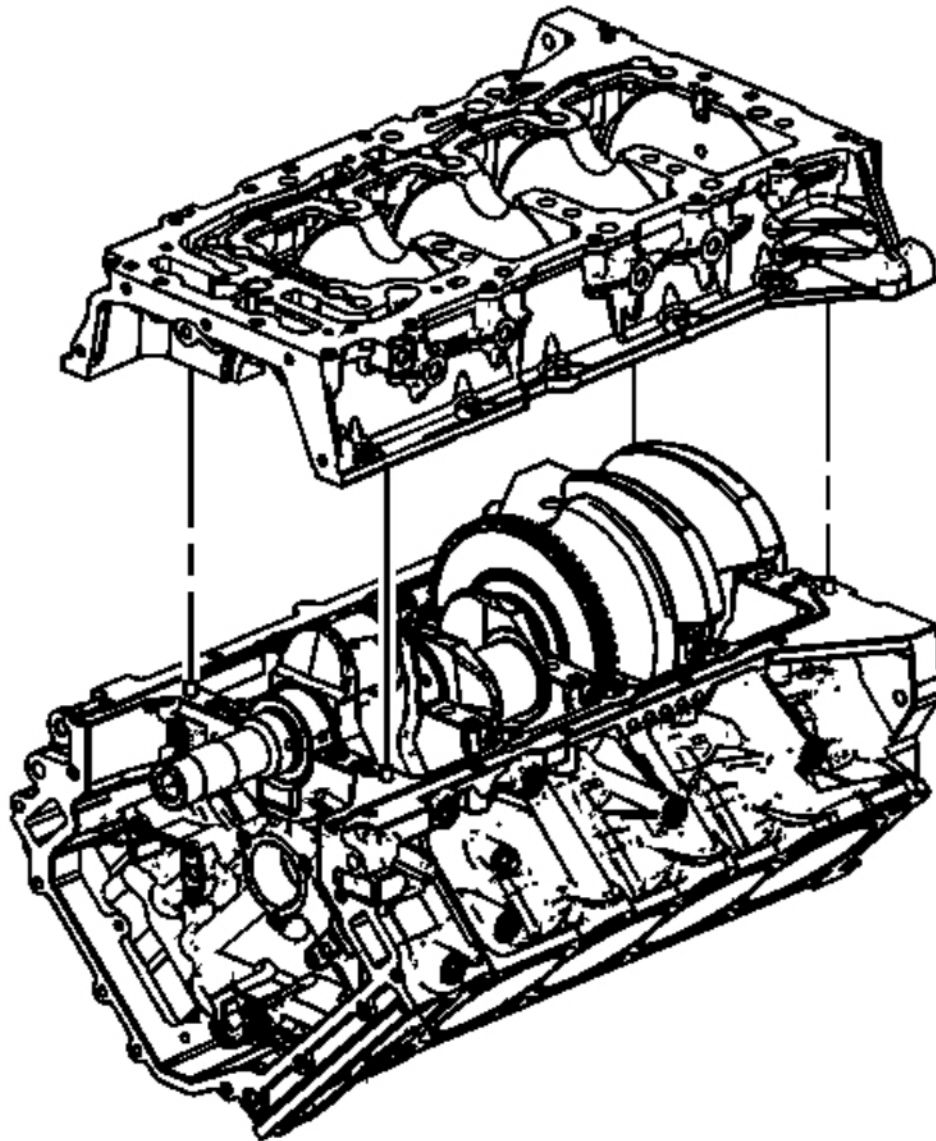


Fig. 24: View Of Lower Crankcase
Courtesy of GENERAL MOTORS CORP.

7. Remove the lower crankcase.

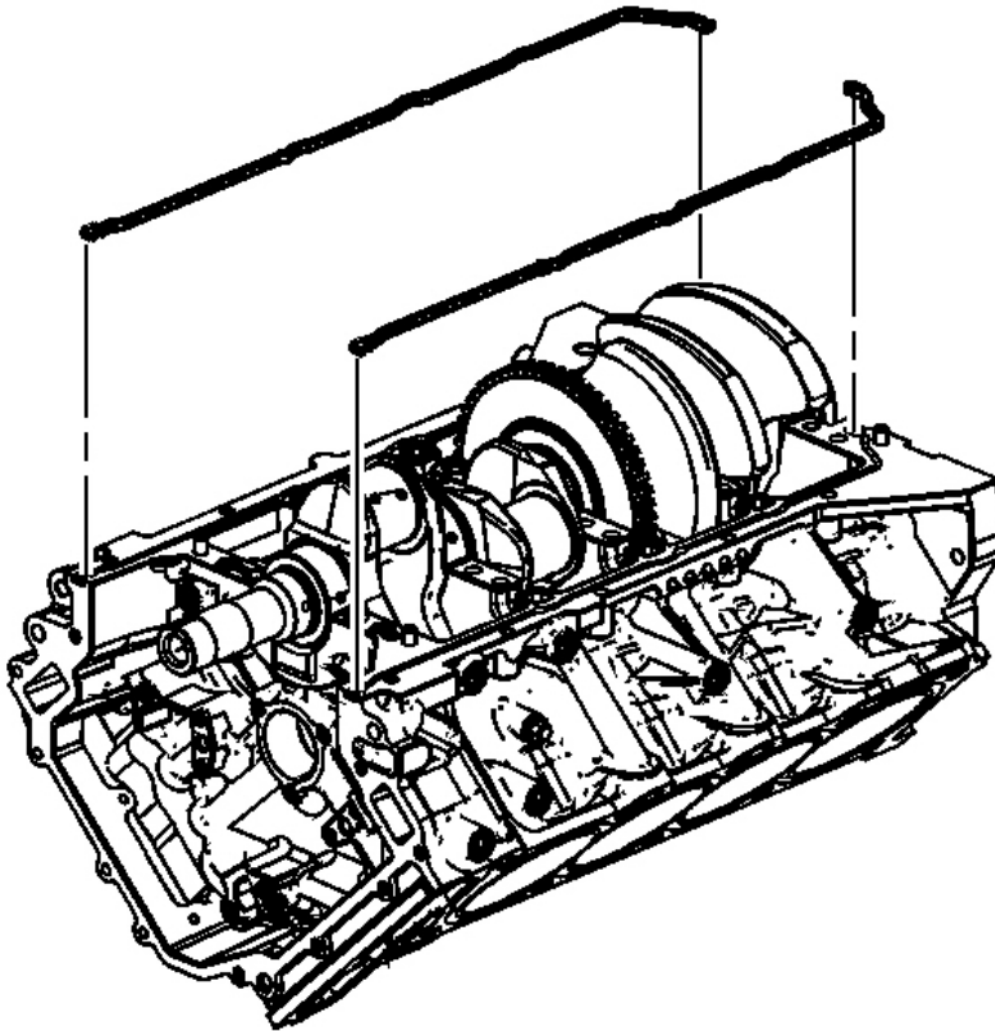


Fig. 25: View Of Upper-To-Lower Crankcase Seals
Courtesy of GENERAL MOTORS CORP.

8. If equipped, remove the upper-to-lower crankcase seals.

PISTON, CONNECTING ROD, AND BEARING REMOVAL

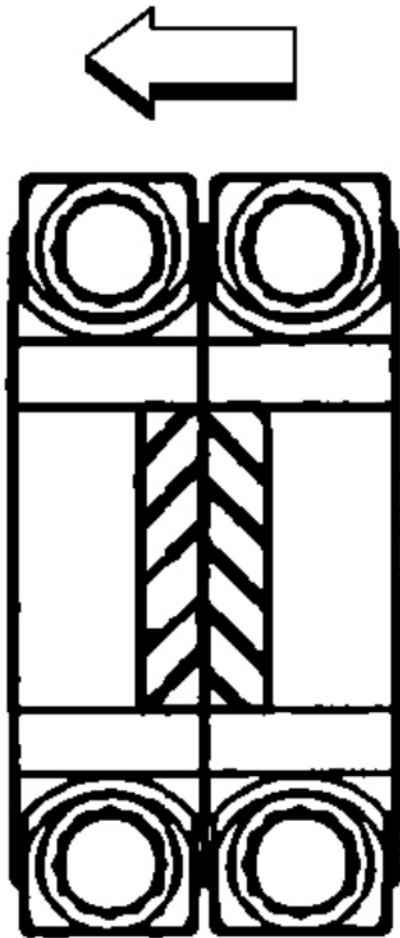
Tools Required:**EN 46121** Connecting Rod Guide Pin Set

Fig. 26: View Of Paired Connecting Rod Bearing Cap Notches
Courtesy of GENERAL MOTORS CORP.

1. Note the orientation of paired connecting rods on each crankpin. The notches in the connecting rod cap must be facing each other.
2. Before removing the connecting rods, check the connecting rod end play using the following procedure:

1. Tap the connecting rod to one end of the crankshaft journal with a dead-blow or wooden hammer.
 2. Using feeler gages, measure the clearance between the crankshaft counterweight and the connecting rod.
 3. The connecting rod end play should not exceed 0.500 mm (0.020 in).
 4. If the end play exceeds the specified limits, measure the width of the crankpin end of the connecting rod.
 5. The width of the crankpin end of the connecting rod should be 21.745 - 21.805 mm (0.856 - 0.858 in).
 6. If the connecting rod width is significantly smaller than specified and severe wear is present on the side of the connecting rod, replace the connecting rod.
 7. If the connecting rod width is within specification and excessive scoring is present on the crankshaft journals, replace the crankshaft.
3. Using a paint stick or permanent marker, number each piston face. Draw an arrow along the centerline of the piston pointing toward the front of the engine.

NOTE: Do not use a stamp, punch or any other method that may distort or stress the connecting rod or connecting rod cap. Extensive engine damage may result from a connecting rod that is distorted or stressed.

IMPORTANT: Do NOT stamp or use a punch to mark a powdered metal connecting rod for identification.

4. Mark the cylinder number on the connecting rod and the connecting rod cap with paint stick, scribe or permanent marker. The connecting rod caps must remain with the original connecting rod.

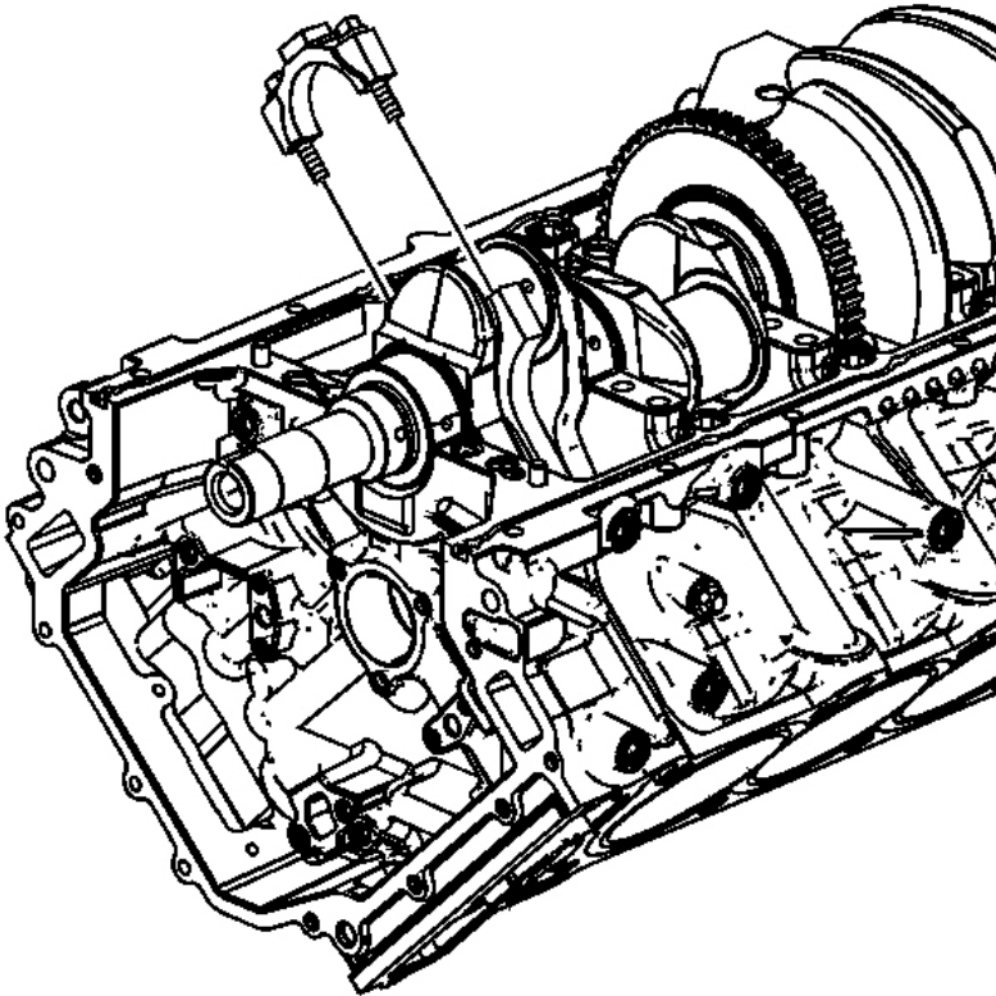


Fig. 27: View Of Connecting Rod Cap
Courtesy of GENERAL MOTORS CORP.

NOTE: Powdered metal connecting rods have rod bolts which yield when torqued. If the rod bolts are loosened or removed the rod bolts must be replaced. Rod bolts that are not replaced will not torque to the correct clamp load and can lead to serious engine damage.

5. Remove the connecting rod bolts.

6. Remove the connecting rod cap.

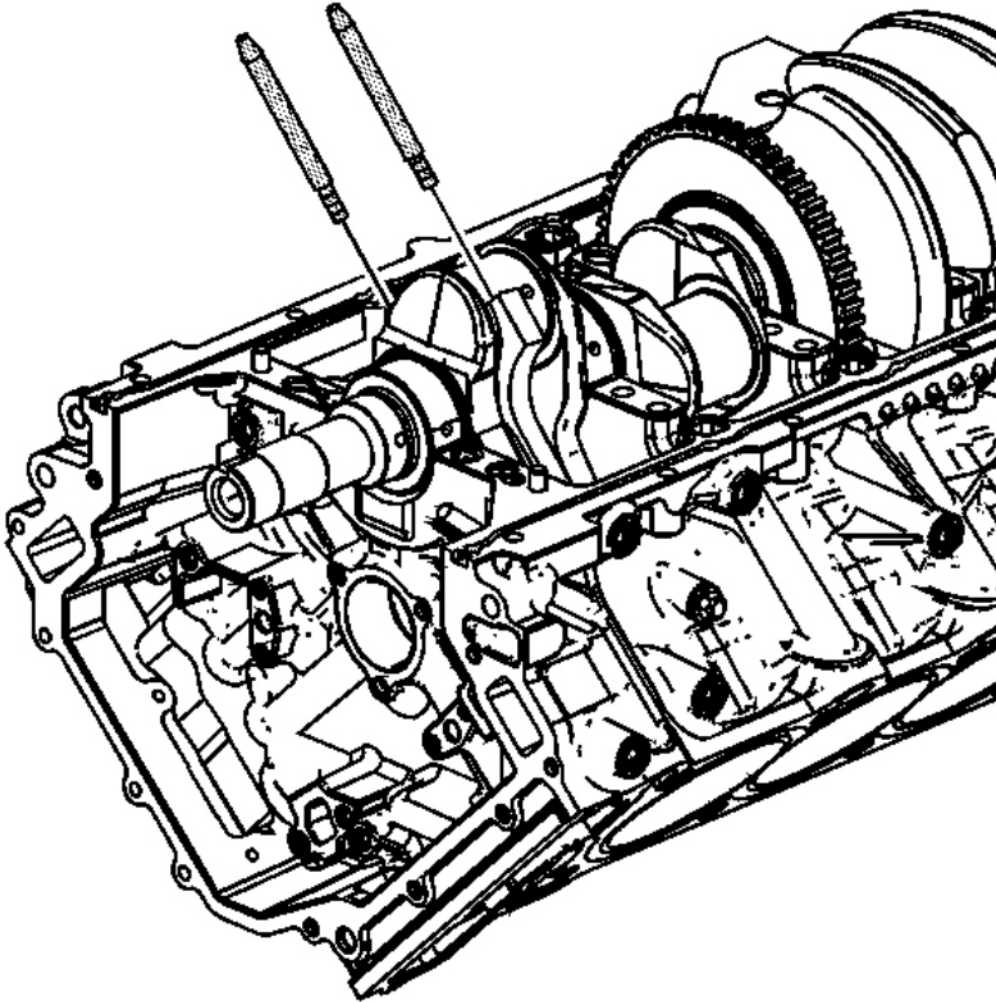


Fig. 28: Installing EN 46121
Courtesy of GENERAL MOTORS CORP.

7. Install the **EN 46121** into the connecting rod bolt holes.

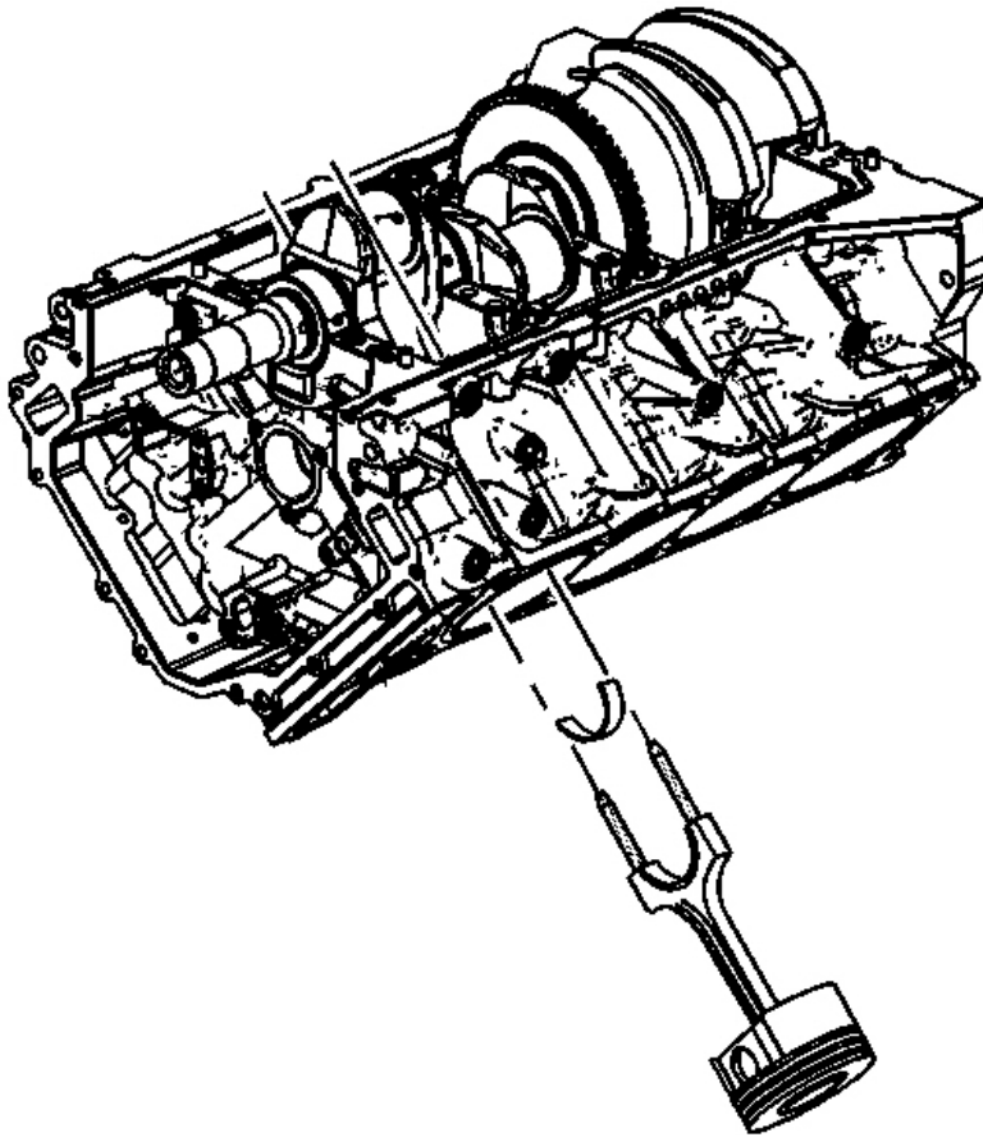


Fig. 29: Removing Connecting Rod & Piston Assembly
Courtesy of GENERAL MOTORS CORP.

8. Using the **EN 46121** push the connecting rod and piston assembly down through the top of the cylinder. Do not scratch the crankshaft journal or the cylinder wall when removing the connecting rod and piston assembly.

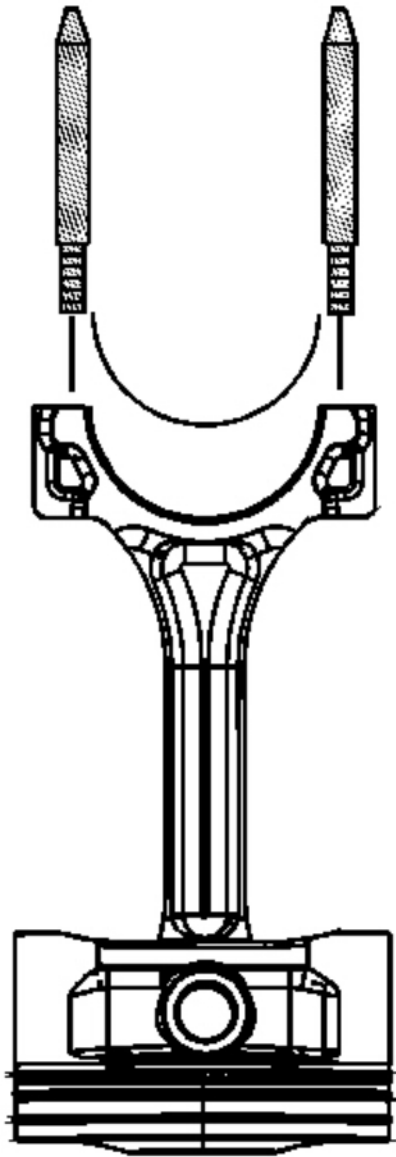


Fig. 30: Removing EN 46121

Courtesy of GENERAL MOTORS CORP.

9. Remove the **EN 46121** from the connecting rod bolt holes.

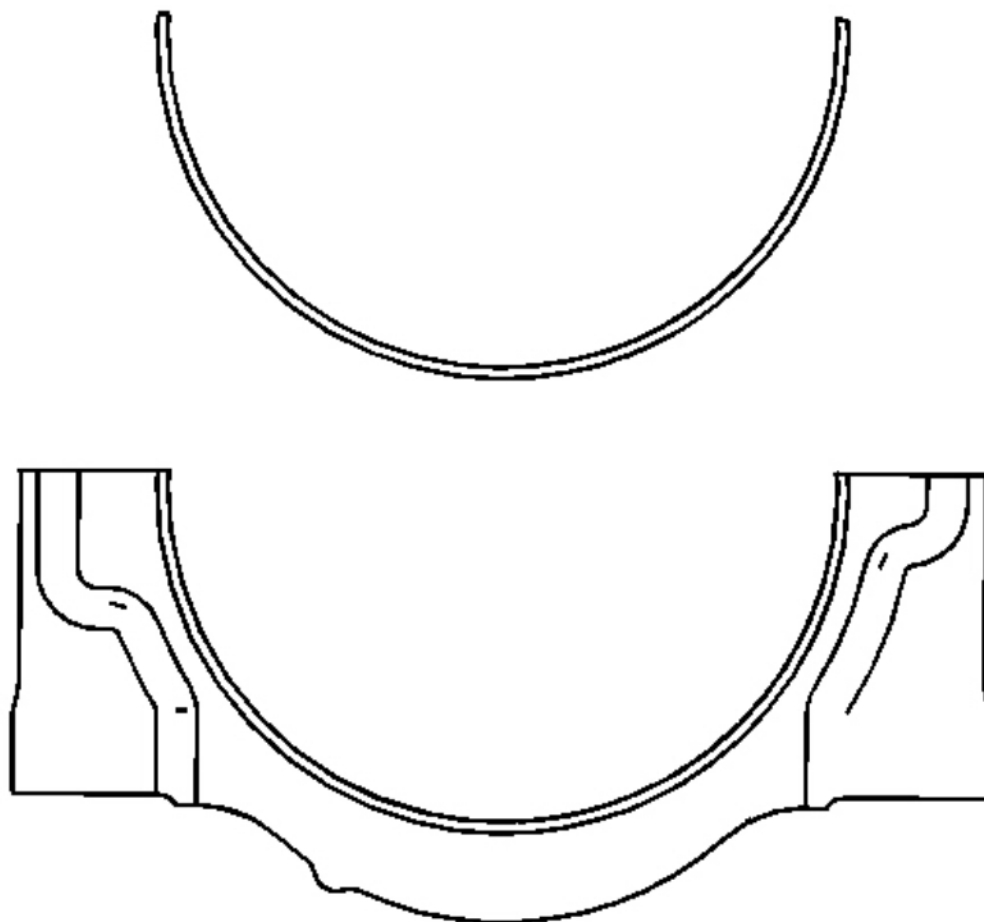


Fig. 31: View Of Lower Connecting Rod Cap And Bearing
Courtesy of GENERAL MOTORS CORP.

10. Remove the connecting rod bearings. NEVER re-use the connecting rod bearings. Refer to **Crankshaft and Bearings Cleaning and Inspection** for inspection.
11. Reattach the connecting rod cap to the connecting to prevent damage to their mating surfaces. The cap and rod are a matched set and must be kept together.

CRANKSHAFT AND BEARINGS REMOVAL

Crankshaft Removal Procedure

1. Before removing the crankshaft, measure the crankshaft end play using the following procedure:
 1. Reinstall the lower crankcase.
 2. Place a dial indicator at the crankshaft nose.
 3. Gently force the crankshaft to the extreme front and rear positions with a pry tool while monitoring the movement of the dial indicator.
 4. The crankshaft end play should not exceed 0.05-0.5 mm (0.002-0.020 in).
 5. If the specifications are exceeded, replace the thrust bearing.
 6. If a new thrust bearing does not bring the tolerances within specification, replace the crankshaft.
 7. Remove the lower crankcase.
2. Locate or fabricate two V-blocks to support the crankshaft.

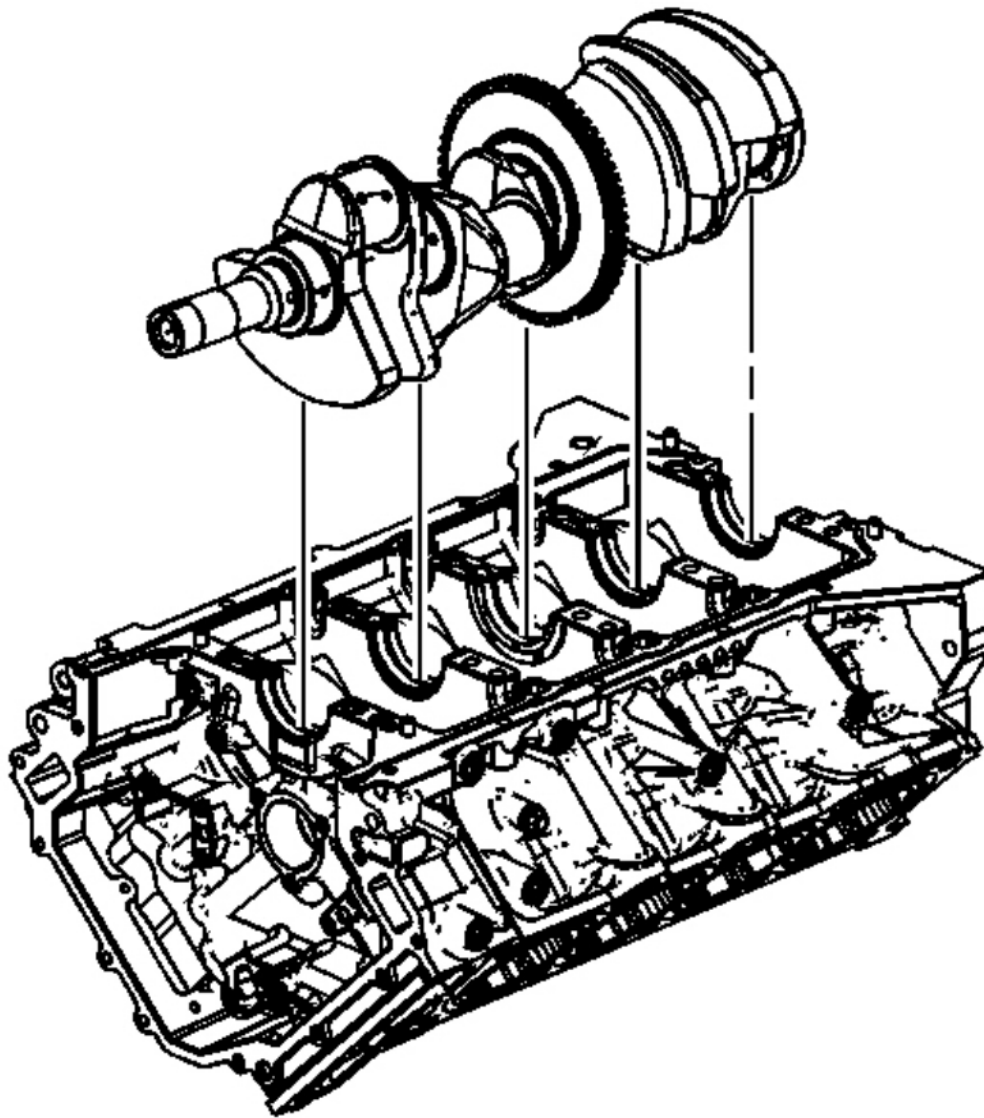


Fig. 32: View Of Crankshaft
Courtesy of GENERAL MOTORS CORP.

3. Using two hands, lift the crankshaft straight up from the engine block.
4. Place the crankshaft on the V-blocks in a secure place.

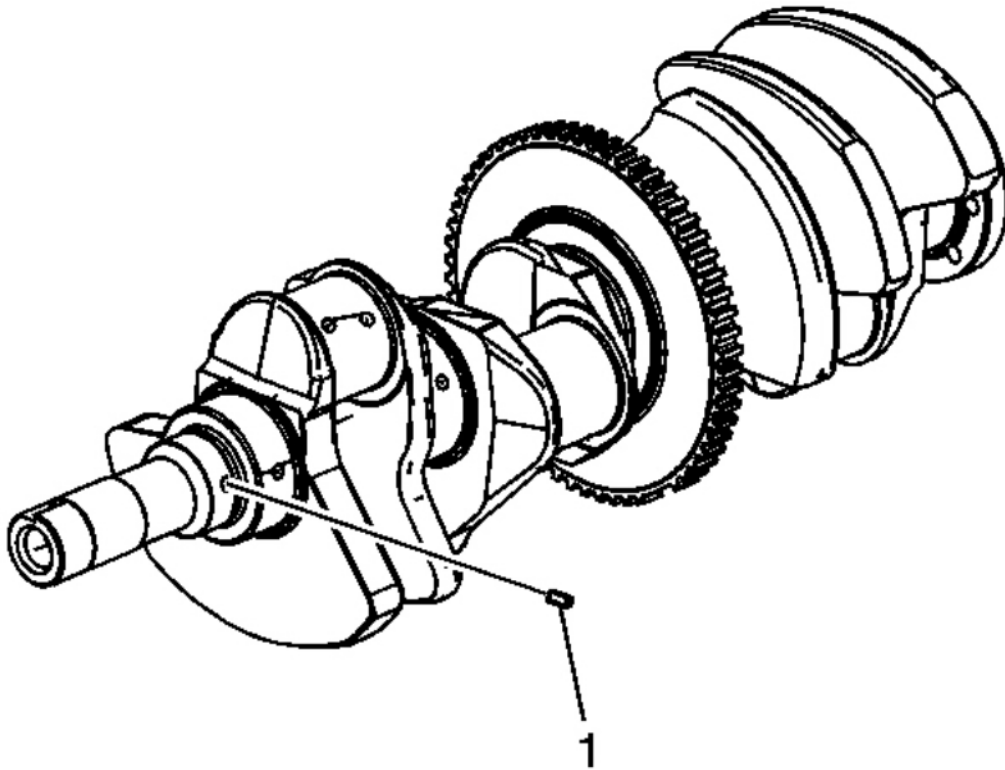


Fig. 33: View Of Crankshaft Sprocket Drive Pin
Courtesy of GENERAL MOTORS CORP.

5. If damaged, remove the crankshaft sprocket drive pin (1) from the nose of the crankshaft.

Crankshaft Bearing Removal Procedure

1. Prepare a piece of cardboard, or equivalent, numbered one to five for bearing identification. Main bearing journals are numbered from the front of the engine.

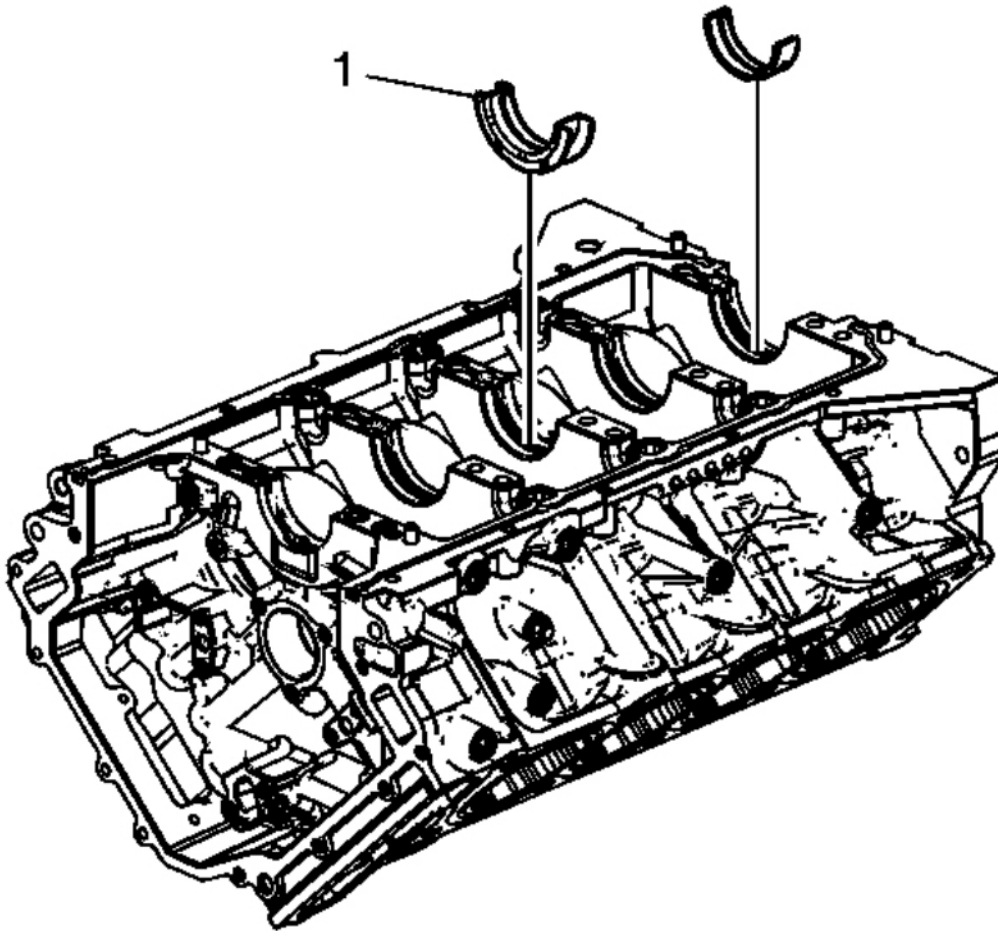


Fig. 34: View Of Thrust Bearing
Courtesy of GENERAL MOTORS CORP.

2. Remove the upper crankshaft bearing halves from the cylinder block. Note the position of the thrust bearing (1) at the number three journal.
3. Place the upper main bearing halves on the cardboard in the correct positions. Note that the number three bearing is the thrust bearing.

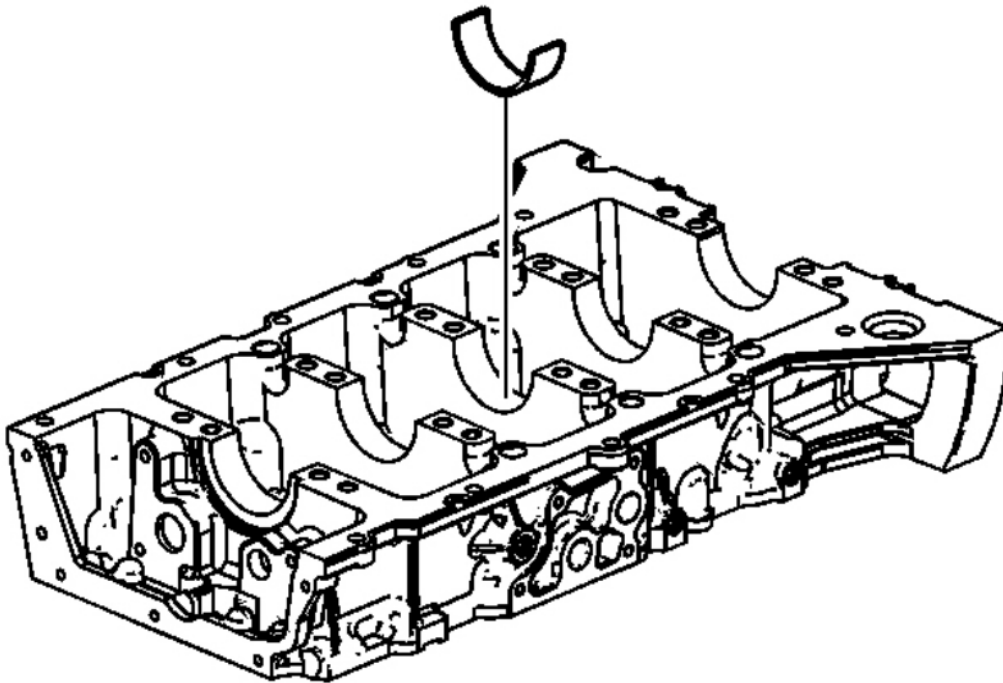


Fig. 35: View Of Lower Main Bearing Half
Courtesy of GENERAL MOTORS CORP.

4. Remove the lower main bearing halves from the lower crankcase.
5. Place the lower main bearing halves in the correct positions on the cardboard.

ENGINE BLOCK DISASSEMBLE - UPPER

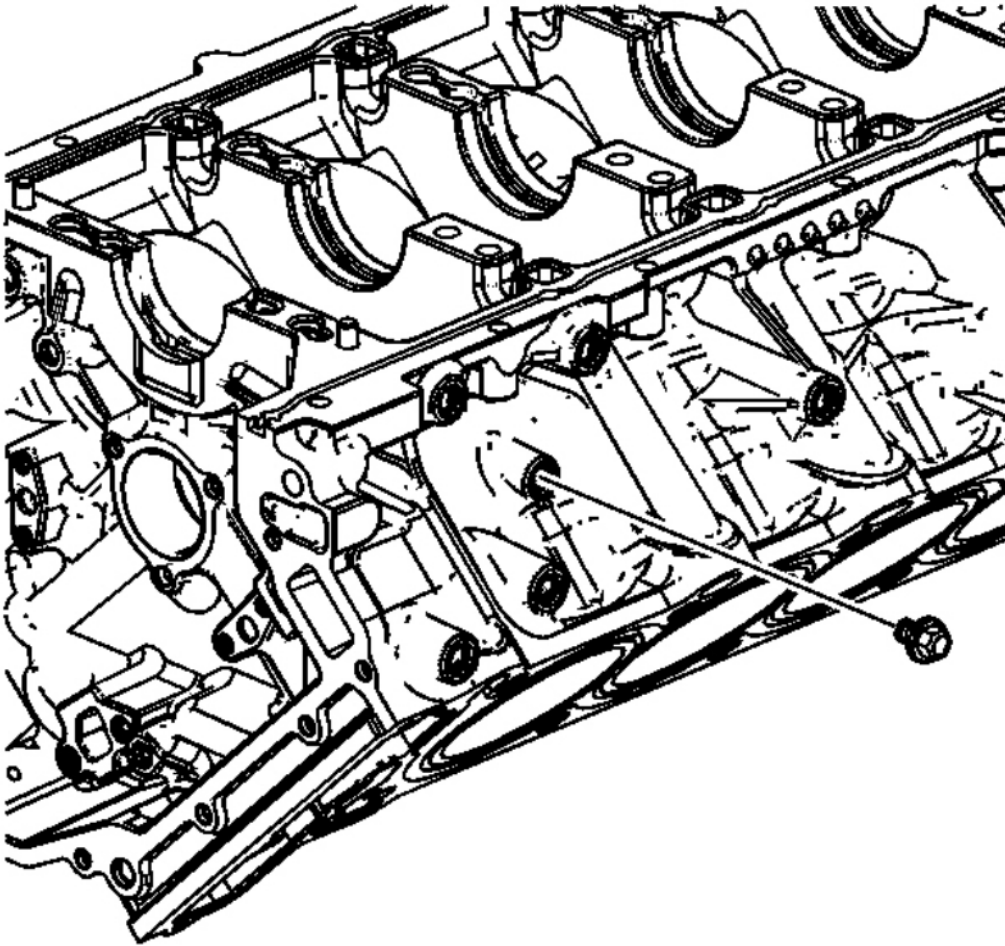


Fig. 36: View Of Engine Coolant Drain Plug
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine coolant drain plug.

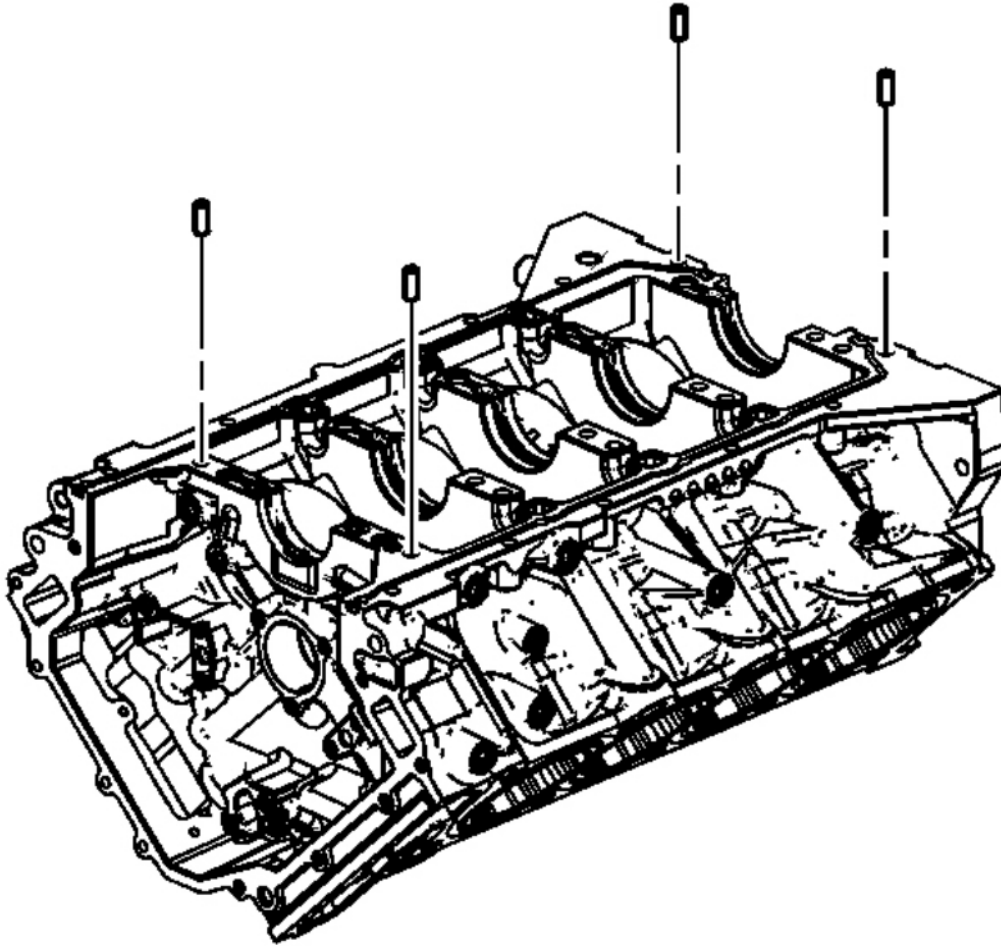


Fig. 37: View Of Engine Block-To-Crankcase Pins
Courtesy of GENERAL MOTORS CORP.

2. Remove the engine block to crankcase pins.

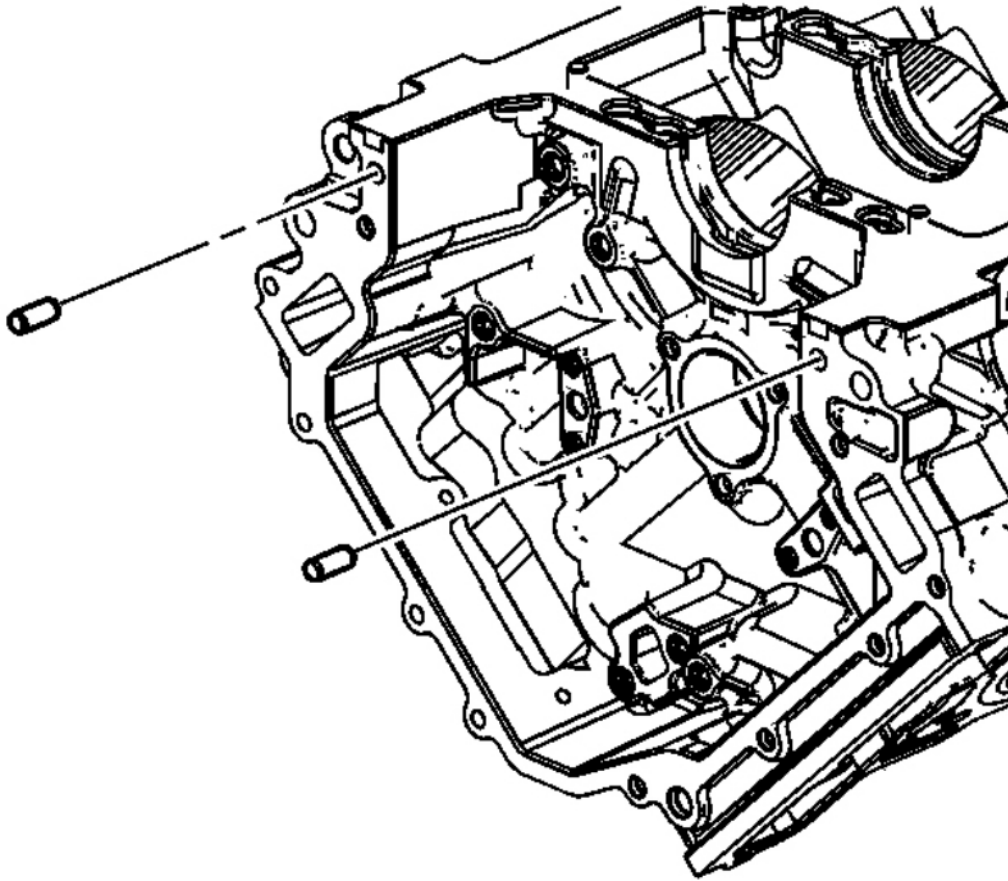


Fig. 38: View Of Engine Block-To-Engine Front Cover Pins
Courtesy of GENERAL MOTORS CORP.

3. Remove the engine block to engine front cover pins.

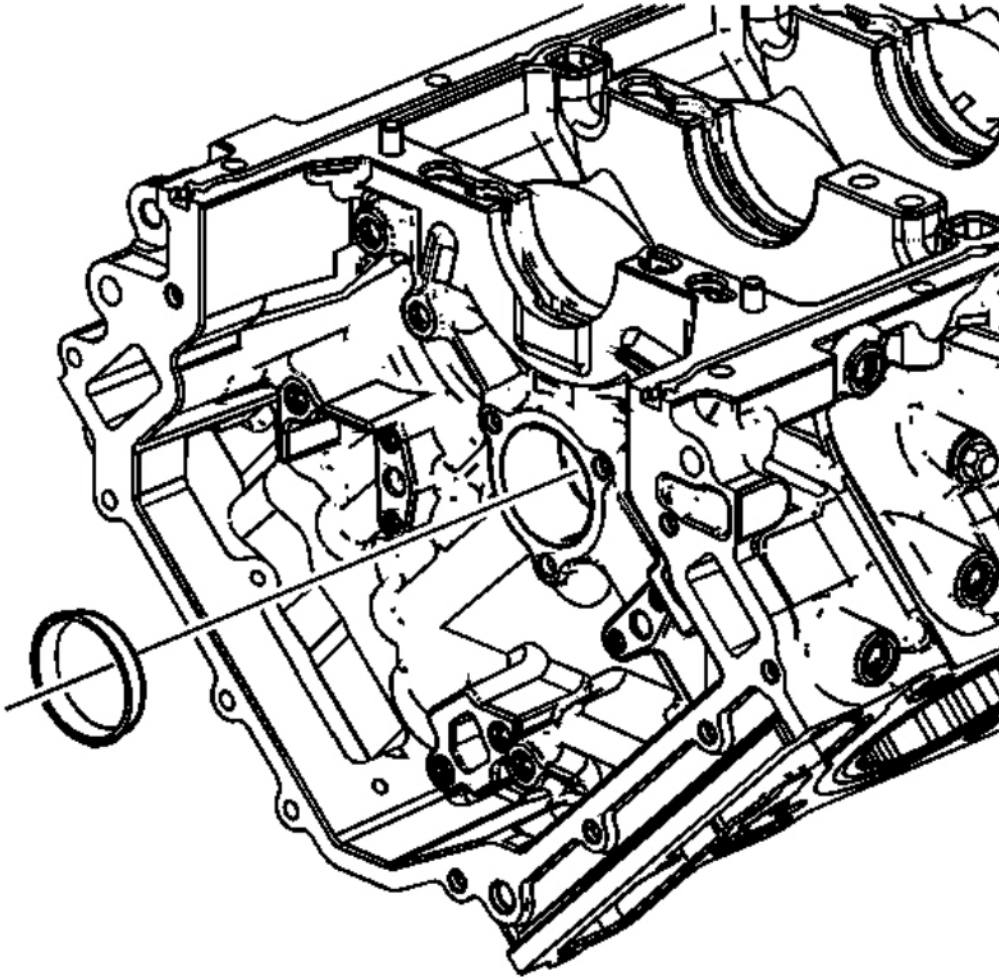


Fig. 39: View Of Camshaft Intermediate Drive Shaft Block Plug
Courtesy of GENERAL MOTORS CORP.

4. Remove the camshaft intermediate drive shaft block plug and discard.

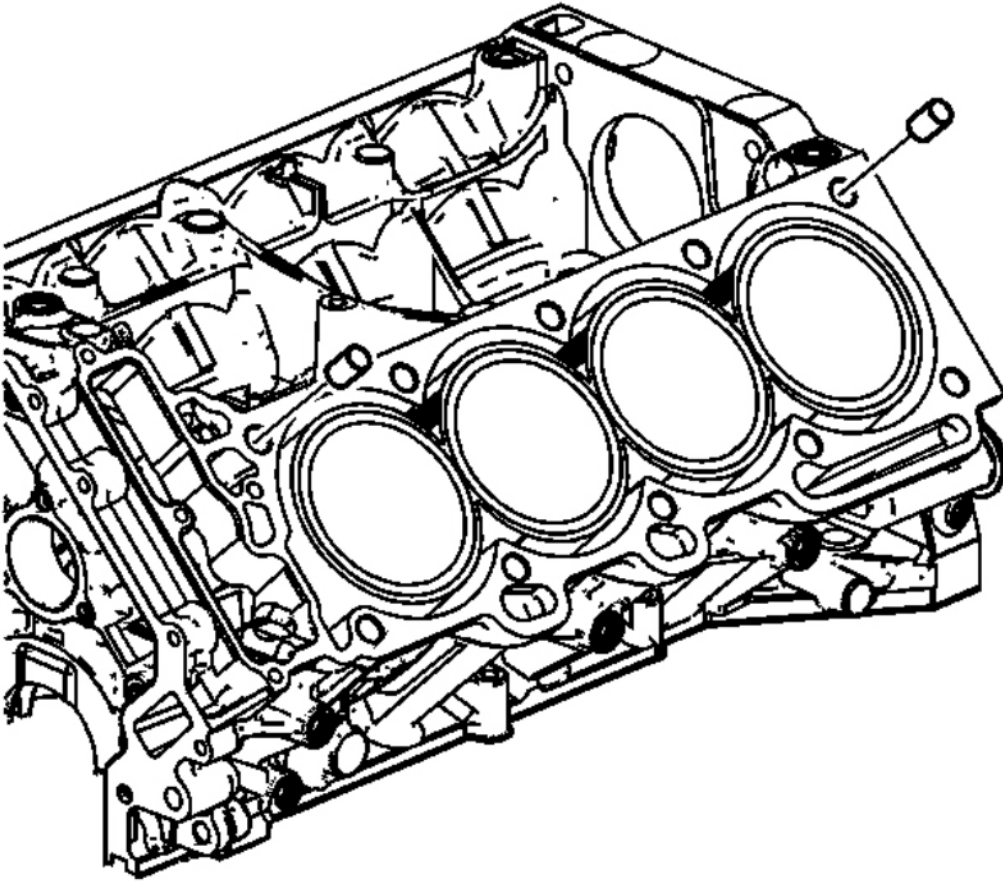


Fig. 40: View Of Left Side Block Deck Face-To-Left Cylinder Head Dowels
Courtesy of GENERAL MOTORS CORP.

5. Remove the left side block deck face to left cylinder head dowels.

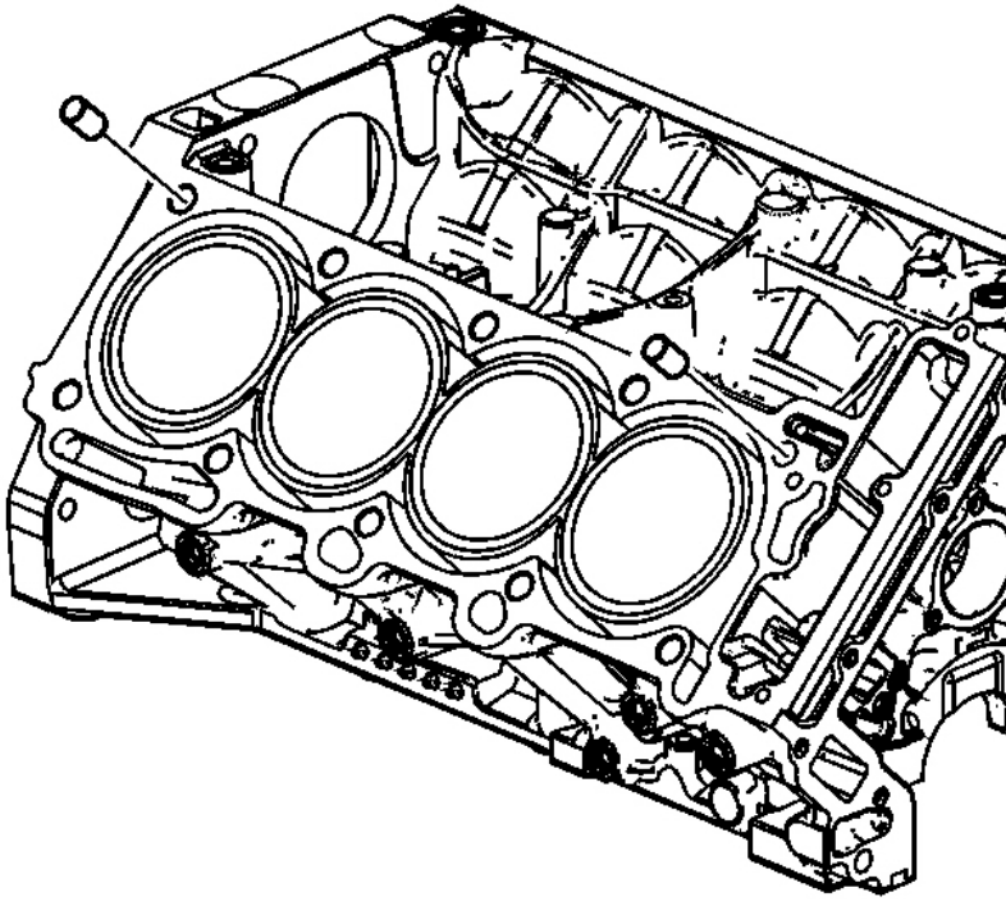


Fig. 41: View Of Right Side Block Deck Face-To-Right Cylinder Head Dowels
Courtesy of GENERAL MOTORS CORP.

6. Remove the right side block deck face to right cylinder head dowels.

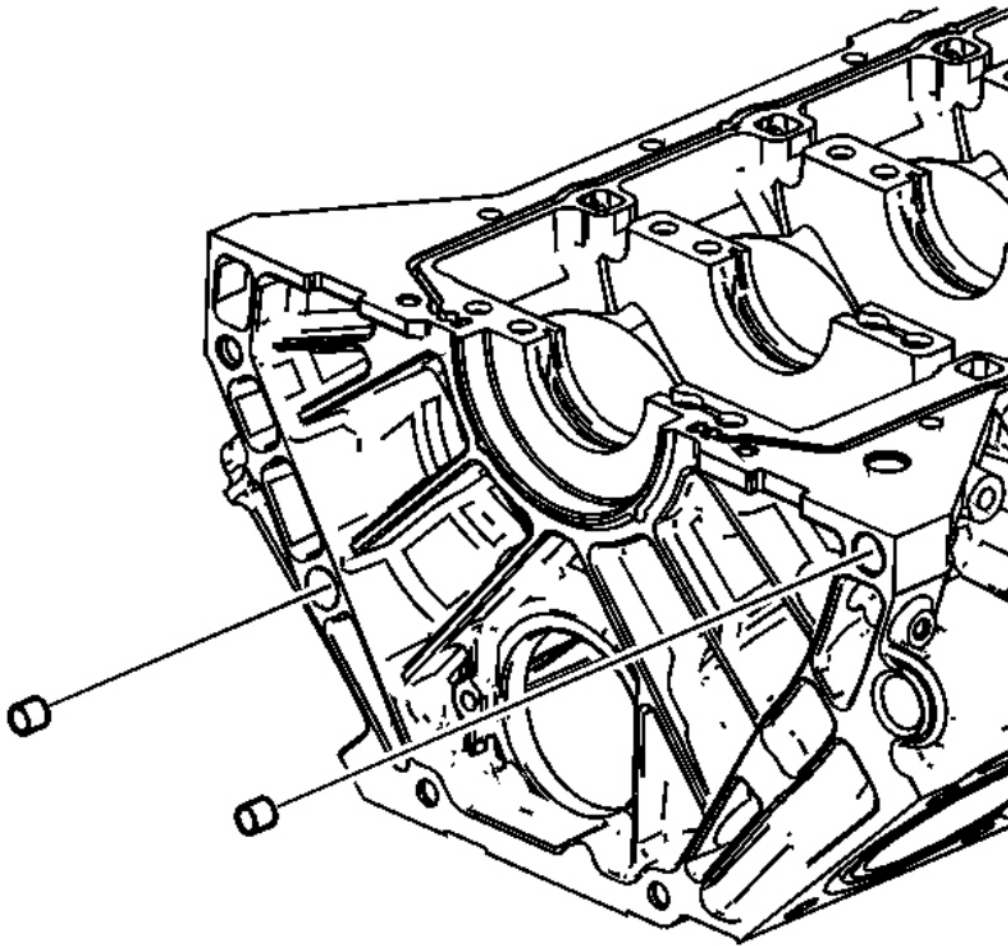


Fig. 42: View Of Engine Block-To-Transmission Dowels
Courtesy of GENERAL MOTORS CORP.

7. Remove the engine block to transmission dowels.

ENGINE BLOCK CLEANING AND INSPECTION - UPPER

Tools Required

J 8087 Cylinder Bore Gage

Cleaning Procedure

1. Remove any old thread sealant and gasket material or sealant.
2. Clean all the following areas with solvent:
 - Sealing surfaces
 - Cooling passages
 - Oil passages
 - Bearing journals
3. Clean all threaded and through holes with solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

4. Dry the upper engine block with compressed air.

Visual Inspection

1. Inspect the crankshaft bearing journals for damage or spun bearings. The crankshaft bearing journals are not repairable, if the crankshaft bearing journals are damaged the cylinder block assembly must be replaced.
2. Inspect the crankshaft rear oil seal bore for damage. The crankshaft rear oil seal bore is not repairable, if the crankshaft rear oil seal bore is damaged the cylinder block assembly must be replaced.
3. Inspect all sealing and mating surfaces for damage, repair or replace the cylinder block assembly if necessary.
4. Inspect all threaded and through holes for damage or excessive debris.
5. Inspect all bolts for damage, if damaged replace with new bolts only.
6. Inspect the cylinder walls for cracks or damage. The cylinders sleeves are not serviced separately, if the cylinders are damaged the cylinder block assembly must be replaced.
7. Inspect the upper engine block for cracks. Do not repair any cracks. If cracks are found, the cylinder block assembly must be replaced.
8. Repair any damaged threaded holes. Refer to Thread Repair Specifications and Thread Repair .

Cylinder Bore Diameter Measurement Procedure

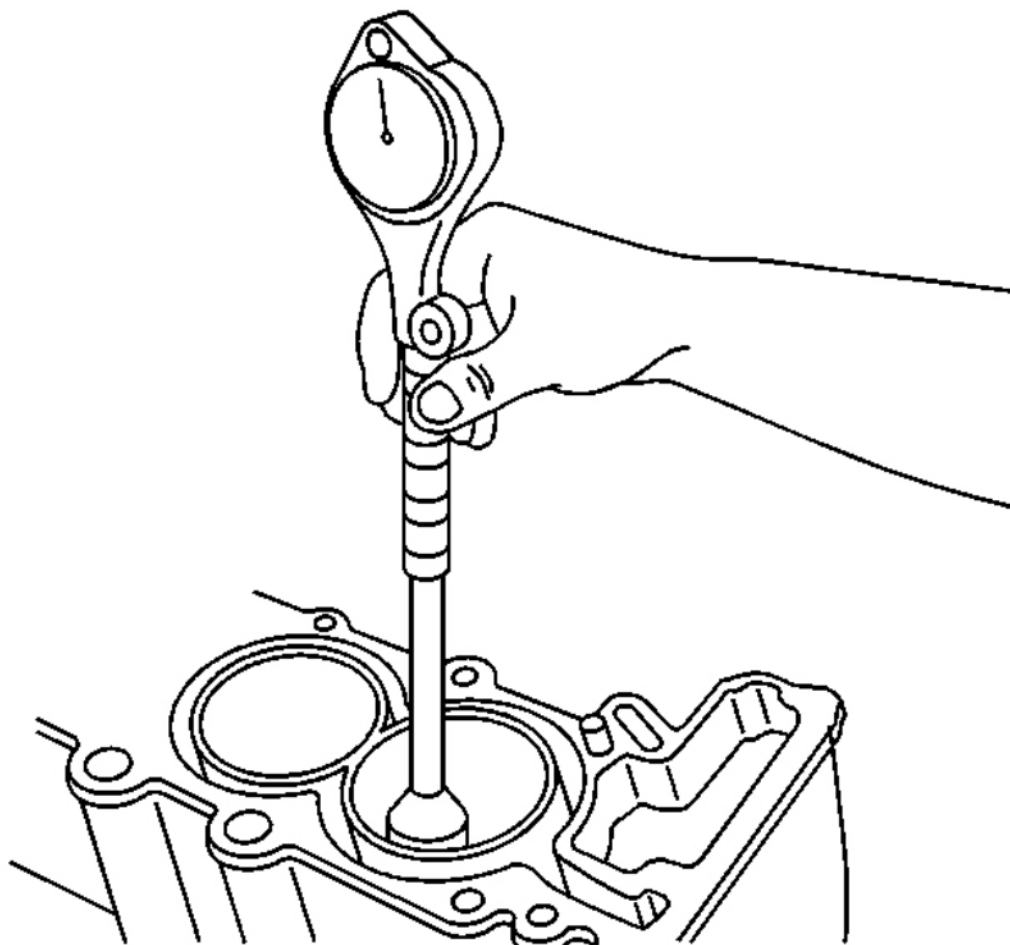


Fig. 43: Measuring Cylinder Bore Diameter
Courtesy of GENERAL MOTORS CORP.

1. Measure the cylinder bore diameter at 41 mm (1.61 in) below the cylinder block deck surface using the **J 8087** .
2. Compare the results with the engine mechanical specifications. If the cylinder diameter exceeds the specifications, the cylinder block must be replaced. There are no oversized pistons available for service. Refer to **Engine Mechanical Specifications** .

Deck Face Flatness Measurement Procedure

1. Place a straight edge across the deck face of the cylinder block at an angle starting at the

front of the block and sloping downward to the rear of the block.

2. Measure the gap between the straight edge and cylinder block by sliding the feeler gages under the straight edge at the front, center and rear of the block. Insert the greatest thickness gage that will fit.
3. Find the difference between the largest and smallest measurement.
4. Change the position of the straight edge so that the angle travels up from the front of the block to the rear.
5. Measure the gap between the straight edge and the deck face again at the front, center and rear. Insert the greatest thickness gage that will fit.
6. Find the difference between the largest and smallest measurement.
7. Position the straight edge so it travels through the center of the cylinder bores.
8. Measure the gap between the straight edge and the deck face a final time at the front, center and rear. Insert the greatest thickness gage that will fit.
9. Find the difference between the largest and smallest measurement.

IMPORTANT: If the flatness measurement exceeds the specifications, replace the cylinder block. Machining of the deck face surface is NOT allowed.

10. Compare your measurement to the engine mechanical specifications.

Cylinder Bore Taper Measurement Procedure

1. Measure the cylinder bore along the thrust surfaces at 5 mm (0.200 in) below the deck surface with the bore gage perpendicular to the crankshaft centerline and record the measurements.
2. Measure the cylinder bore along the thrust surfaces at 102 mm (4.000 in) below the deck surface with the bore gage perpendicular to the crankshaft centerline and record the measurements.
3. Calculate the difference between the two measurements. The result will be the cylinder taper.
4. Compare your results with the engine mechanical specifications. If the cylinders exceed these specifications, replace the cylinder block.

Cylinder Bore Out-of-Round Measurement Procedure

1. Measure both the thrust and non-thrust cylinder diameter 5 mm (0.20 in) below the deck surface using the **J 8087** . Record your measurements.

2. Calculate the difference between the two measurements. The result will indicate out-of-round at the upper end of the cylinder.
3. Measure both the thrust and non-thrust cylinder diameter 102 mm (4.00 in) below the deck surface using the **J 8087** . Record your measurements.
4. Calculate the difference between the two measurements. The result will indicate out-of-round at the lower end of the cylinder.
5. Compare your results with the engine mechanical specifications. If the cylinders exceed these specifications, replace the cylinder block.

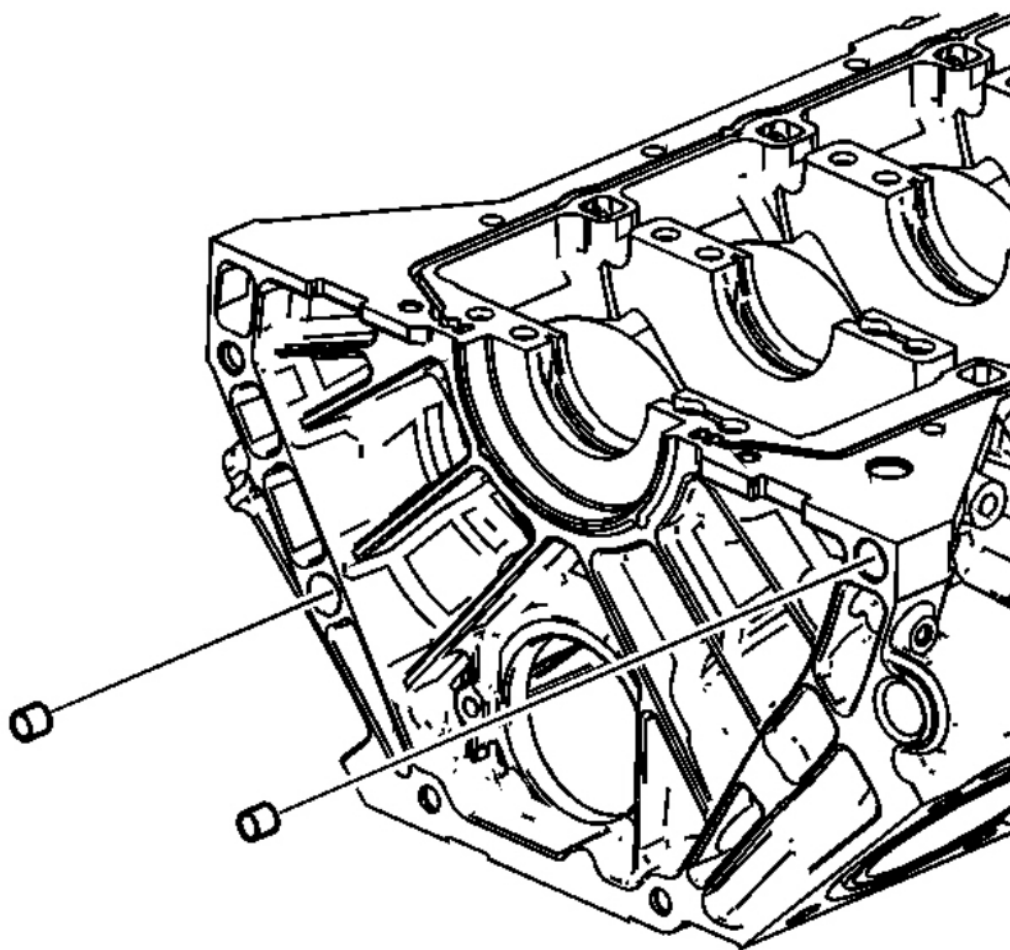
ENGINE BLOCK ASSEMBLY - UPPER

Fig. 44: View Of Engine Block-To-Transmission Dowels
Courtesy of GENERAL MOTORS CORP.

1. Install the engine block to transmission dowels.

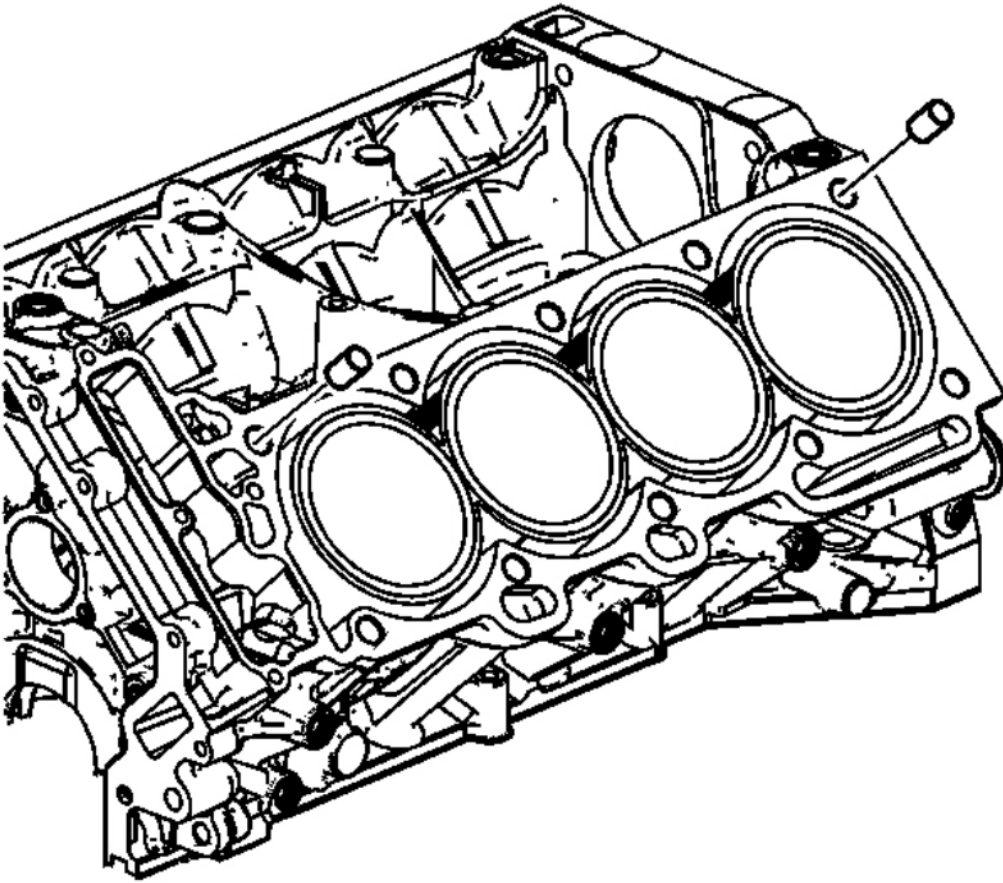


Fig. 45: View Of Left Side Block Deck Face-To-Left Cylinder Head Dowels
Courtesy of GENERAL MOTORS CORP.

2. Remove the left side block deck face to left cylinder head dowels.

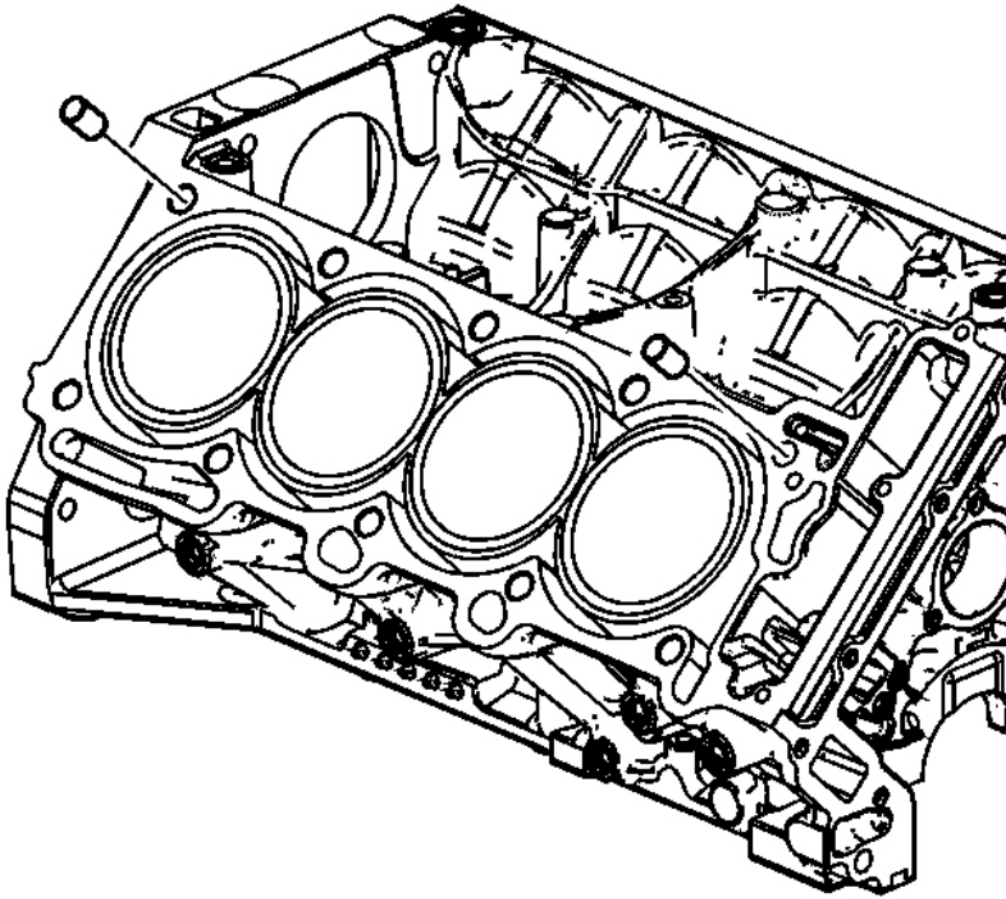


Fig. 46: View Of Right Side Block Deck Face-To-Right Cylinder Head Dowels
Courtesy of GENERAL MOTORS CORP.

3. Install the right side block deck face to right cylinder head dowels.

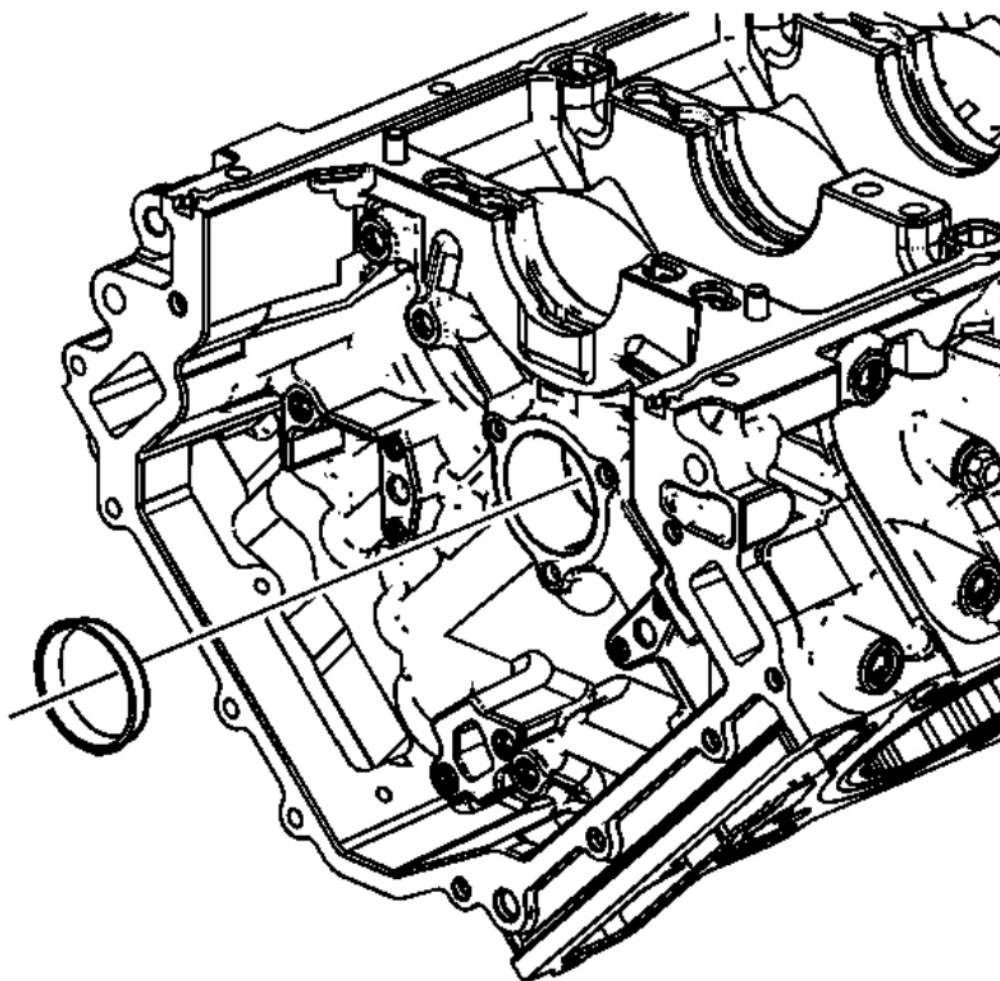


Fig. 47: View Of Camshaft Intermediate Drive Shaft Block Plug
Courtesy of GENERAL MOTORS CORP.

NOTE: Proper installation of the camshaft intermediate shaft plug must be ensured. An improperly installed camshaft intermediate shaft plug can interfere and restrict oil flow to the cylinder heads if installed too shallow, and may interfere with the crankshaft if installed too deep. Failure to properly install the camshaft intermediate shaft plug can lead to engine damage.

4. Install the NEW camshaft intermediate drive shaft block plug.

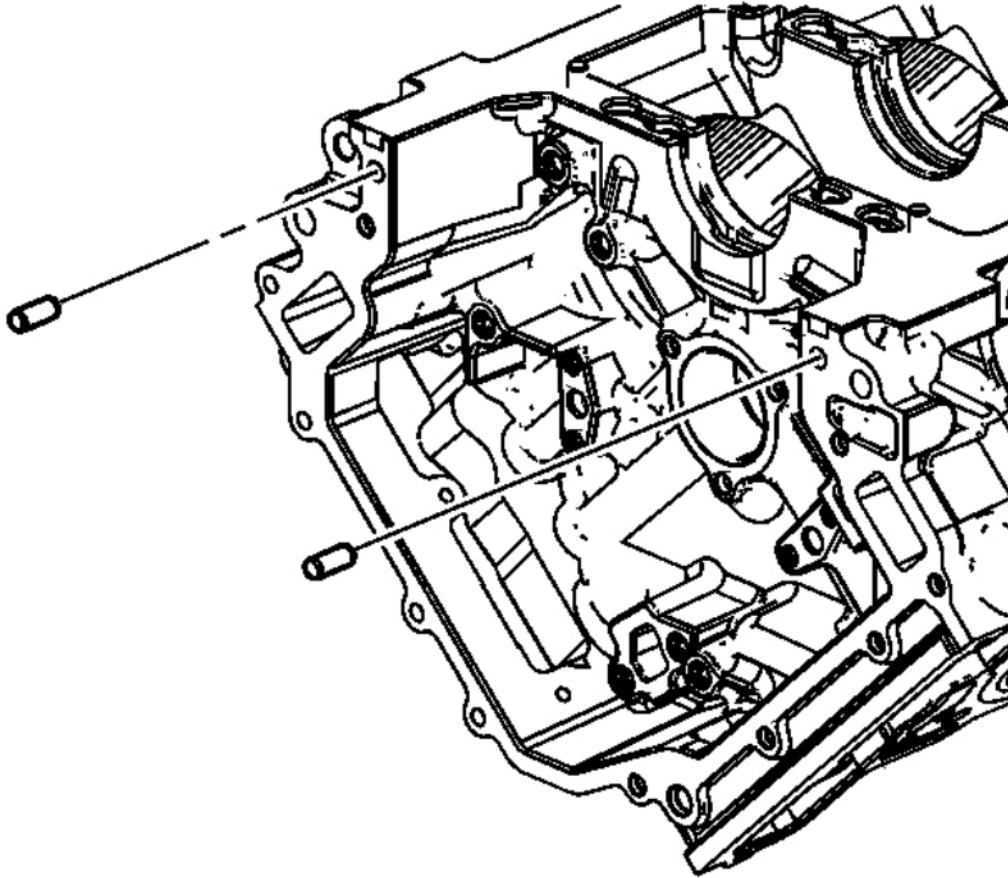


Fig. 48: View Of Engine Block-To-Engine Front Cover Pins
Courtesy of GENERAL MOTORS CORP.

5. Install the engine block to engine front cover pins.

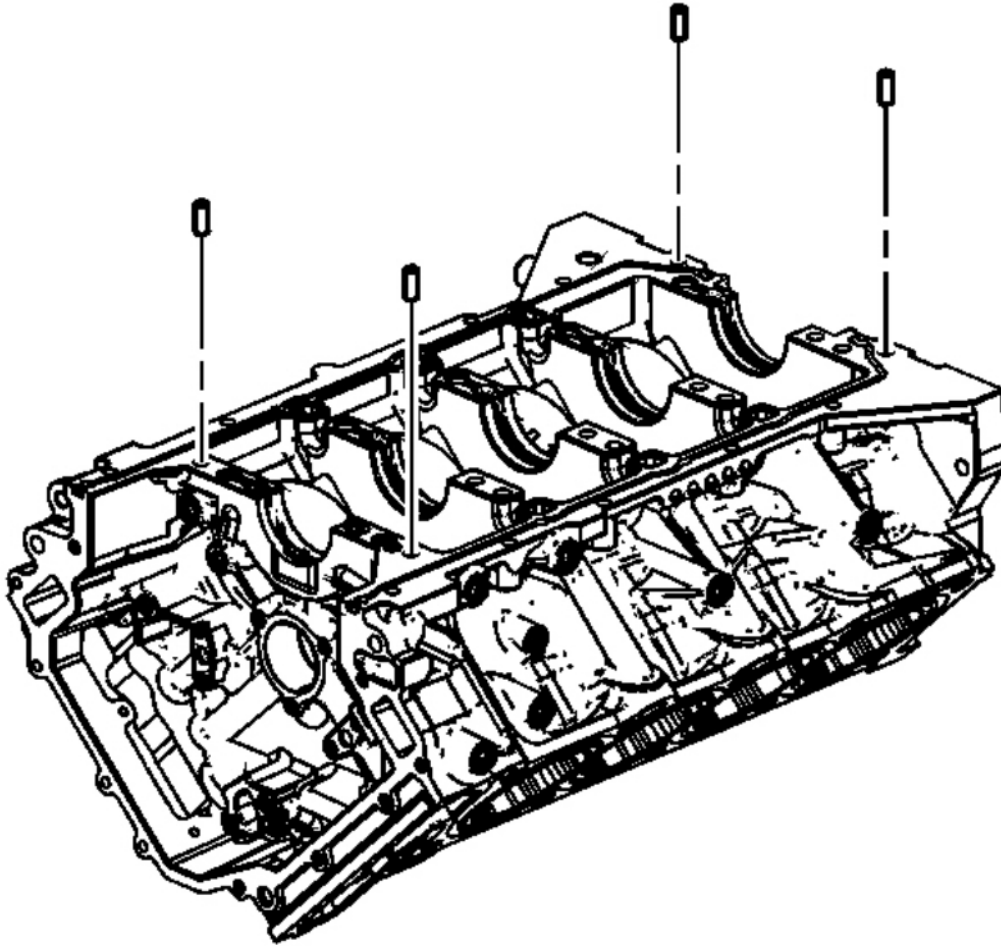


Fig. 49: View Of Engine Block-To-Crankcase Pins
Courtesy of GENERAL MOTORS CORP.

6. Install the engine block to crankcase pins.

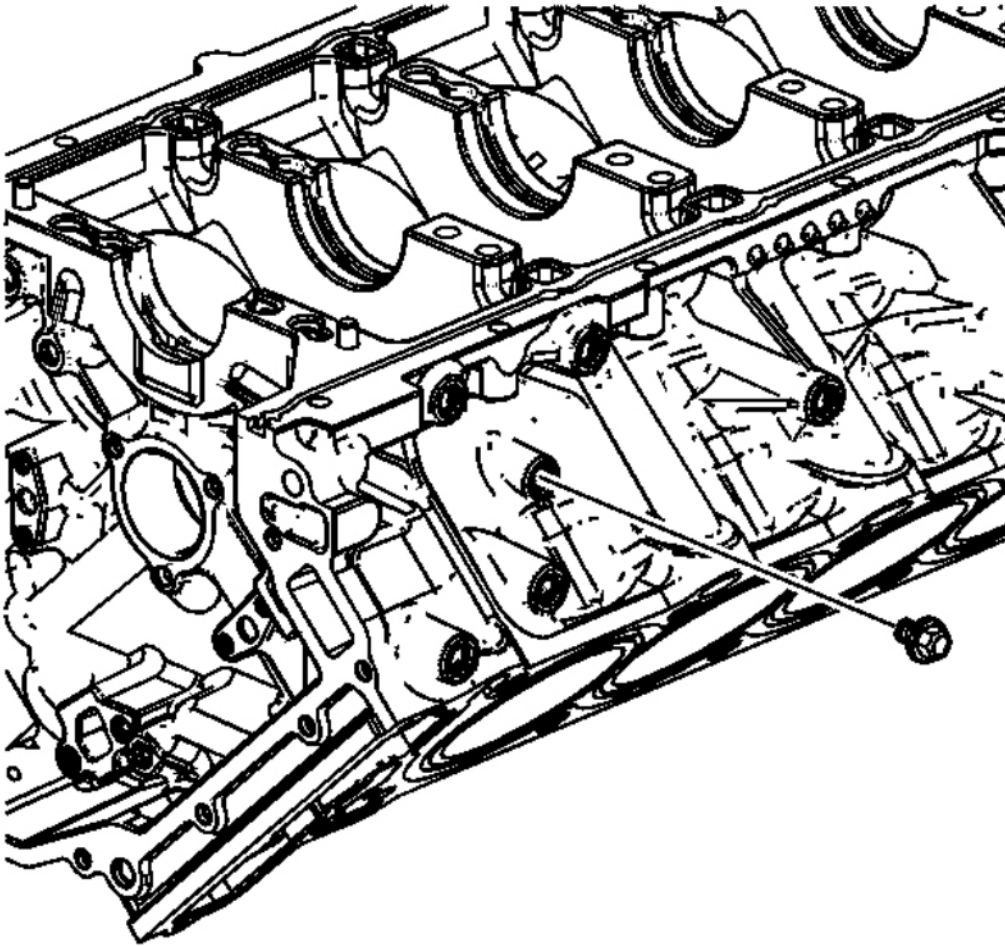


Fig. 50: View Of Engine Coolant Drain Plug
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

7. Install the engine coolant drain plug.

Tighten: Tighten the engine coolant drain plug to 20 N.m (15 lb ft).

ENGINE BLOCK CLEANING AND INSPECTION - LOWER

Cleaning Procedure

1. Remove any old thread sealant and gasket material or sealant.
2. Clean all the following areas with solvent:
 - Sealing surfaces
 - Oil passages
 - Bearing journals
3. Clean all threaded and through holes with solvent.
4. Clean the old oil manifold plate in order to use for the main bearing clearance procedure.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

5. Dry the lower engine block with compressed air.

Visual Inspection

1. Inspect the crankshaft bearing journals for damage or spun bearings. The crankshaft bearing journals are not repairable, if the crankshaft bearing journals are damaged the cylinder block assembly must be replaced.
2. Inspect the crankshaft rear oil seal bore for damage. The crankshaft rear oil seal bore is not repairable, if the crankshaft rear oil seal bore is damaged the cylinder block assembly must be replaced.
3. Inspect all sealing and mating surfaces for damage, repair or replace the cylinder block assembly if necessary.
4. Inspect all threaded and through holes for damage or excessive debris.
5. Inspect all bolts for damage, if damaged replace with new bolts only.
6. Inspect the lower engine block for cracks. Do not repair any cracks. If cracks are found, the cylinder block assembly must be replaced.
7. Repair any damaged threaded holes. Refer to Thread Repair Specifications and Thread Repair .

CRANKSHAFT AND BEARINGS CLEANING AND INSPECTION

Cleaning Procedure

1. Clean the following components in solvent:
 - Crankshaft bearings
 - Connecting rod bearings

- Crankshaft journals
- Crankpin journals
- Crankshaft oil passages
- Crankshaft threaded holes

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Dry the following components with compressed air:

- Crankshaft bearings
- Connecting rod bearings
- Crankshaft journals
- Crankpin journals
- Crankshaft oil passages
- Crankshaft threaded holes

Visual Inspection

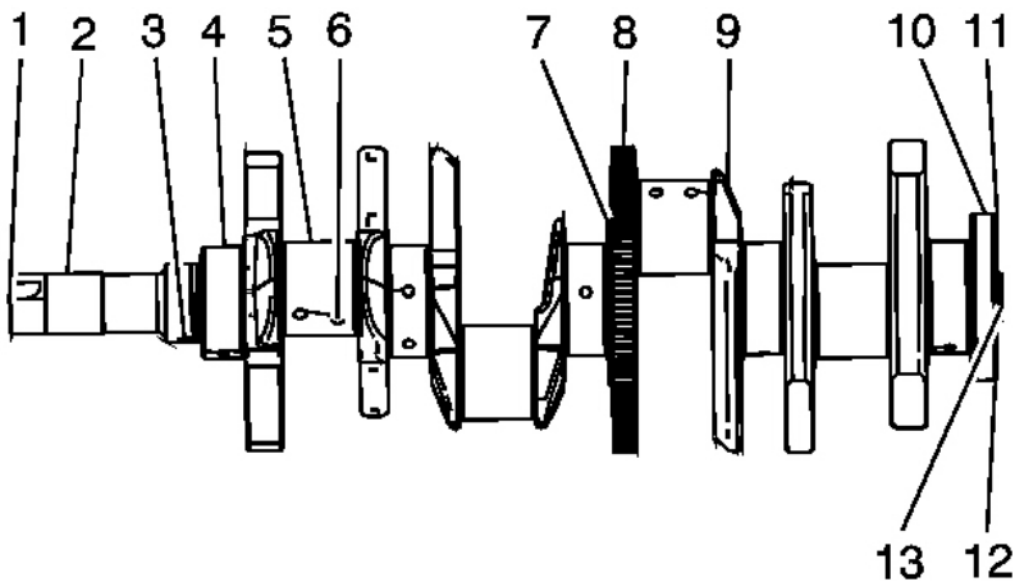


Fig. 51: Inspecting Crankshaft
Courtesy of GENERAL MOTORS CORP.

1. Perform the following visual inspections:
 - Inspect the crankshaft balancer bolt hole (1) for thread damage
 - Inspect the crankshaft balancer mounting area (2) for damage
 - Inspect the crankshaft sprocket pin hole (3) for damage
 - Inspect the crankshaft main journals (4) for damage
 - Inspect the crankshaft connecting rod journals (5) for damage
 - Inspect the crankshaft oil passages (6) for obstructions
 - Inspect the crankshaft main bearing thrust wall surfaces (7) for damage
 - Inspect the crankshaft reluctor ring teeth (8) for damage
 - Inspect the crankshaft counterweights (9) for damage
 - Inspect the crankshaft rear main oil seal surface (10) for damage
 - Inspect the crankshaft engine flywheel mounting surface (11) for damage
 - Inspect the crankshaft engine flywheel bolt holes (12) for thread damage
 - Inspect the crankshaft pilot hole (13) for damage
2. Repair or replace the crankshaft as necessary.

Crankshaft Bearing Inspection

IMPORTANT: All connecting rod and main journal bearings that have been used in a running engine must be replaced. Never re-use the crankshaft or connecting rod bearings.

The following bearing wear conditions should be used to diagnose engine operating conditions or root cause of a condition.

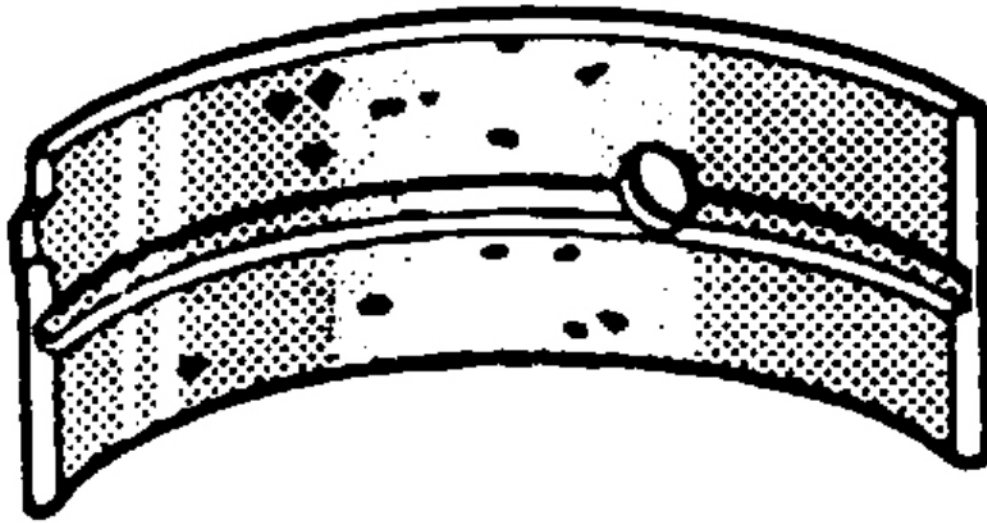


Fig. 52: Identifying Crankshaft Bearing Craters Or Pockets
Courtesy of GENERAL MOTORS CORP.

1. Inspect for fatigue indicated by craters or pockets. Flattened sections on the bearing halves also indicate fatigue.

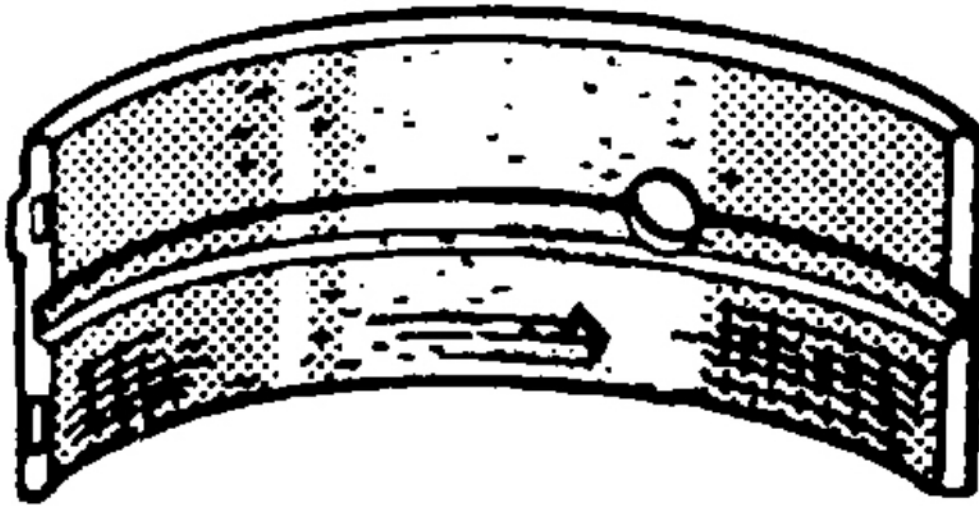


Fig. 53: Identifying Connecting Rod Bearing Scoring Or Discoloration
Courtesy of GENERAL MOTORS CORP.

2. Inspect for excessive scoring or discoloration on both front and back of the bearing halves.
3. Inspect the main bearings for dirt imbedded into the bearing material.

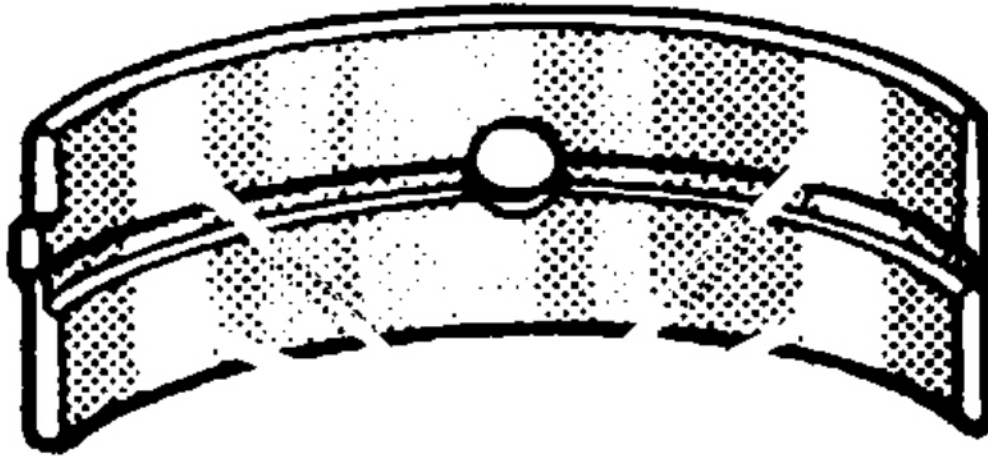


Fig. 54: Crankshaft Bearing Polished Sections (Improper Seating)
Courtesy of GENERAL MOTORS CORP.

4. Inspect for improper seating indicated by bright, polished sections.

Crankshaft Measurement

Tools Required:

J 7872 Magnetic Base Dial Indicator

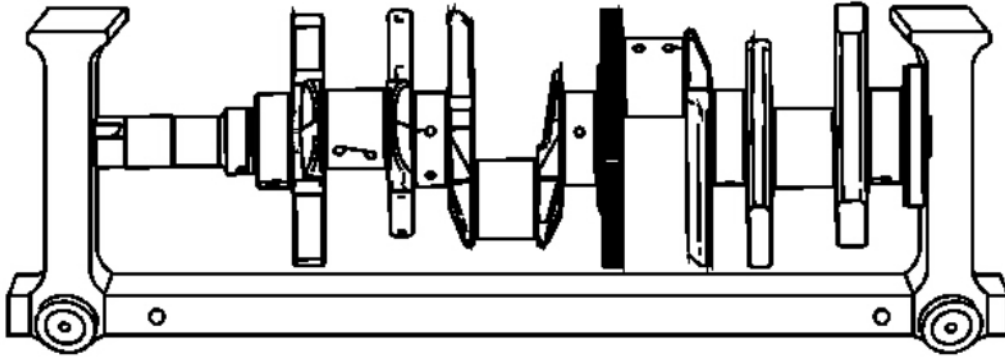


Fig. 55: Supporting Crankshaft
Courtesy of GENERAL MOTORS CORP.

1. Using a suitable fixture, support the crankshaft.

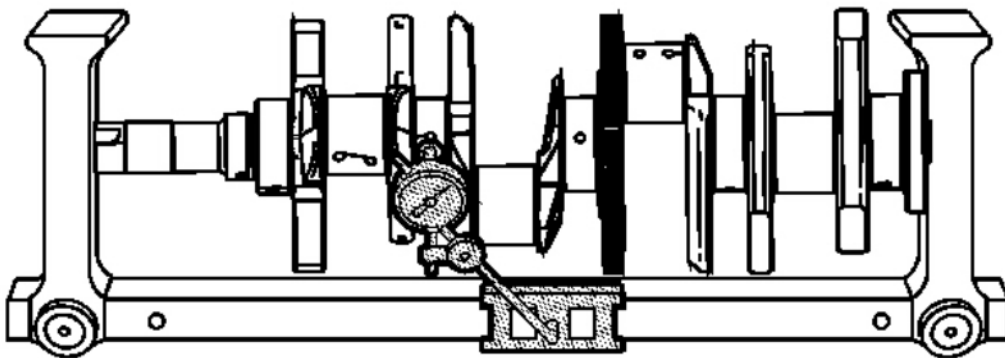


Fig. 56: Measuring Crankshaft Runout
Courtesy of GENERAL MOTORS CORP.

2. Install the **J 7872** .
3. Measure the crankshaft runout using **J 7872** . Refer to **Engine Mechanical Specifications** .

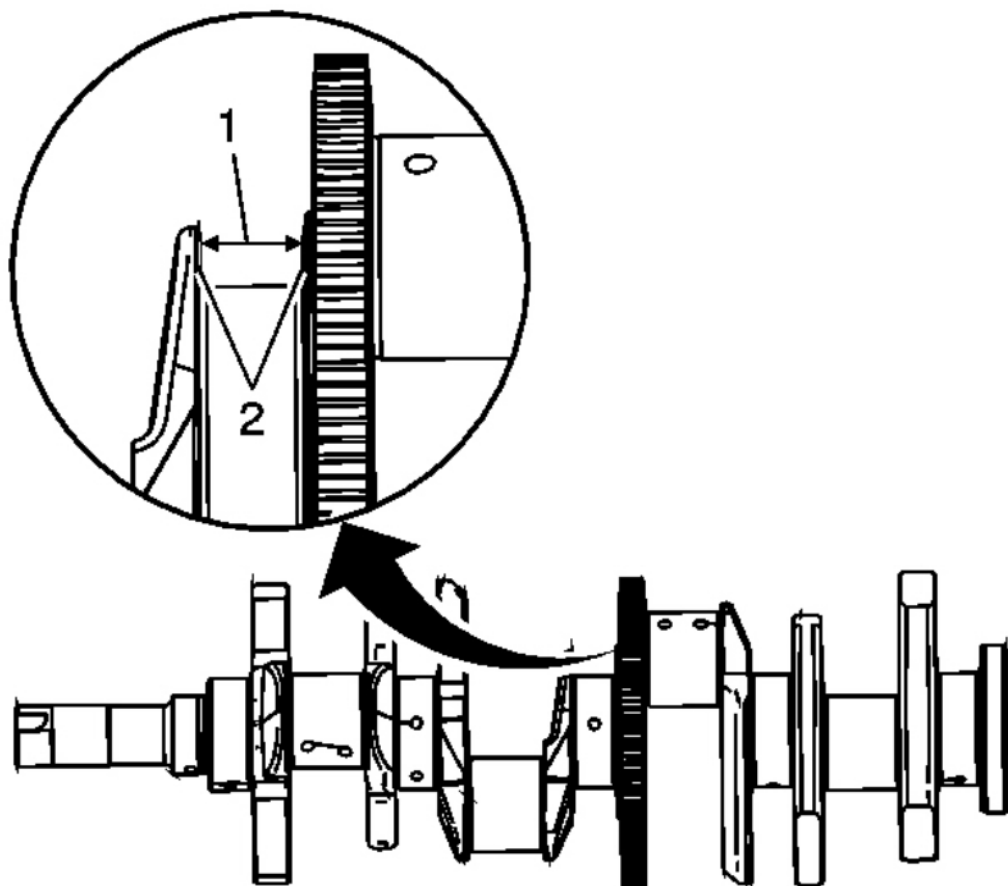


Fig. 57: Measuring Crankshaft Thrust Wall Width & Surface
Courtesy of GENERAL MOTORS CORP.

4. Measure the crankshaft thrust wall width (1) for wear using an inside micrometer. Refer to **Engine Mechanical Specifications** .
5. Measure the crankshaft thrust wall surface (2) for runout using **J 7872** . Refer to **Engine Mechanical Specifications** .
6. If the crankshaft thrust walls are damaged or worn beyond specifications, replace the crankshaft. No machining of the crankshaft thrust wall is allowed.

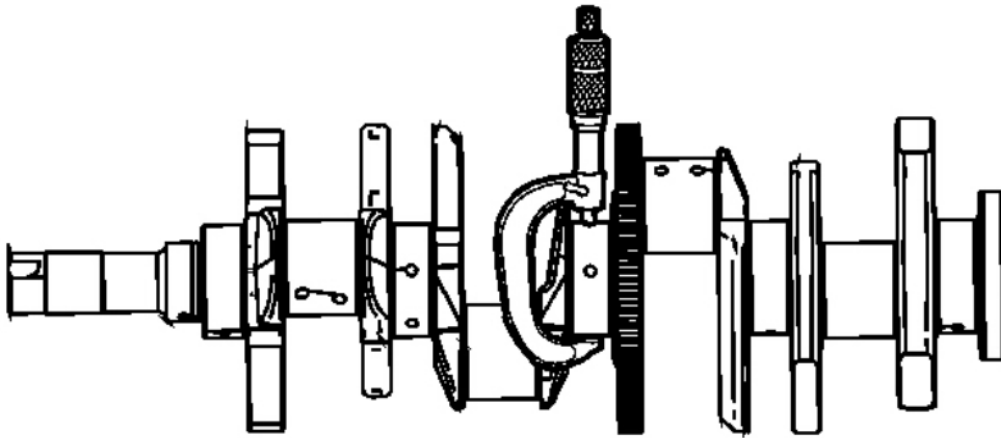


Fig. 58: Checking Crankshaft Main Journals For Undersize
Courtesy of GENERAL MOTORS CORP.

7. Check the crankshaft main journals for undersize using an outside micrometer.

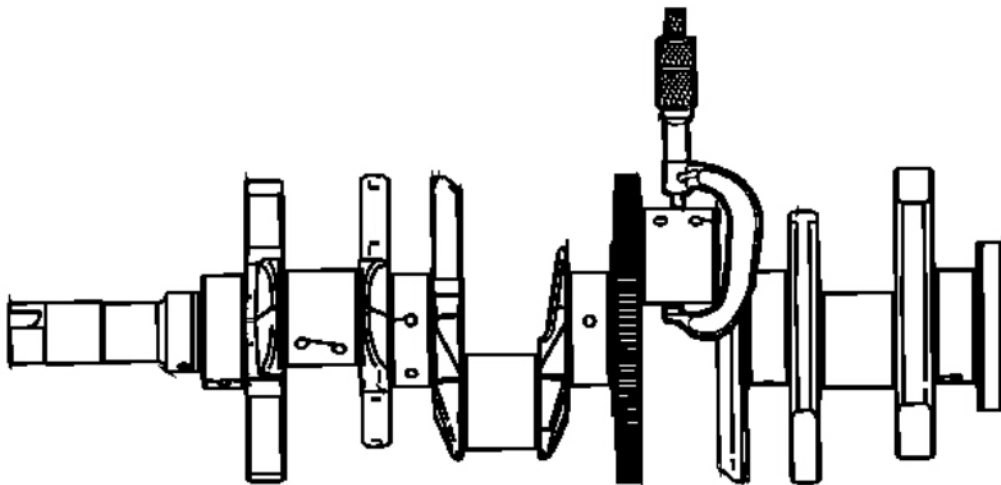


Fig. 59: Checking Crankpins For Undersize

Courtesy of GENERAL MOTORS CORP.

8. Check the crankpins for undersize using an outside micrometer.
9. Compare your measurements with those listed in the **Engine Mechanical Specifications** . If the crankshaft journals are worn beyond the specified limits, the crankshaft must be replaced. Crankshaft machining is not allowed and there are no undersized bearings available for service.

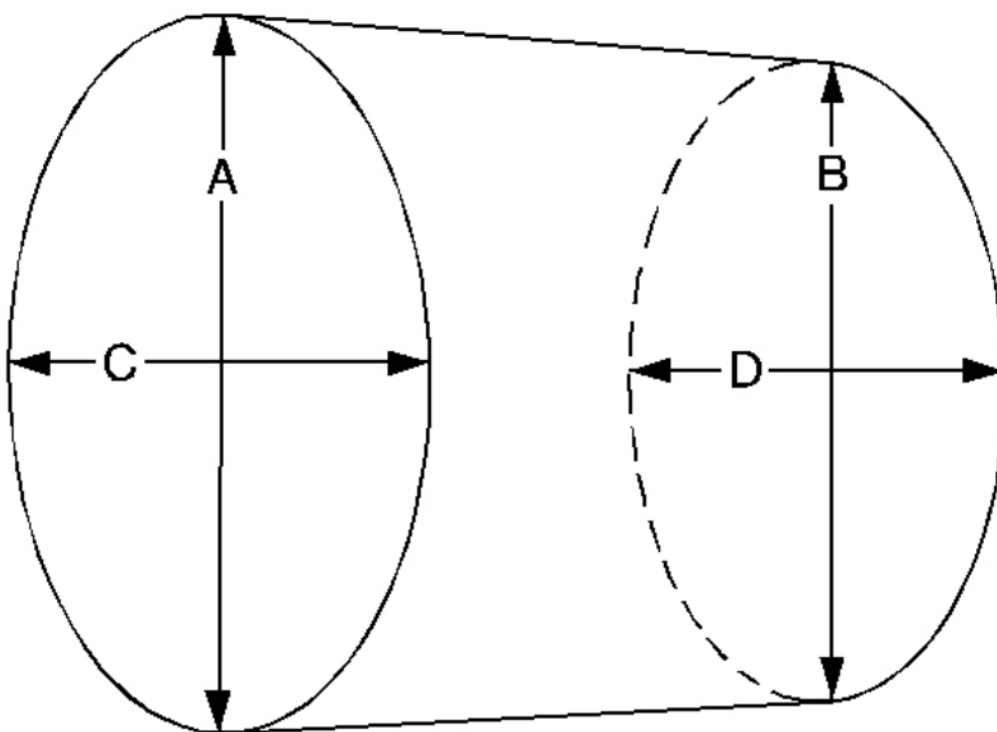


Fig. 60: Measuring Main Bearing & Crankpin Journals For Out-Of-Round
Courtesy of GENERAL MOTORS CORP.

10. Measure the main bearing and crankpin journals for out-of-round using the following procedure:
 1. Using an outside micrometer, measure the journal at the extreme front and rear locations on the journal. Call these points A and B.
 2. Measure the journal in two new locations exactly 90 degrees from the first points. Call

these points C and D.

3. Subtract A from C and B from D. The differences will indicate journal out-of-round.
 4. The out-of-round should not exceed 0.004 mm (0.00016 in) maximum.
 5. If the specifications are exceeded, replace the crankshaft.
11. Measure the main bearing and crankpin journals for taper using the following procedure:
1. Using an outside micrometer, measure the journal at the extreme front (A) and rear (B) of the journal parallel to the crankshaft centerline.
 2. Subtract the smallest from the largest measurement. The result will be the journal taper.
 3. If the main bearing journal taper exceeds 0.004 mm (0.00016 in), replace the crankshaft.
 4. If the crankpin journal taper exceeds 0.004 mm (0.00016 in), replace the crankshaft.

CRANKSHAFT BALANCER CLEANING AND INSPECTION

Cleaning Procedure

1. Clean the crankshaft balancer in solvent that is compatible with the rubber.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Dry the crankshaft balancer with compressed air.

Inspection Procedure

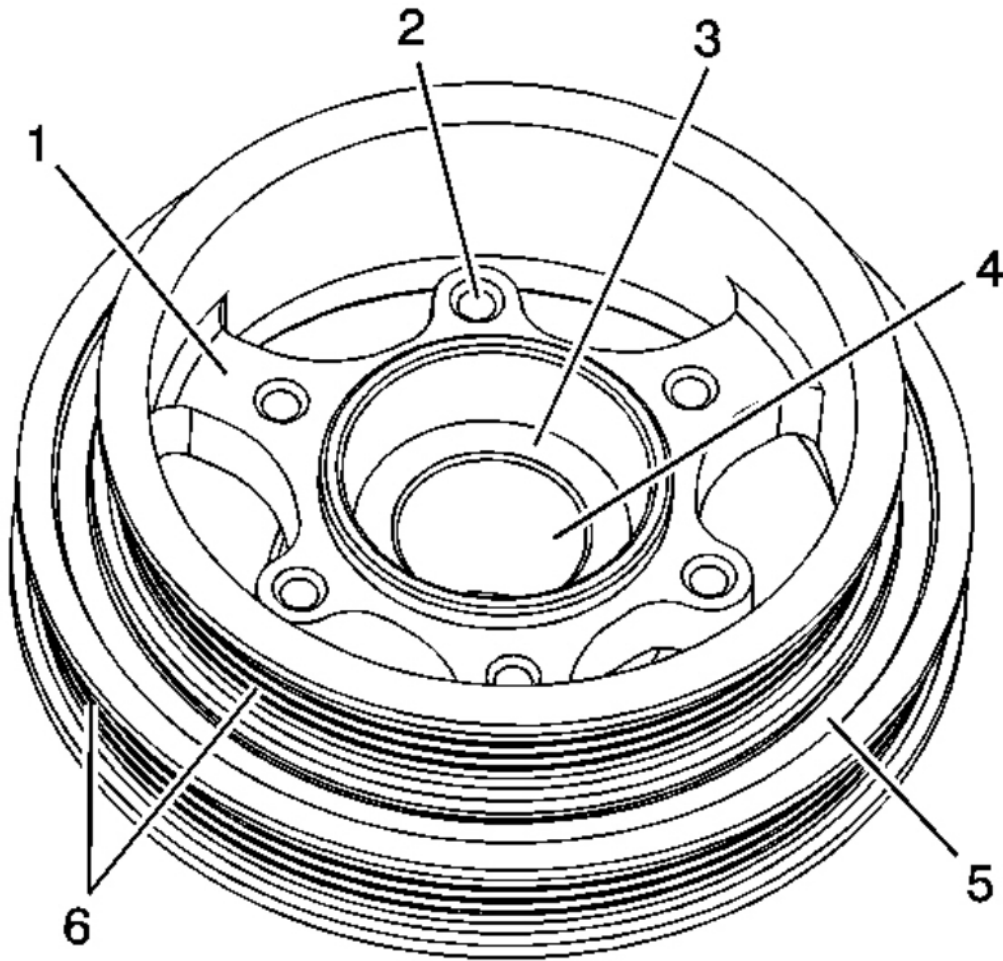


Fig. 61: Inspecting Exterior Crankshaft Balancer
Courtesy of GENERAL MOTORS CORP.

1. Inspect the exterior of the crankshaft balancer for the following:
 - Damage to the webs (1) between the hub and the drive belt inner pulley
 - Damage to the threaded holes (2)
 - Damage to the seating surface (3) for the crankshaft balancer bolt's washer
 - Wear or damage to the hub-to-crankshaft surface (4)
 - Wear, chunking or deteriorated rubber (5) between the drive belt inner and outer pulleys

- Damage to the drive belt inner and/or outer pulley ribs (6)

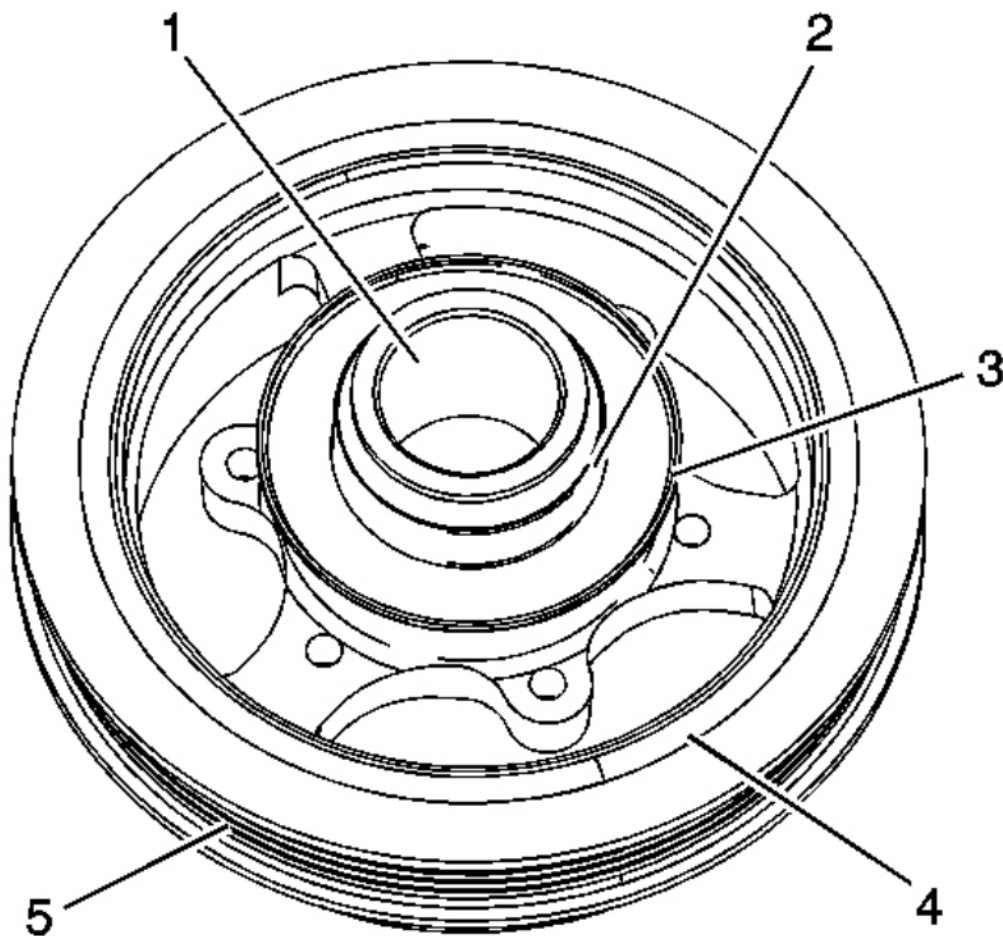


Fig. 62: Inspecting Interior Crankshaft Balancer
Courtesy of GENERAL MOTORS CORP.

2. Inspect the interior of the crankshaft balancer for the following:
 - Wear or damage to the hub-to-crankshaft surface (1)
 - Wear, grooves or damage to the hub sealing surface (2). A crankshaft balancer hub sealing surface with excessive scoring, grooves, rust or other damage must be replaced.
 - Bent, damage or missing crankshaft front oil seal shield (3)

- Wear, chunking or deteriorated rubber (4) between the drive belt inner and outer pulleys
 - Damage to the drive belt inner and/or outer pulley ribs (5)
3. Repair or replace the crankshaft balancer as necessary.

ENGINE FLYWHEEL CLEANING AND INSPECTION

Cleaning Procedure

1. Clean the engine flywheel in solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Dry the engine flywheel with compressed air.

Inspection Procedure

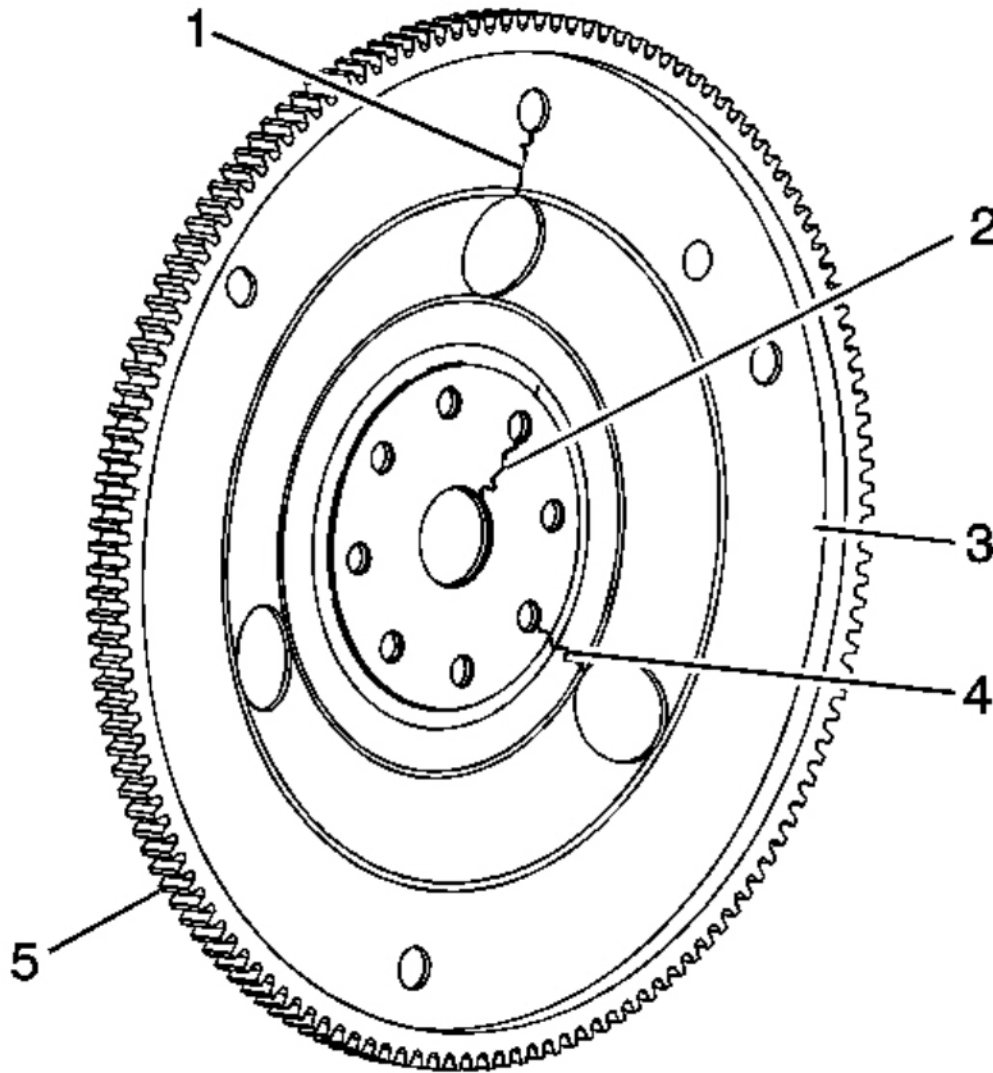


Fig. 63: Inspecting Engine Flywheel

Courtesy of GENERAL MOTORS CORP.

1. Inspect the engine flywheel for the following conditions:
 - Stress cracks around the engine flywheel-to-torque converter mounting bolt hole locations (1) and/or engine flywheel-to-crankshaft (2, 4)

IMPORTANT: Do not attempt to repair the welded areas that retain the ring gear to the engine flywheel plate. Install a new engine flywheel.

- Cracks at welded areas that retain the ring gear onto the engine flywheel (3)
 - Damaged or missing ring gear teeth (5)
2. Replace the engine flywheel as necessary.

PISTON AND CONNECTING ROD DISASSEMBLE

Tools Required:

J 43654 Piston Pin Clip Remover and Installer

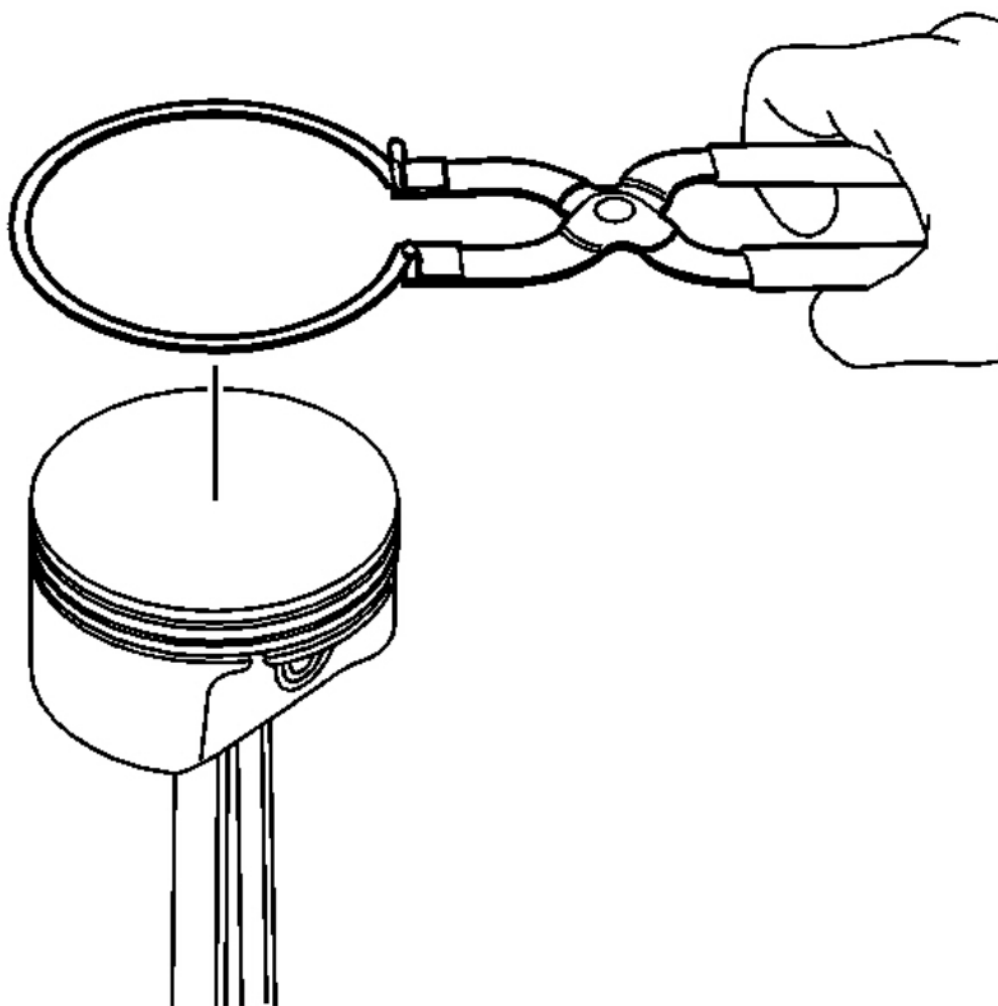


Fig. 64: Removing/Installing Piston Rings
Courtesy of GENERAL MOTORS CORP.

NOTE: You must use a piston ring expander to remove and install the piston rings. Only expand the rings far enough to fit over the piston lands. If the rings are overexpanded, the top ring will shatter and the others will distort.

1. Remove the piston rings using a piston ring expander. Place each ring in a clean shop towel for storage.

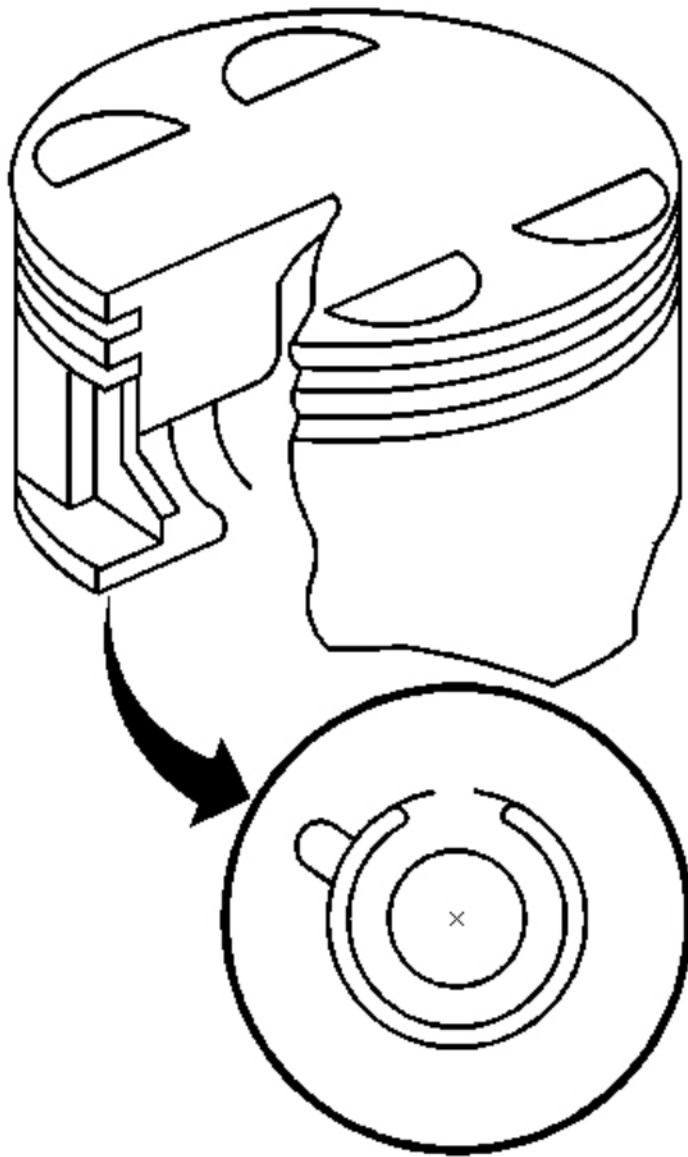


Fig. 65: Locating Piston Ring Retainers
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Be careful not to nick or gouge the piston or the retaining ring groove with the screwdriver if the piston is to be reused.

2. Using the **J 43654** , pry out the piston pin retainers by using the removal access notch in the side of the piston.
3. Discard the old piston pin retainers.

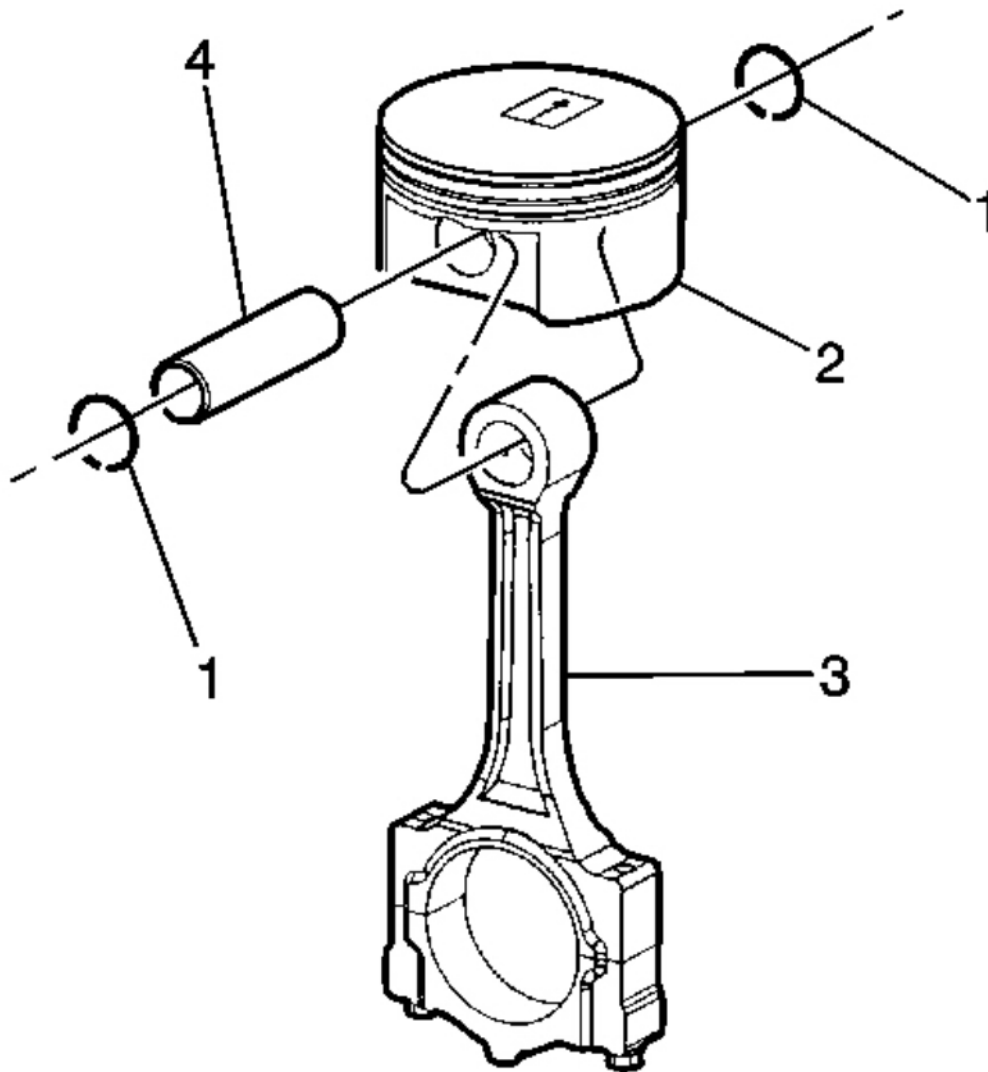


Fig. 66: Exploded View Of Piston & Connecting Rod Assembly
Courtesy of GENERAL MOTORS CORP.

4. Slide the piston pin (4) out of the piston. The piston will disconnect from the connecting rod (2).

PISTON, CONNECTING ROD, AND BEARINGS CLEANING AND INSPECTION

Piston Cleaning Procedure

IMPORTANT: DO NOT wire brush any part of the piston.

1. Clean the piston and piston pin with solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Clean the piston ring grooves with a groove cleaner. Ensure the oil ring holes and slots are clean.
3. Dry the piston and piston pin with compressed air.

Piston Inspection Procedure

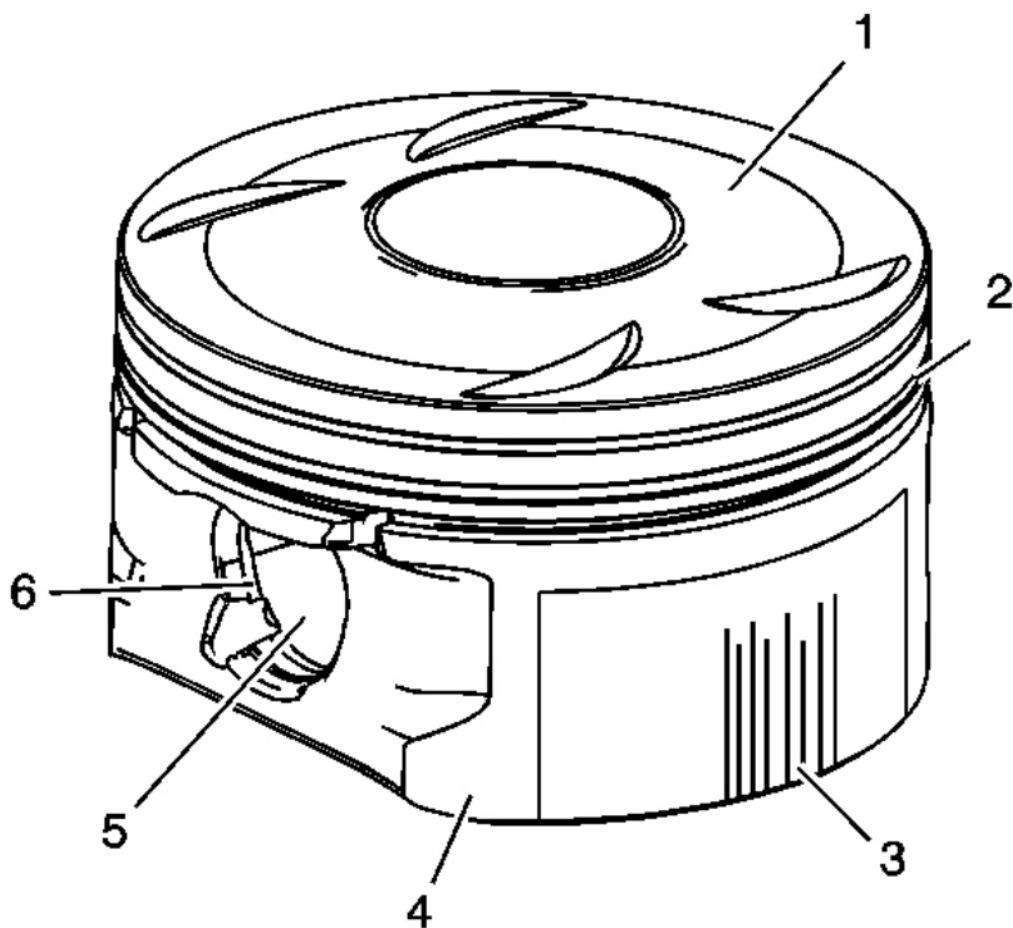


Fig. 67: Inspecting Piston

Courtesy of GENERAL MOTORS CORP.

1. Inspect the top of the piston (1) for erosion.
2. Inspect the ring lands and ring grooves (2) for cracks, warpage, wear and nicks/burrs that cause binding.
3. Inspect the piston skirt coating (3) for excessive wear.
4. Inspect the piston skirt (4) for cracks.
5. Inspect the piston pin bore (5) for wear, cracks and pin retainer grooves (6) for burrs.

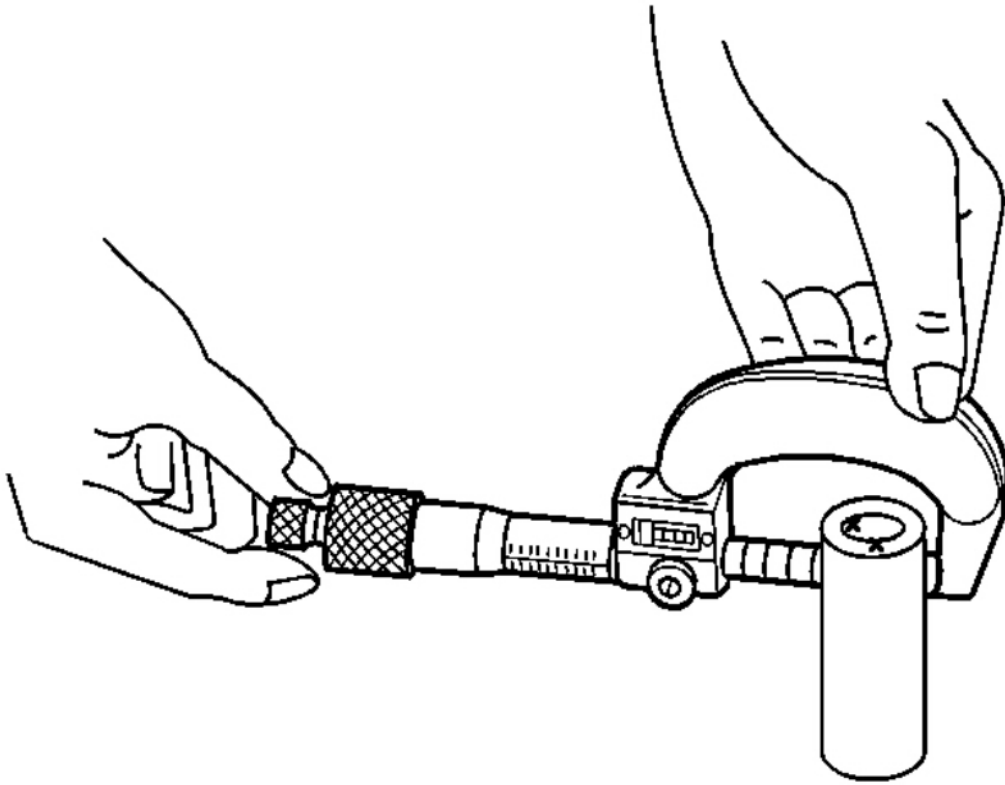


Fig. 68: Measuring Piston Pin Diameter
Courtesy of GENERAL MOTORS CORP.

6. Replace any piston and/or piston pin that have damage or excessive wear.

Piston Diameter Measurement Procedure

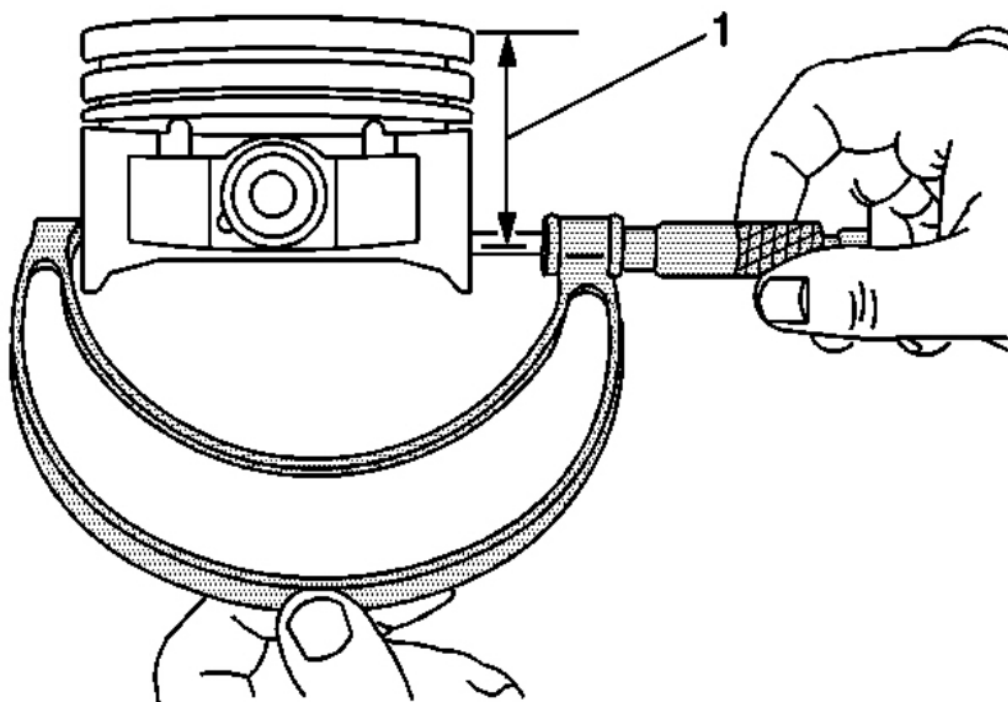


Fig. 69: Measuring Width Of Piston
Courtesy of GENERAL MOTORS CORP.

1. Using an outside micrometer, measure the width of the piston 40 mm (1.575 in) below the crown (top) of the piston at the thrust surface which is perpendicular to the centerline of the piston pin (1).
2. Compare the measurement to the diameter listed in the engine mechanical specifications.
3. You must replace the piston if any of its dimensions are out of specification. There are no oversized pistons available.

Piston Pin Bore Measurement Procedure

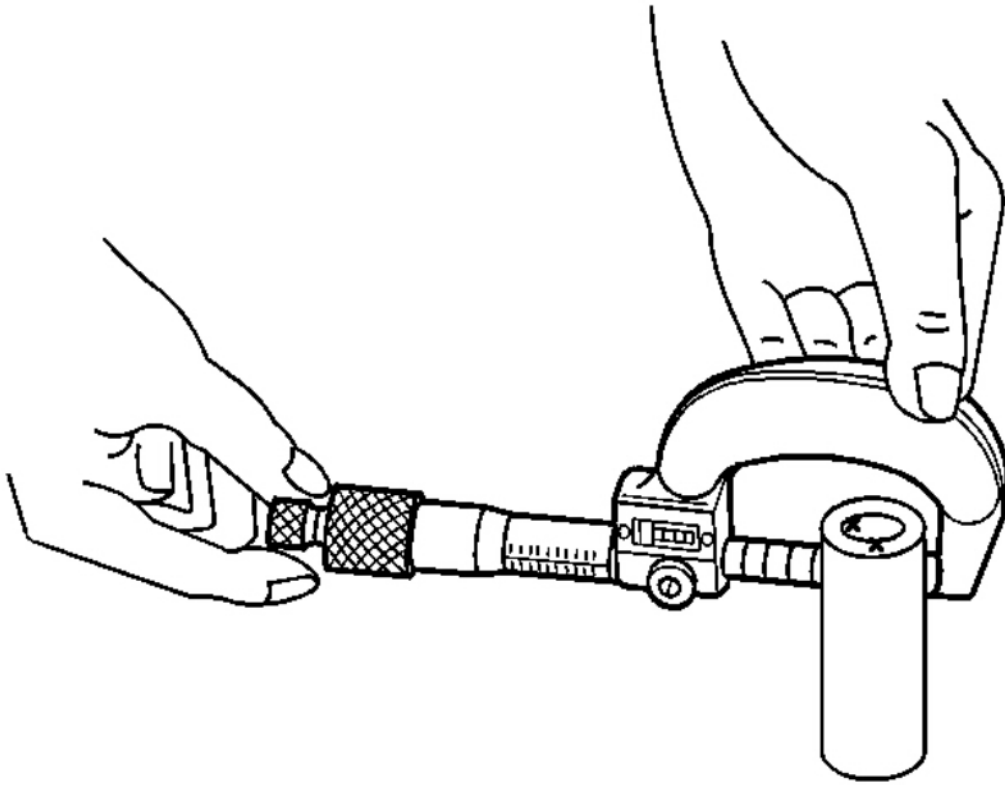


Fig. 70: Measuring Piston Pin Diameter
Courtesy of GENERAL MOTORS CORP.

1. Piston pin bores and pins must be free of varnish or scuffing.
2. Use an outside micrometer to measure the piston pin in the piston contact areas.

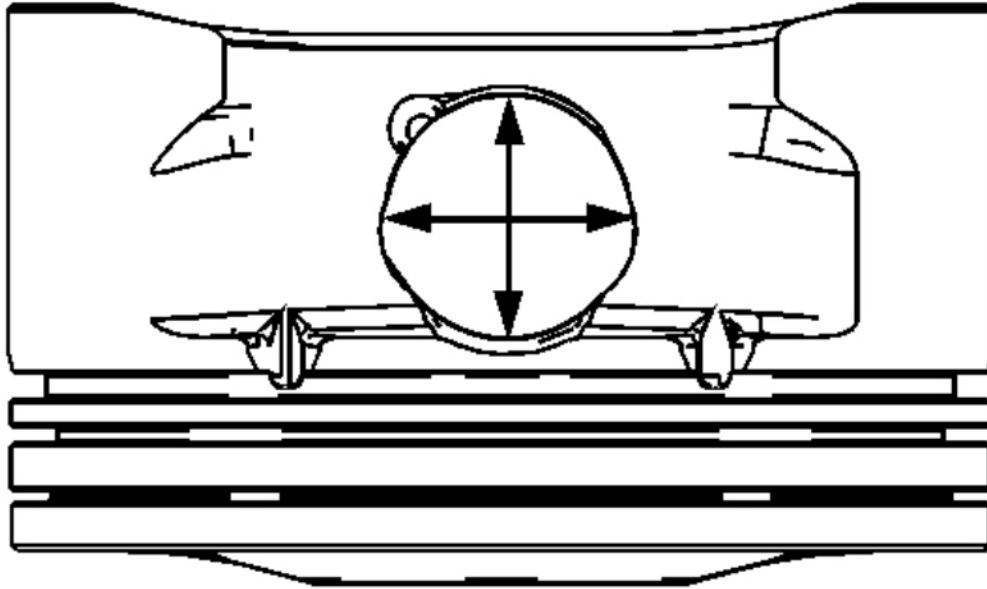


Fig. 71: Measuring Piston Pin Bore
Courtesy of GENERAL MOTORS CORP.

3. Using an inside micrometer, measure the piston pin bore.
4. Subtract the measurement of the piston pin bore from the piston pin.
5. Compare the result with the engine mechanical specifications.
6. If the clearance is excessive, determine which piece is out of specification and replace as necessary.

Piston Ring End Gap Measurement Procedure

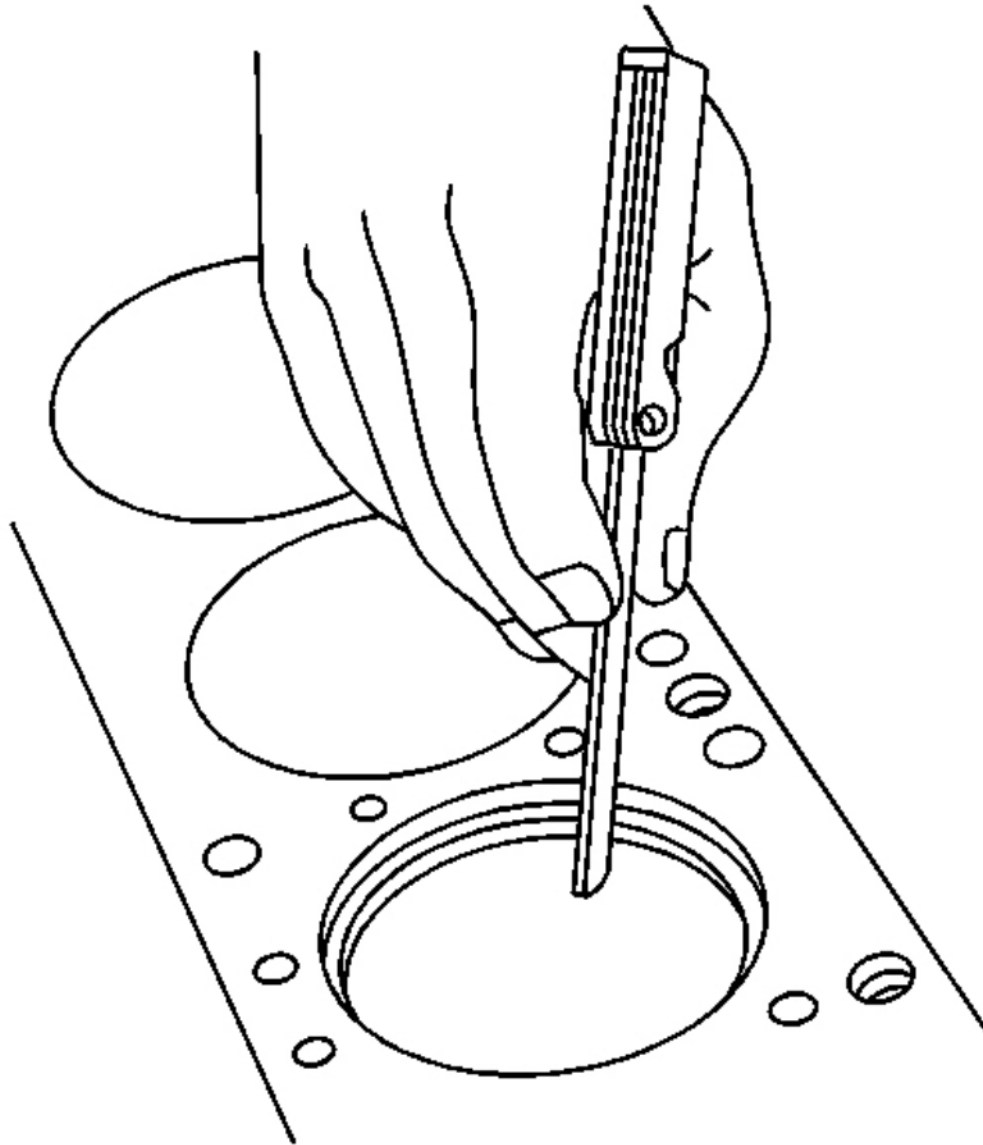


Fig. 72: Measuring Piston Ring End Gap
Courtesy of GENERAL MOTORS CORP.

1. Place the piston ring in the area of the bore where the piston ring will travel, approximately 25 mm (1 in) down from the deck surface. Be sure the ring is square with the cylinder bore by positioning the ring with the piston head.

2. Measure the end gap of the piston ring with feeler gages. Compare the measurements with those provided in the engine mechanical specifications.
3. If the clearance exceeds the provided specifications, the piston rings must be replaced.
4. Repeat this procedure for all the piston rings.

Piston Ring Side Clearance Measurement Procedure

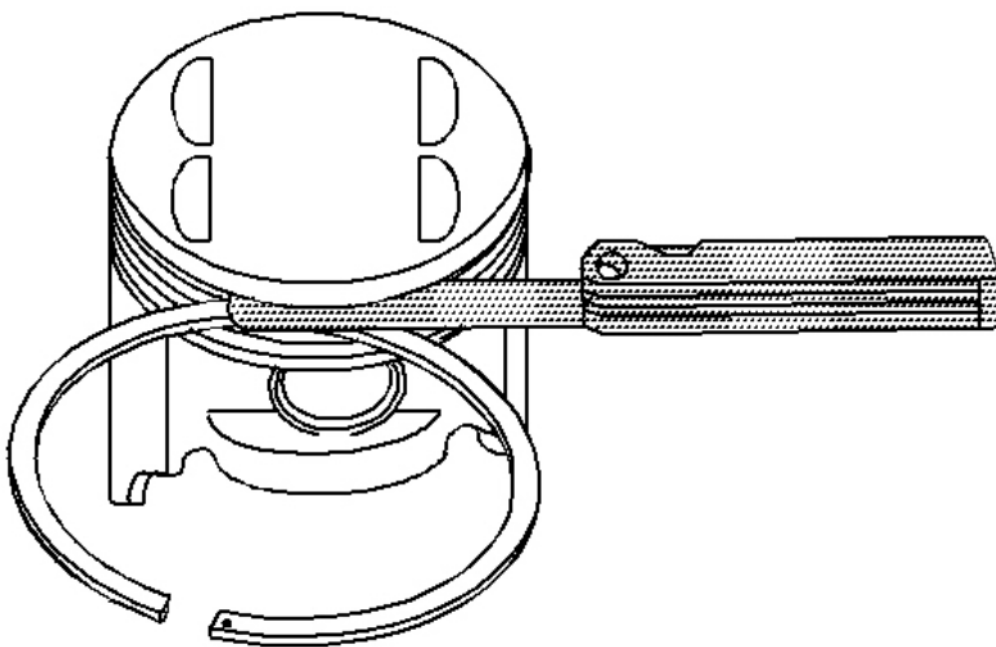


Fig. 73: Checking Piston Ring Side Clearance
Courtesy of GENERAL MOTORS CORP.

1. Roll the piston ring entirely around the piston ring groove. If any binding is caused by the ring groove, dress the groove with a fine file. If any binding is caused by a distorted piston ring, replace the ring.
2. With the piston ring on the piston, use feeler gages to check side clearance at multiple locations.
3. Compare your measurements with those found in the engine mechanical specifications.
4. If the clearance is greater than specifications, replace the piston rings.

5. If new piston rings do not bring the clearance within specification, the piston must be replaced.
6. When replacing the piston rings, only install re-ring sets that have a 1.2 mm (0.047 in) thick nitrided steel upper compression ring and multi-piece oil rings. The top compression ring may be installed with either side up. There is a locating dimple on the 2nd compression ring near the end for identification of the top side. Install the 2nd compression ring with the dimple facing up.

Connecting Rod Cleaning Procedure

1. Clean the connecting rods in solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Dry the connecting rods with compressed air.

Connecting Rod Visual Inspection Procedure

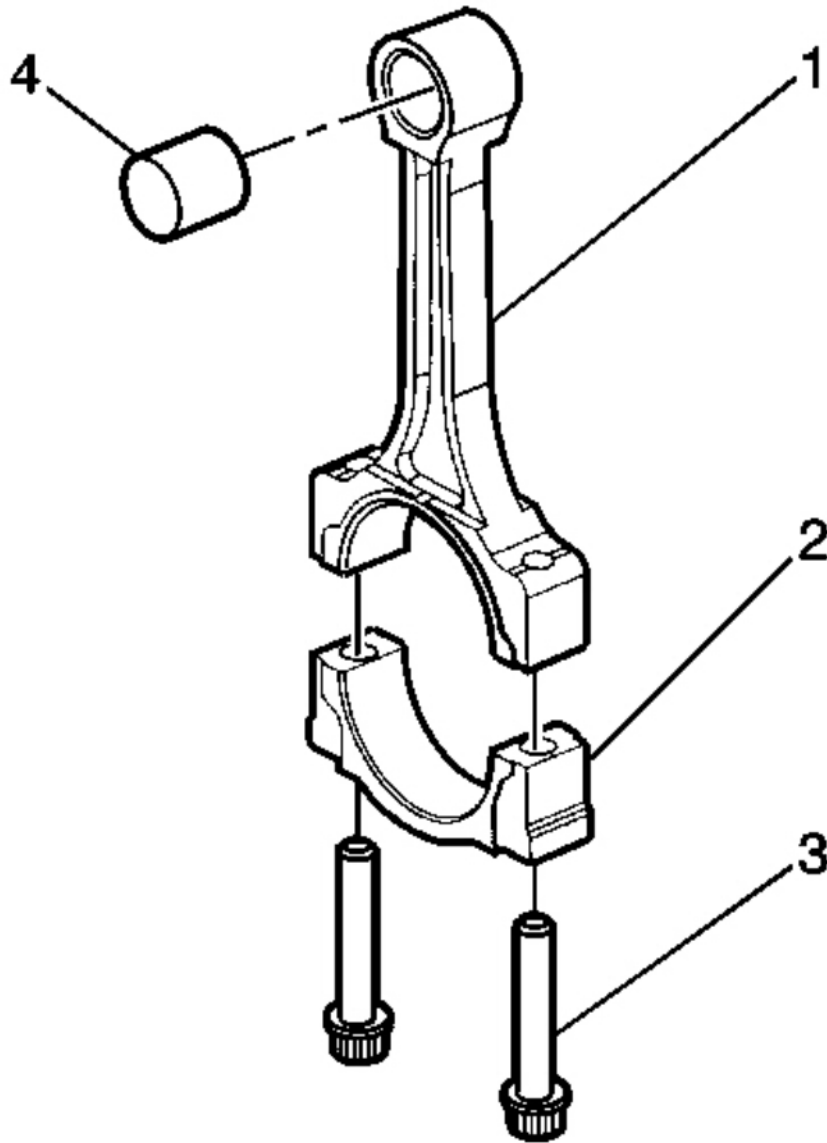


Fig. 74: Inspecting Connecting Rod
Courtesy of GENERAL MOTORS CORP.

1. Inspect the piston pin bushing (4) for scoring or damage.
2. Inspect the connecting rod beam (1) for twisting or bending.

3. Inspect the rod cap (2) for any nicks or damage caused by possible interference.
4. Inspect for scratches or abrasion on the rod bearing seating surface.

IMPORTANT: DO NOT scrape the rod or rod cap.

5. If the connecting rod bores contain minor scratches or abrasions, clean the bores in a circular direction with a light emery paper.

Connecting Rod Measurement Procedure

Piston Pin End

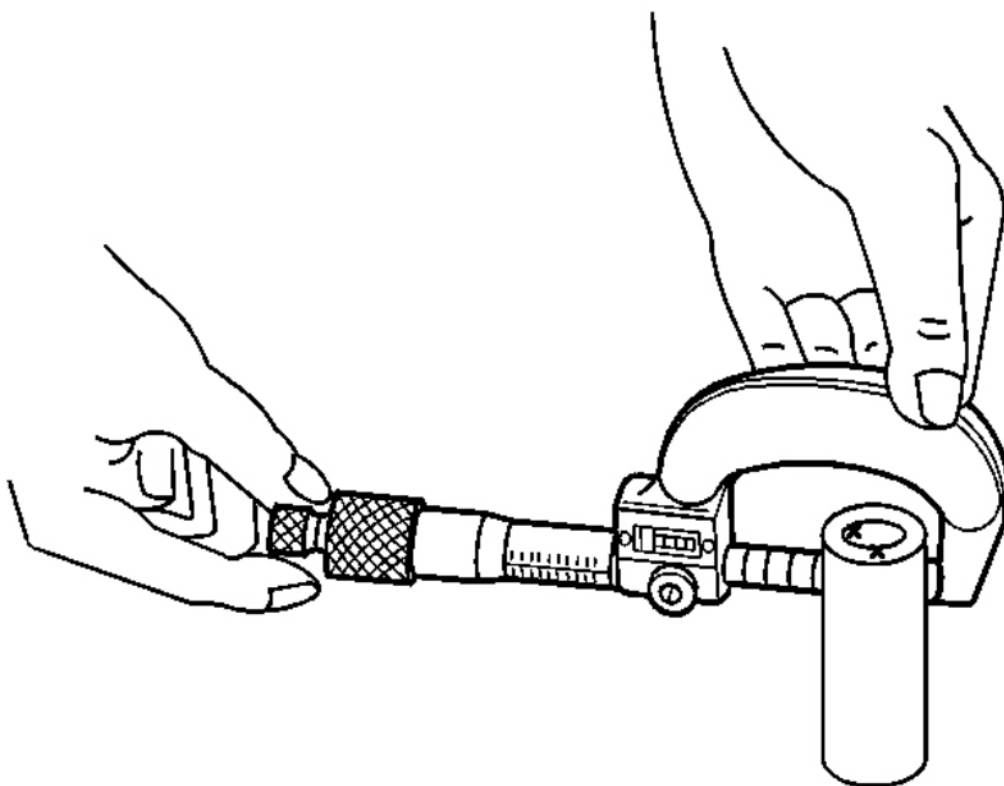


Fig. 75: Measuring Piston Pin Diameter
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Measurements of all components should be taken with the components at normal room temperature.

1. Using an outside micrometer, take 2 measurements of the piston pin in the area of the connecting rod contact.

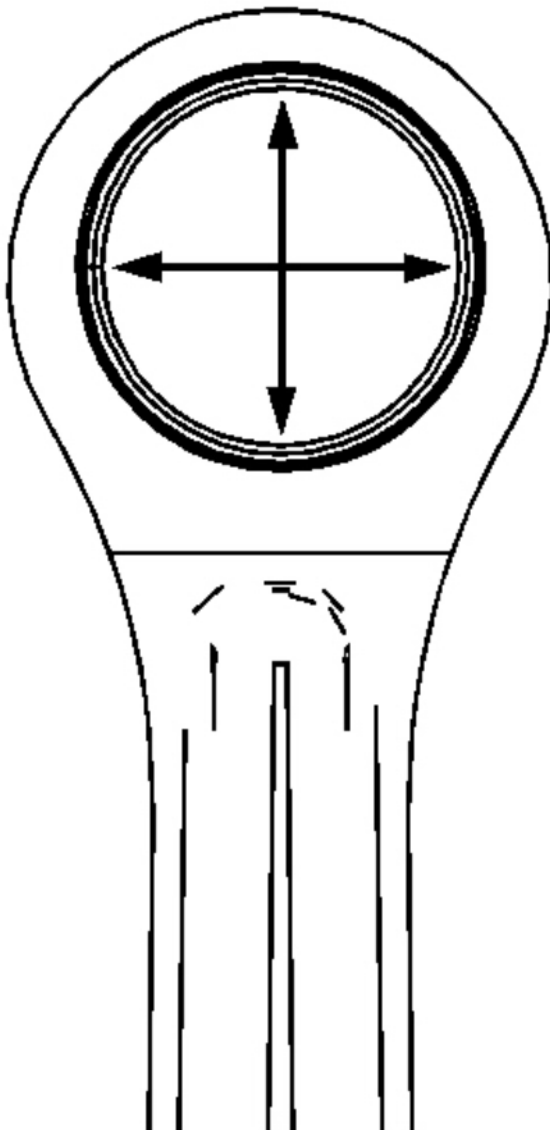


Fig. 76: Measuring Connecting Rod Piston Pin Bore
Courtesy of GENERAL MOTORS CORP.

2. Using an inside micrometer, measure the connecting rod piston pin bore.
3. Subtract the piston pin diameter from the piston pin bore.
4. Compare the clearance measurements with the Engine Mechanical Specifications .
5. If the clearance is excessive, replace the piston pin. If a new pin does not resolve the clearance problem, replace the connecting rod.

Connecting Rod Crankshaft Bearing End

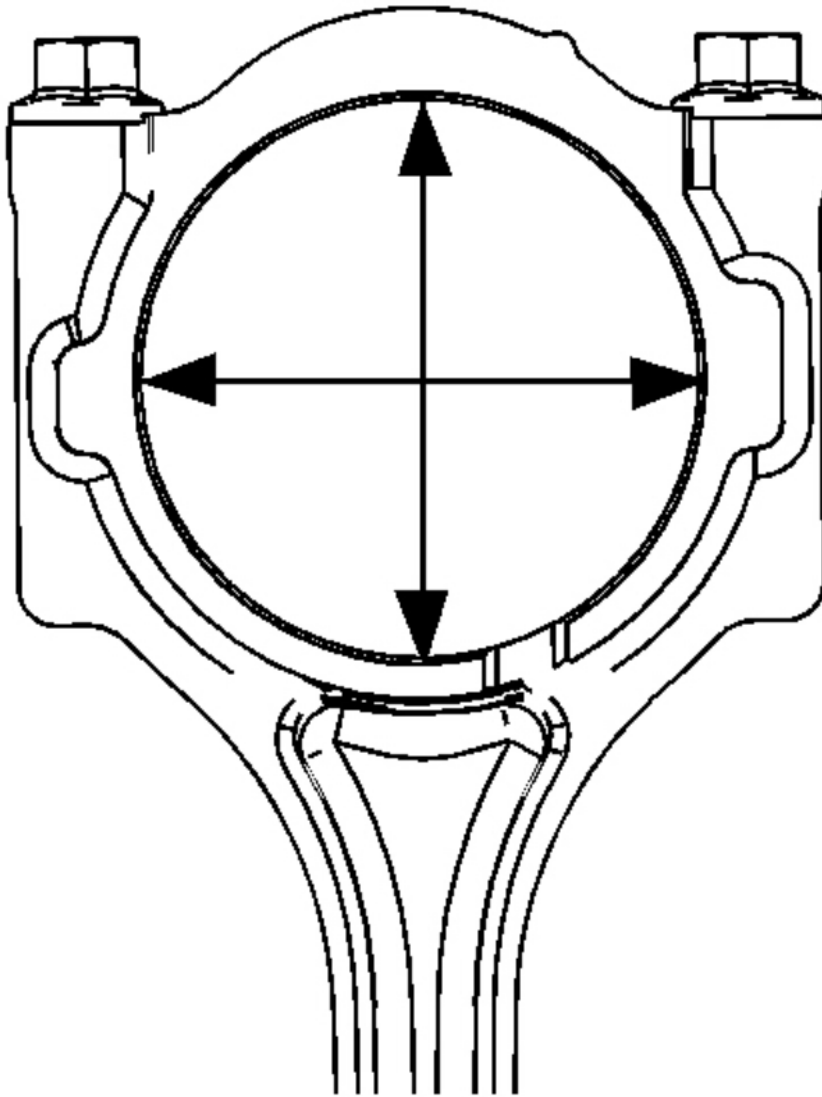


Fig. 77: Measuring Connecting Rod Crankshaft Bearing Bore
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Measurements of all components should be taken with the components at normal room temperature.

1. Using an inside micrometer, measure the connecting rod crankshaft bearing bore.

2004 Cadillac SRX

2004 ENGINE Engine Mechanical - 4.6L (LH2) (Repair Instructions, 3 Of 5) - SRX

2. Compare the bore measurements with the **Engine Mechanical Specifications** .
3. Replace the connecting rod if the bore is out of specifications. DO NOT recondition the connecting rod.

PISTON AND CONNECTING ROD ASSEMBLE

Tools Required

J 43654 Piston Pin Clip Remover and Installer

Piston and Piston Pin Installation Procedure

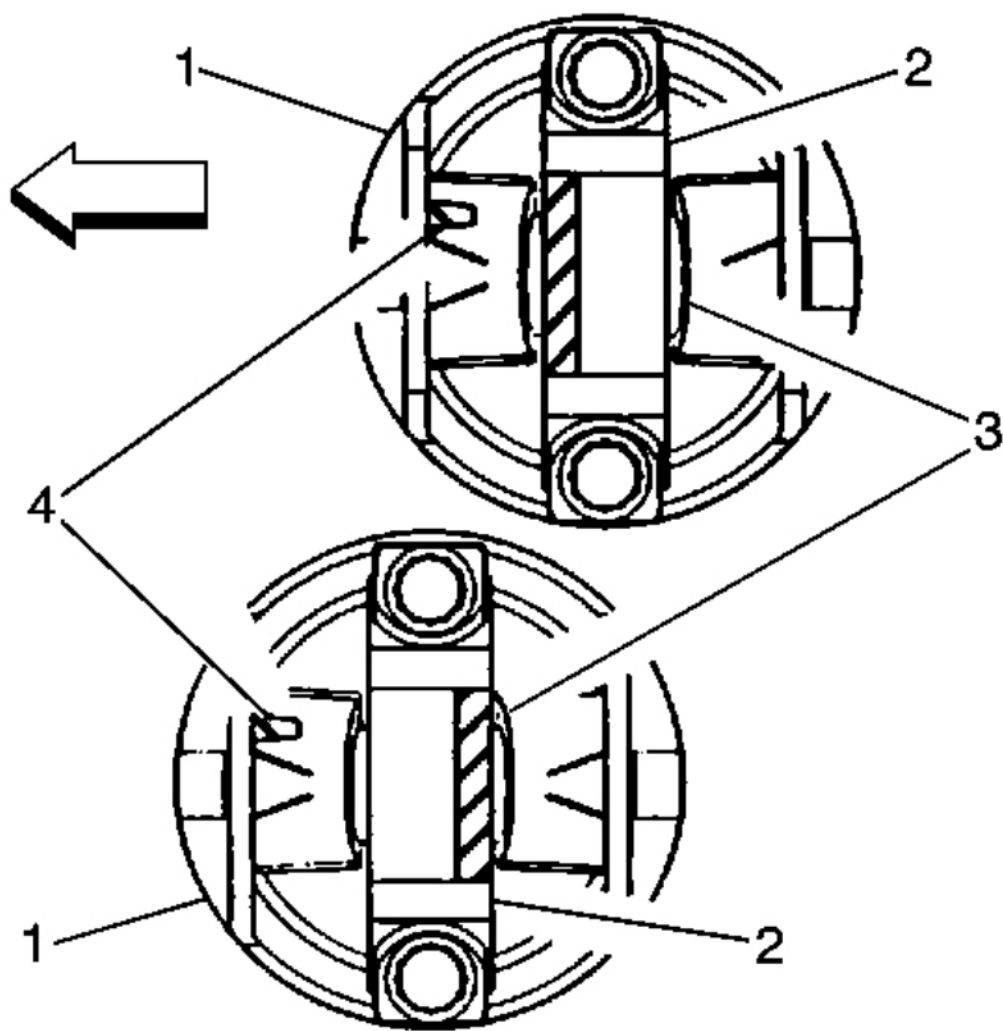


Fig. 78: Identifying Piston & Connecting Rod Locating Marks
Courtesy of GENERAL MOTORS CORP.

1. Properly orient the piston (1) on the connecting rod (2) as follows:
 - The locating mark (4) cast into the underside of the piston should point towards the front of the engine.
 - The locating notch (3) on the connecting rod cap should be pointing towards the rear of the engine on odd-numbered cylinders and towards the front of the engine on even-numbered cylinders.

2. Lubricate the piston pin bores in the piston and connecting rod with GM prelube lubricant GM P/N 1052367 or equivalent.

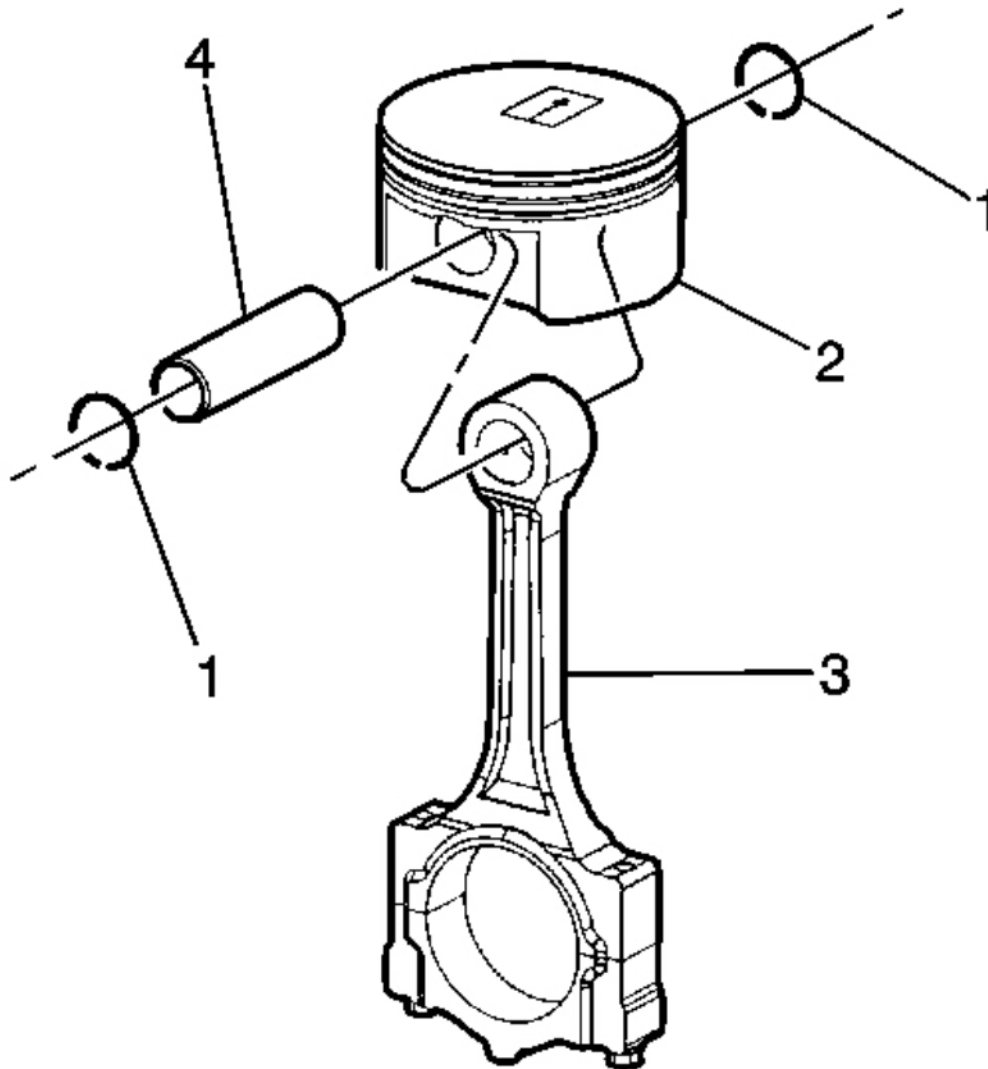


Fig. 79: Exploded View Of Piston & Connecting Rod Assembly
Courtesy of GENERAL MOTORS CORP.

3. Align the piston pin bore with the connecting rod pin bore.

4. Slide the piston pin (4) into the piston and the connecting rod (3).

IMPORTANT: New piston pin retainers must be used. Never reuse the piston pin retainers.

5. Install NEW piston pin retainers (1) using the **J 43654** .
6. Ensure that the piston pin retainers are fully seated in their grooves.
7. Repeat these procedures for the remaining pistons.

Piston Ring Installation Procedure

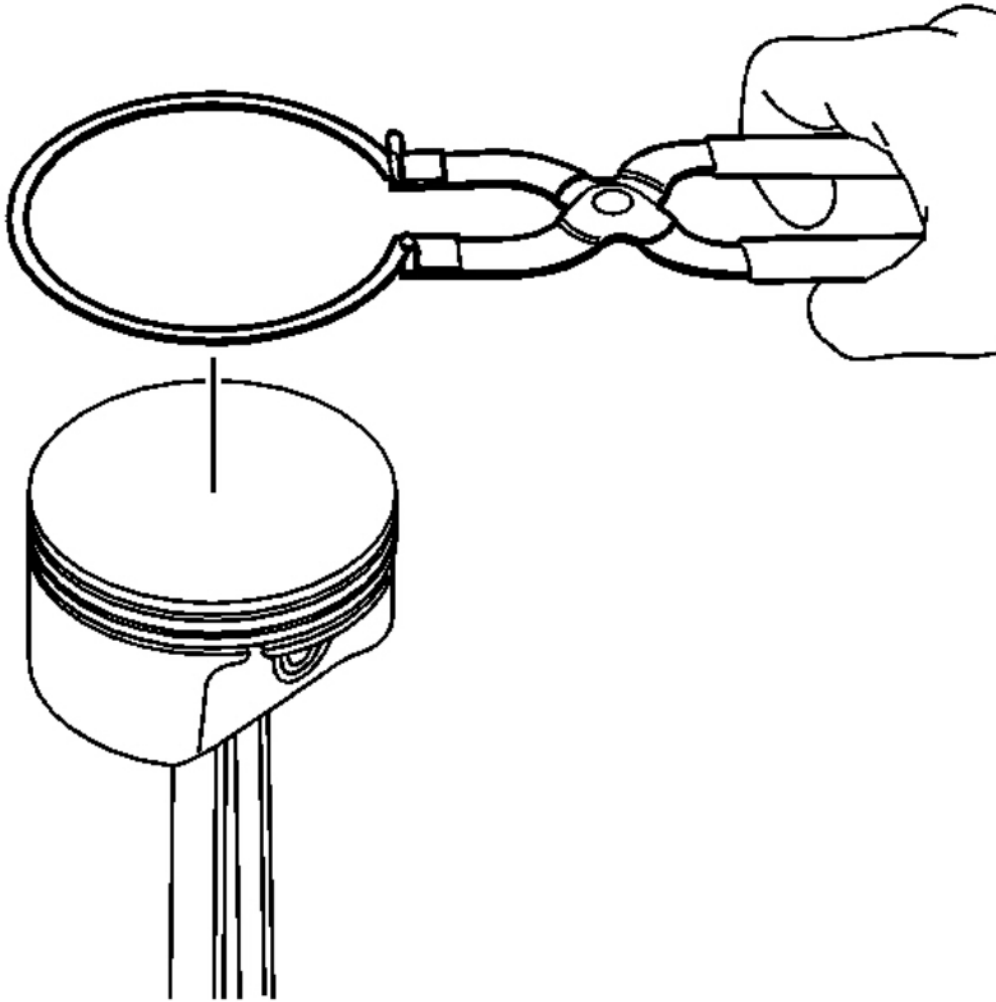


Fig. 80: Removing/Installing Piston Rings
Courtesy of GENERAL MOTORS CORP.

NOTE: Use a piston ring expander to install the piston rings. The rings may be damaged if expanded more than necessary.

1. Install the piston rings using a piston ring installer.

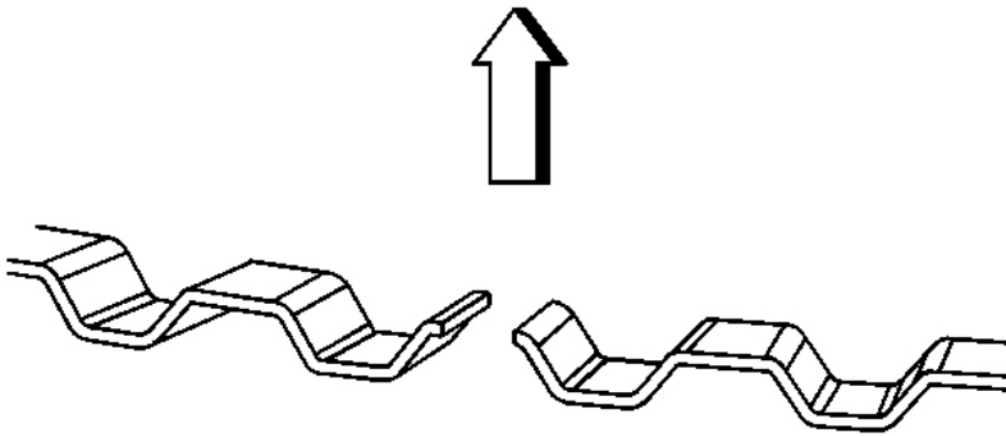


Fig. 81: View Of Oil Control Ring Expander
Courtesy of GENERAL MOTORS CORP.

2. Properly orient the oil control ring expander as shown before installation. The ends of the expander must be facing toward the top of the piston.

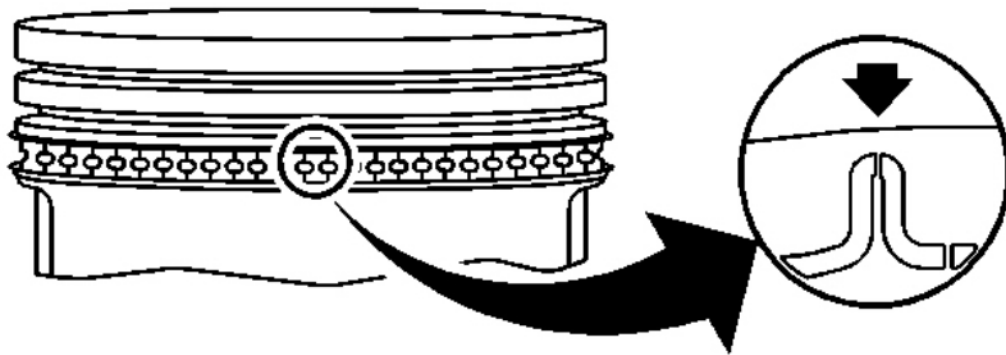


Fig. 82: View Of Lower Oil Control Piston Ring Spacer
Courtesy of GENERAL MOTORS CORP.

3. Install the oil control piston ring spacer onto the piston.

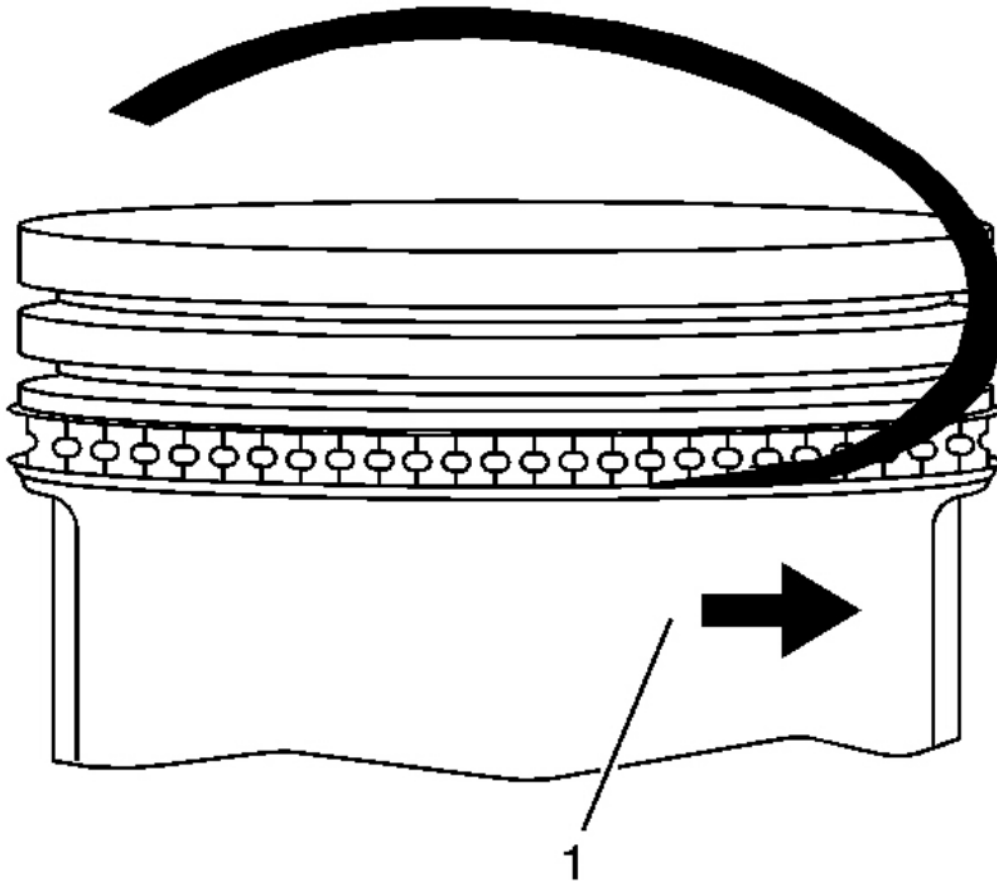


Fig. 83: View Of Lower Oil Control Piston Ring
Courtesy of GENERAL MOTORS CORP.

4. Install the lower oil control piston ring onto the piston (1).

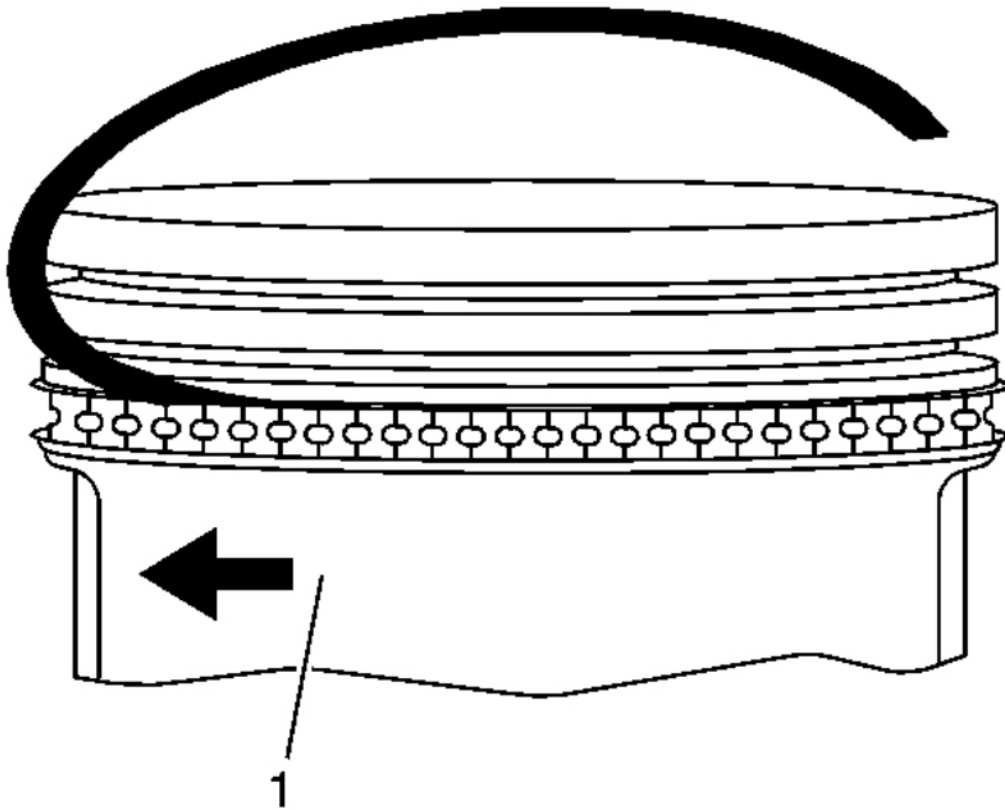


Fig. 84: View Of Upper Oil Control Piston Ring
Courtesy of GENERAL MOTORS CORP.

5. Install the upper oil control piston ring onto the piston (1).

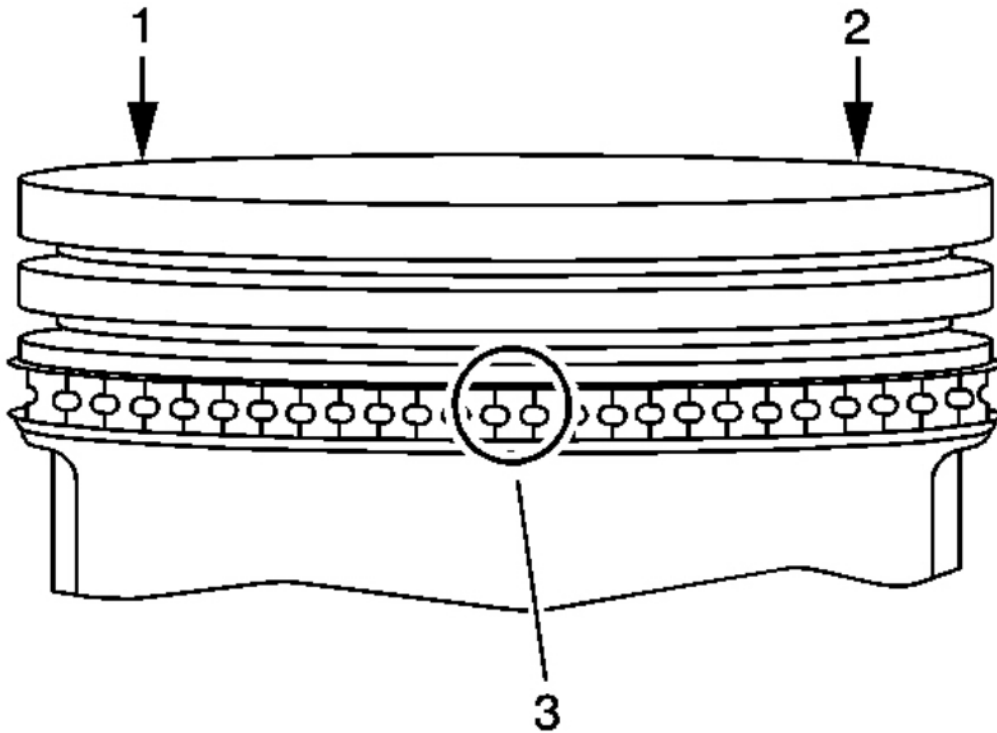


Fig. 85: View Of Oil Control Piston Rings
Courtesy of GENERAL MOTORS CORP.

6. Space the oil control piston ring end gaps (1, 2) a minimum of 90 degrees apart.

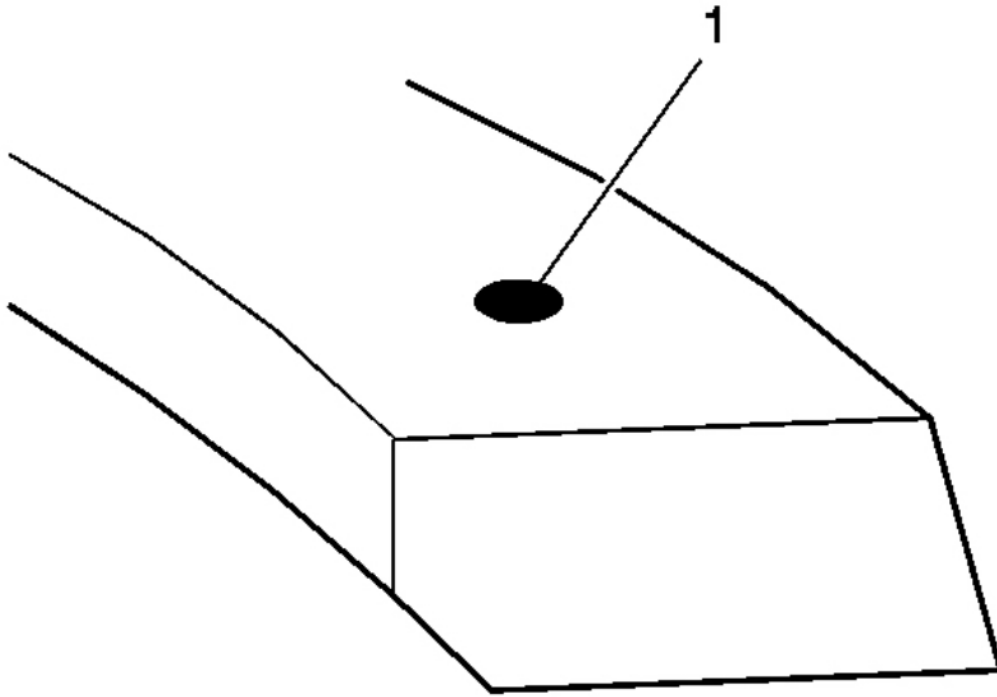


Fig. 86: View Of Lower Compression Piston Ring Mark
Courtesy of GENERAL MOTORS CORP.

7. Install the lower compression piston ring onto the piston (1).

The mark on the side of the piston ring should face the top of the piston.

8. Install the upper compression piston ring onto the piston.

The top compression ring may be installed with either side up.

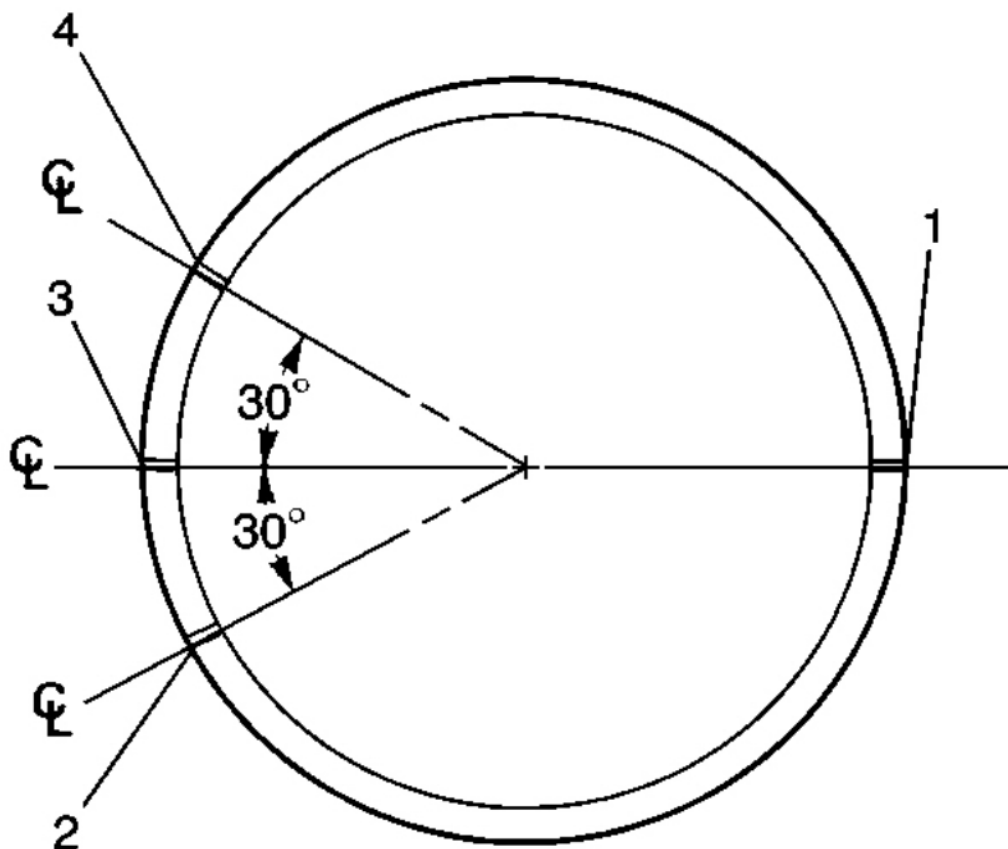


Fig. 87: Identifying Proper Oil Control Ring Gap Positioning
Courtesy of GENERAL MOTORS CORP.

9. Once the rings are installed, set the ring gaps for the oil control, second and top rings in the positions shown:
 1. Oil control ring expander and second compression ring gaps position 1.
 2. Upper oil control ring gap position 2.
 3. Top compression ring gap position 3.
 4. Lower oil control ring gap position 4.

Connecting Rod Bearing Installation Procedure

IMPORTANT: If the connecting rod bearings have been used in a running

engine, you must replace them with NEW connecting rod bearings for reassembly.

1. Clean the connecting rod and the connecting rod cap bearing bore with a lint-free cloth.

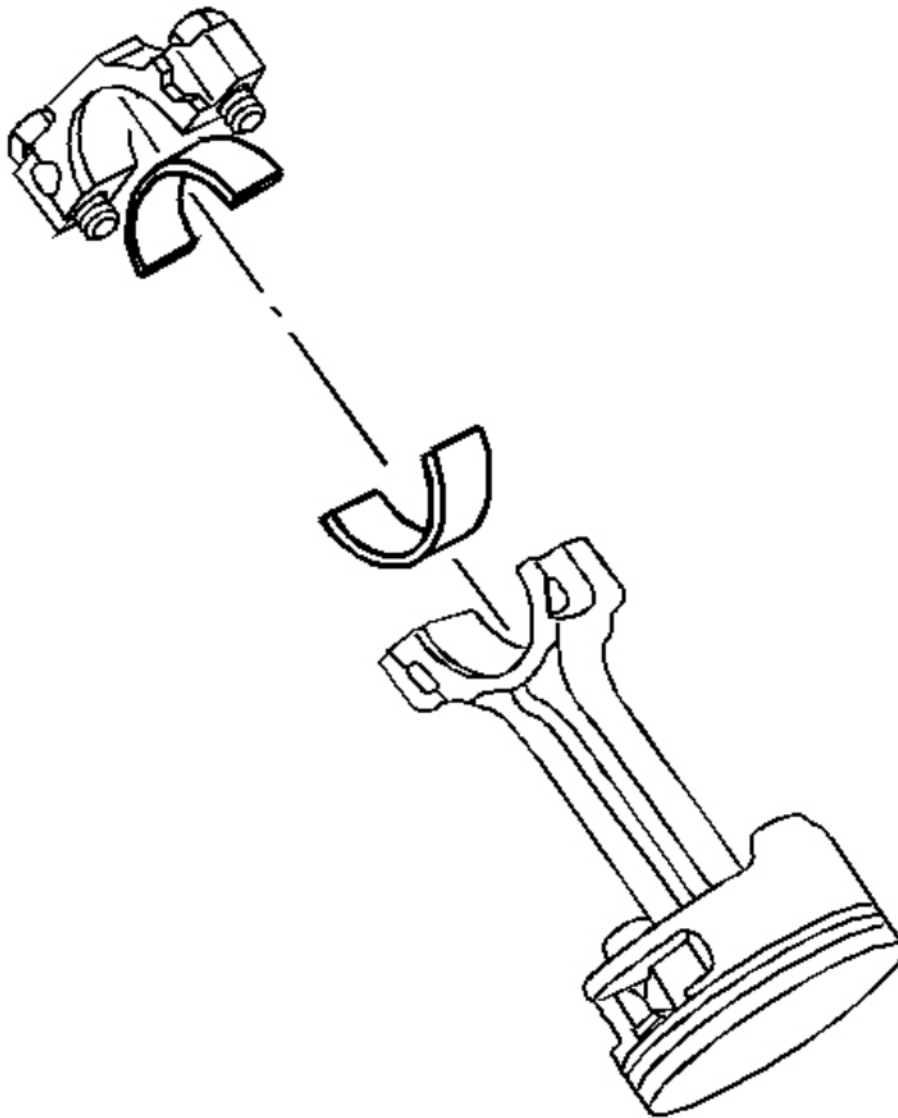


Fig. 88: View Of Piston, Connecting Rod, Bearing Cap, Bearing Halves & Bolts

Courtesy of GENERAL MOTORS CORP.

2. Clean all the oil from behind the connecting rod bearing halves.
3. Install new upper connecting rod bearings into position. Roll the bearing into position so that the lock tang engages the alignment slot. The bearing must fit flush in the connecting rod.
4. Install new lower connecting rod bearings into position in the connecting rod cap. Roll the bearing into position so that the lock tang engages the alignment slot. The bearings must fit flush with the connecting rod cap.

CYLINDER HEAD DISASSEMBLE**Tools Required**

- **J 8062** Valve Spring Compressor
- **J 38820** Valve Stem Seal Installer
- **J 38821** Valve Spring Compressor Adapter
- **J 43059** Valve Retainer Remover/Installer

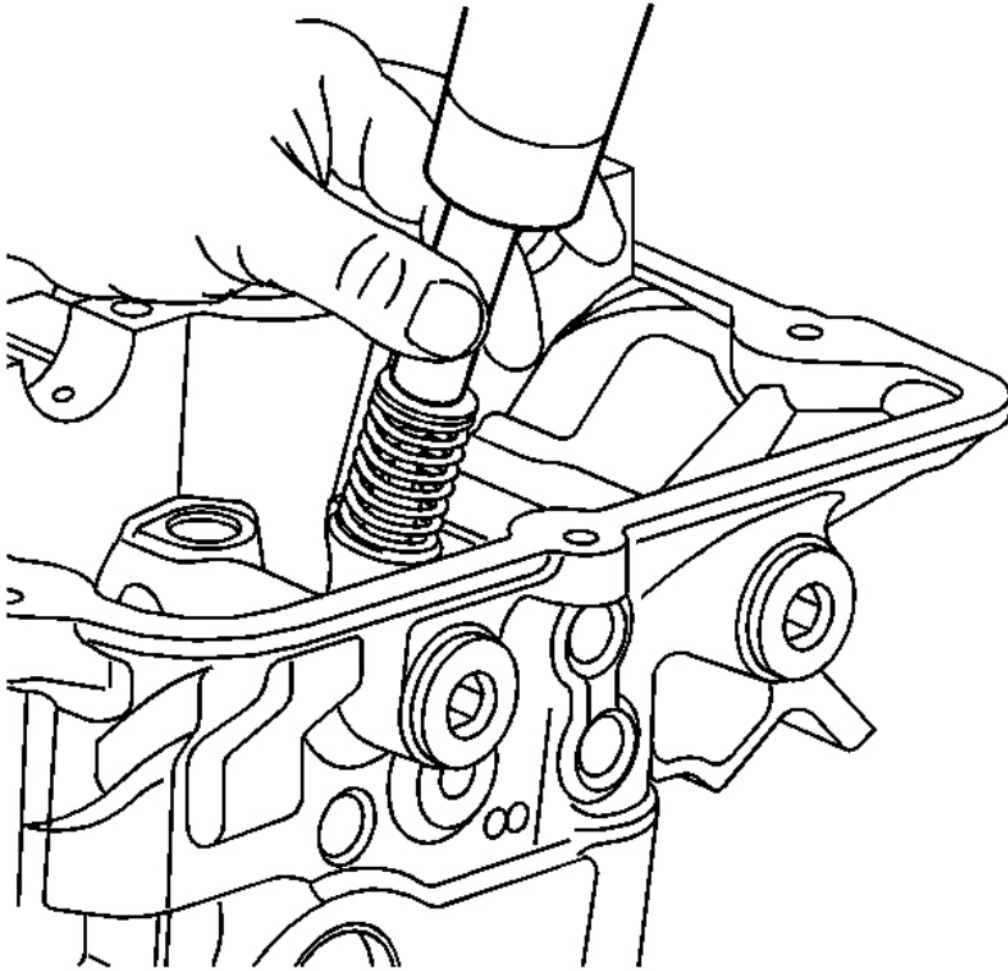


Fig. 89: Loosening Valve Keepers
Courtesy of GENERAL MOTORS CORP.

1. Using an appropriately sized deep socket and a plastic hammer, lightly tap on the valve spring retainer in order to loosen the valve keepers.

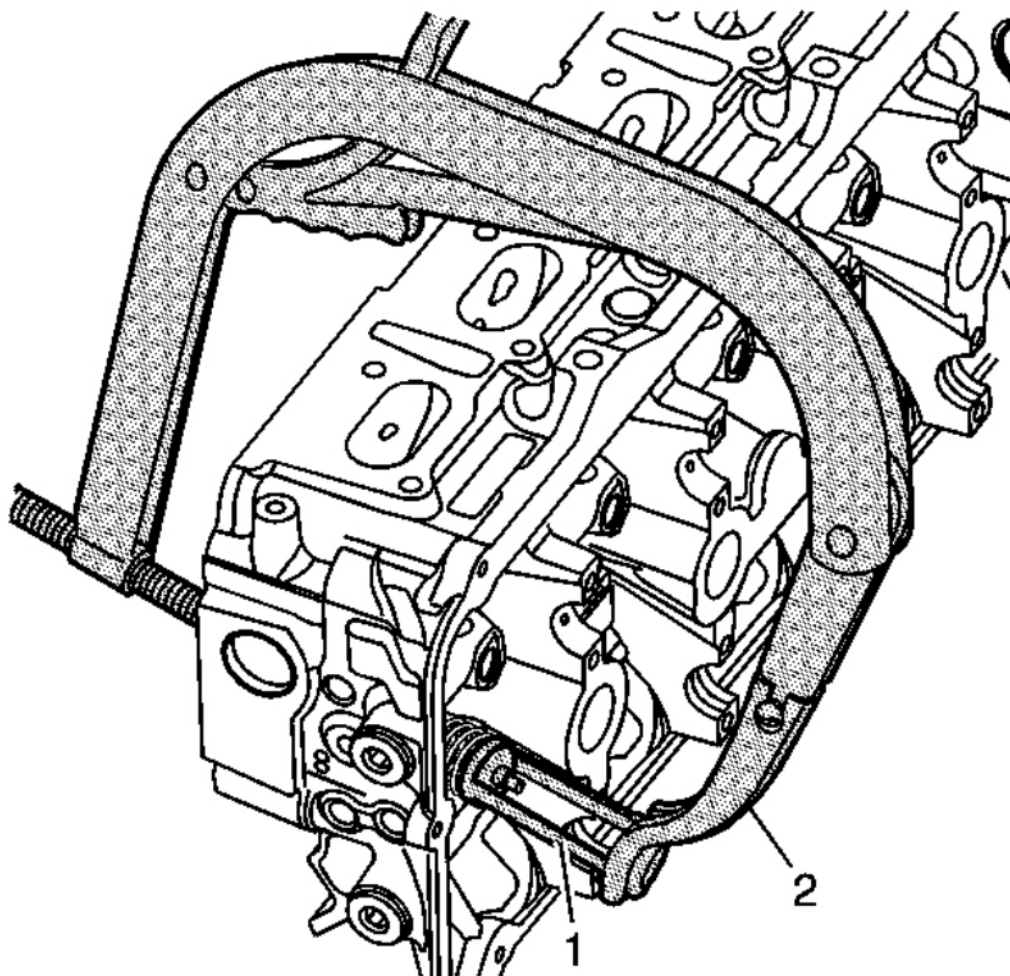


Fig. 90: Compressing Valve Spring
Courtesy of GENERAL MOTORS CORP.

CAUTION: Compressed valve springs have high tension against the valve spring compressor. Valve springs that are not properly compressed by or released from the valve spring compressor can be ejected from the valve spring compressor with intense force. Use care when compressing or releasing the valve spring with the valve spring compressor and when removing or installing the valve stem keys. Failing to use care may cause personal

injury.

NOTE: Do not compress the valve springs less than 24.0 mm (0.943 in). Contact between the valve spring retainer and the valve stem oil seal can cause potential valve stem oil seal damage.

2. Compress the valve spring with the **J 8062** (2) and the **J 38821** (1).

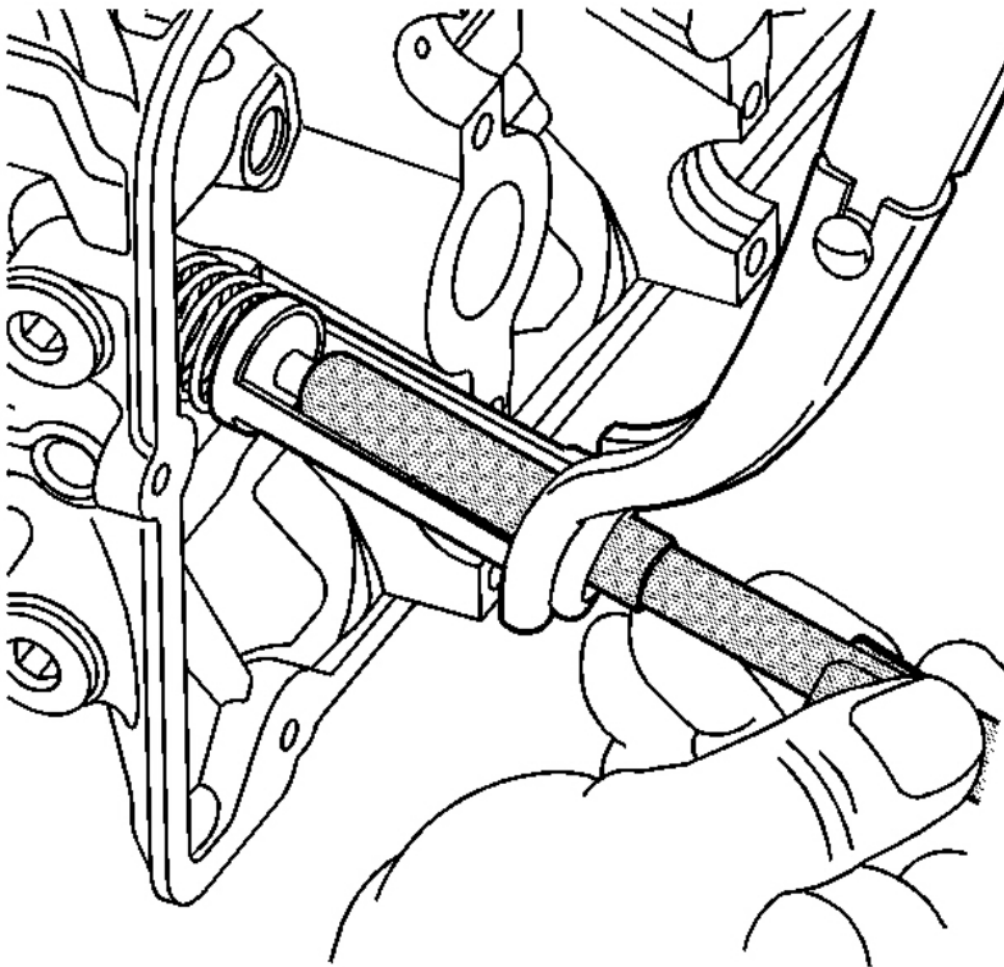


Fig. 91: Removing Valve Keepers
Courtesy of GENERAL MOTORS CORP.

3. Use the magnetic end of the **J 43059** in order to remove the valve keepers.
4. Remove the **J 8062** and the **J 38821**.

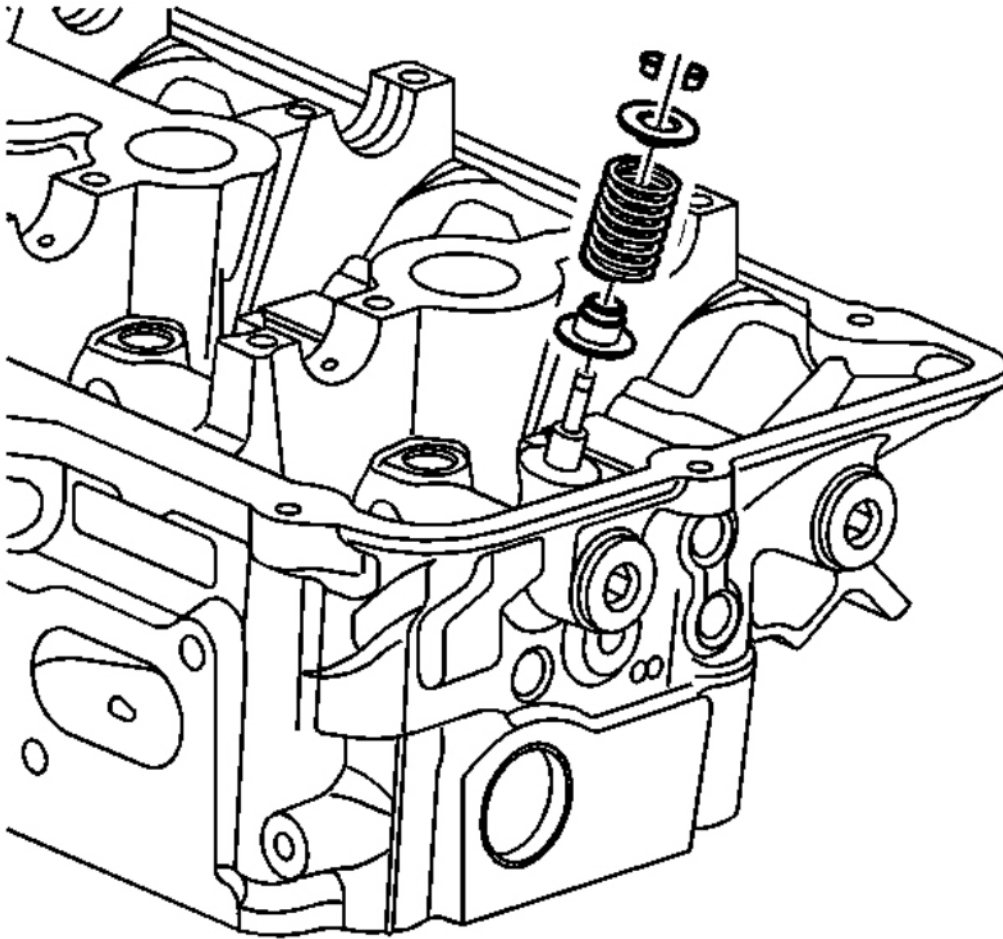


Fig. 92: View Of Valve Spring
Courtesy of GENERAL MOTORS CORP.

5. Remove the valve spring.

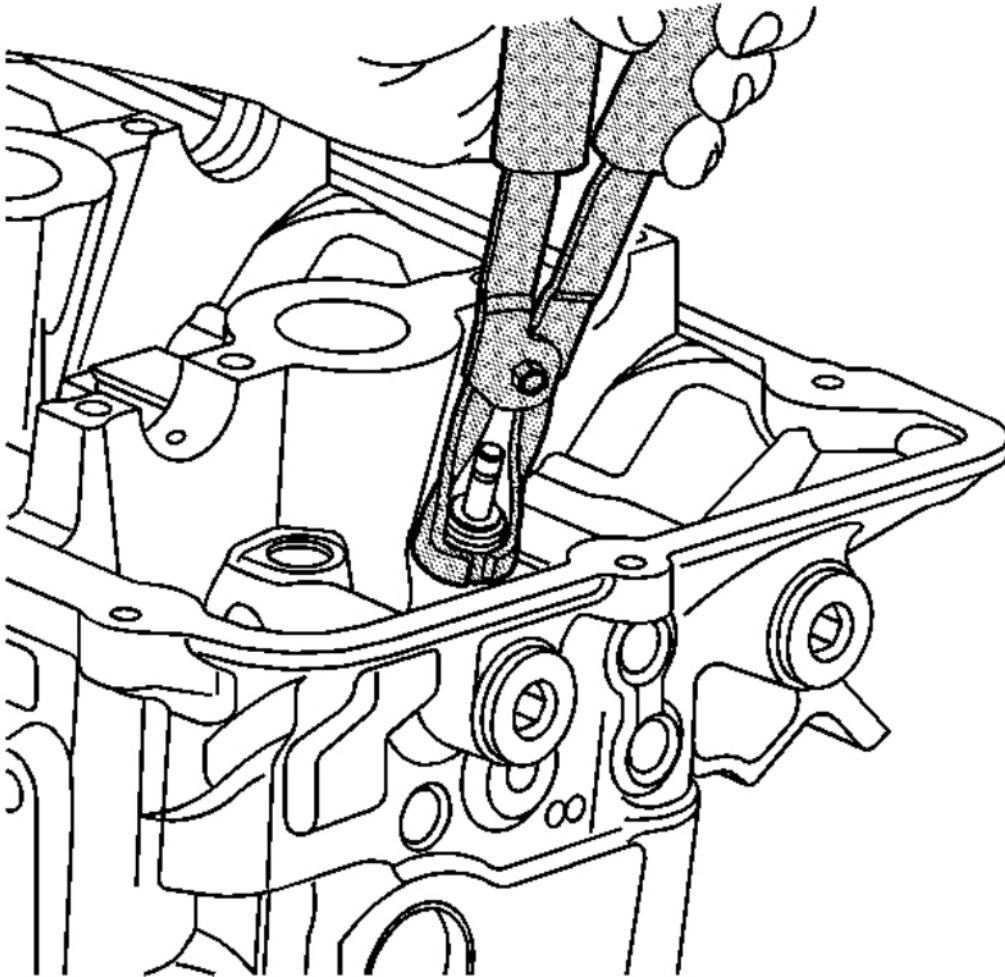


Fig. 93: Removing/Installing Valve Seal
Courtesy of GENERAL MOTORS CORP.

6. Remove the valve seal with the **J 38820** . Discard the valve seal, NEVER re-use the valve seal.
7. Remove the valve.
8. Repeat the procedure for the remaining valves.

CYLINDER HEAD CLEANING AND INSPECTION

Tools Required

- **J 8001** Dial Indicator Set
- **J 8358** Carbon Removal Brush
- **J 28410** Gasket Remover

Visual Inspection Procedure

1. Inspect the cylinder head for the following:
 - Cracks, damage or pitting in the combustion chambers.

IMPORTANT: DO NOT machine the camshaft bearing journals.

- Scoring of the camshaft bearings and/or the journals. If the camshaft bearing journals appear to be scored or damaged, you must replace the cylinder head.
 - Debris in the oil galleries. Continue to clean the galleries until all debris is removed.
 - Coolant leaks or damage to the deck face sealing surface. If coolant leaks are present, measure the surface warpage as described under Cylinder Head Measurement.
 - Damage to any gasket surfaces
 - Damage to any threaded bolt holes
 - Burnt or eroded areas in the combustion chamber
 - Cracks in the exhaust ports and combustion chambers
 - External cracks in the water chamber
 - Restrictions in the intake or exhaust passages
 - Restrictions in the cooling system passages
 - Rusted, damaged, or leaking core plugs
2. If the cylinder head is cracked or damaged, it must be replaced. No welding or patching of the cylinder head is recommended.

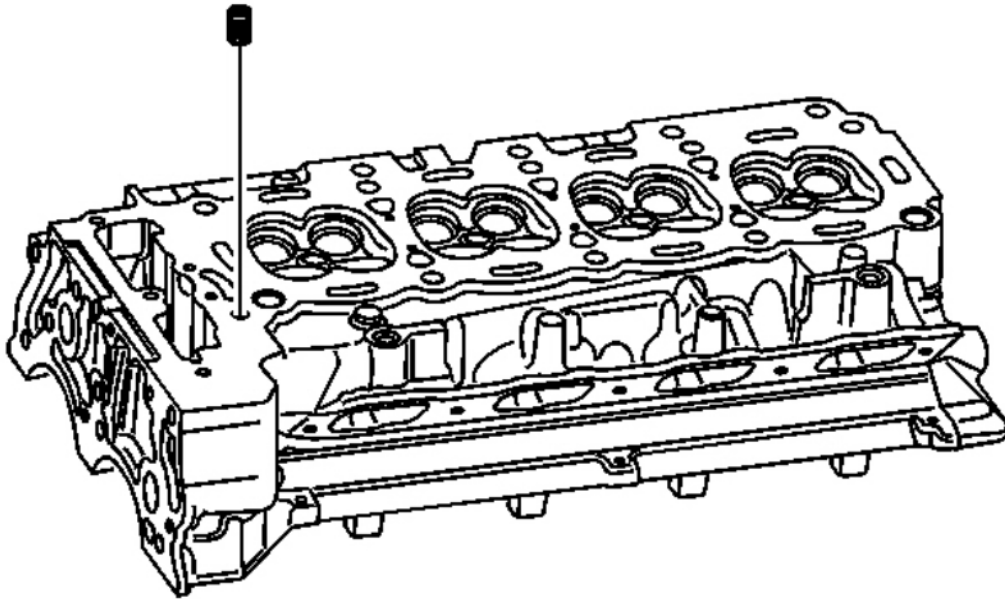


Fig. 94: Locating Left Pressed-In Restrictor
Courtesy of GENERAL MOTORS CORP.

3. The oil passage from the left cylinder head deck face that feeds the stationary hydraulic lifters (SHLAs) and the camshafts has a pressed-in restrictor. The orifice within the restrictor is 3 mm (0.1181 in). DO NOT remove the restrictor. Ensure the restrictor and oil passage are clean and free of any debris.

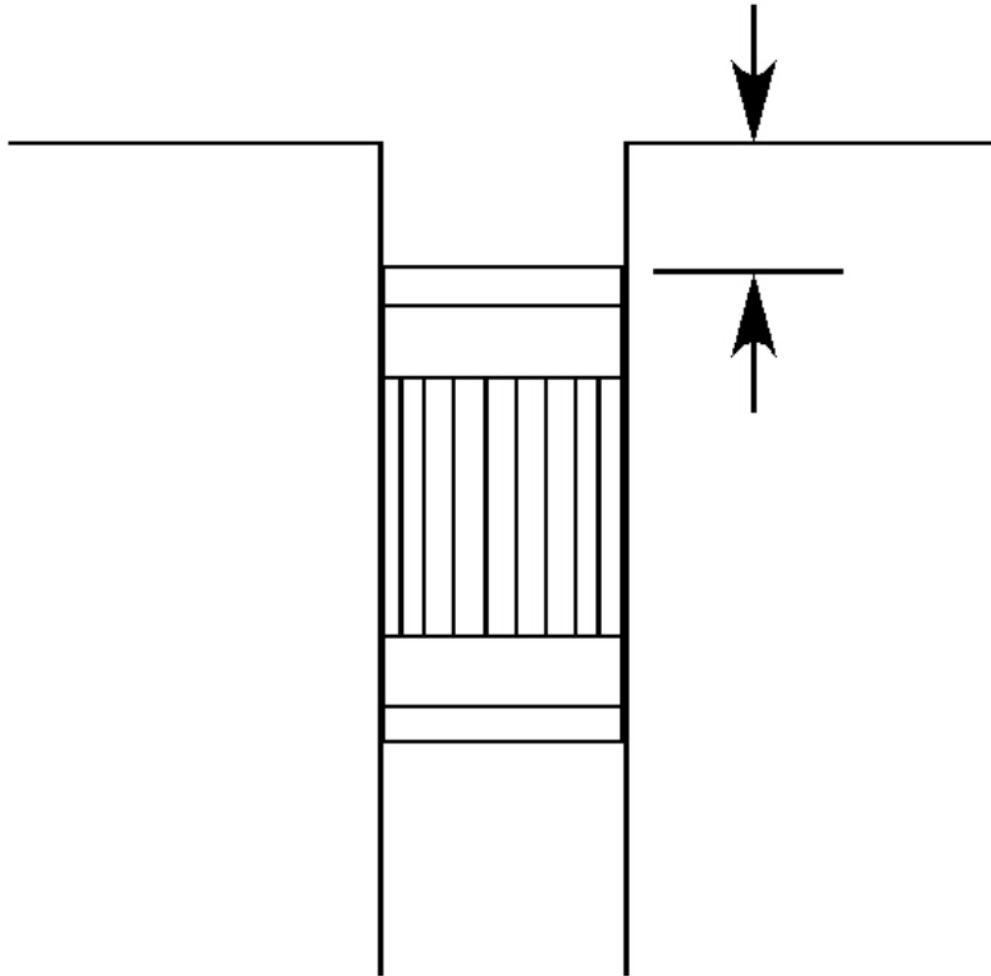


Fig. 95: Insuring Proper Cylinder Head Oil Gallery Restrictor Installation Depth
Courtesy of GENERAL MOTORS CORP.

4. Ensure the left cylinder head oil gallery restrictor is installed to the proper depth of 1.5-5.5 mm (0.059-0.216 in).

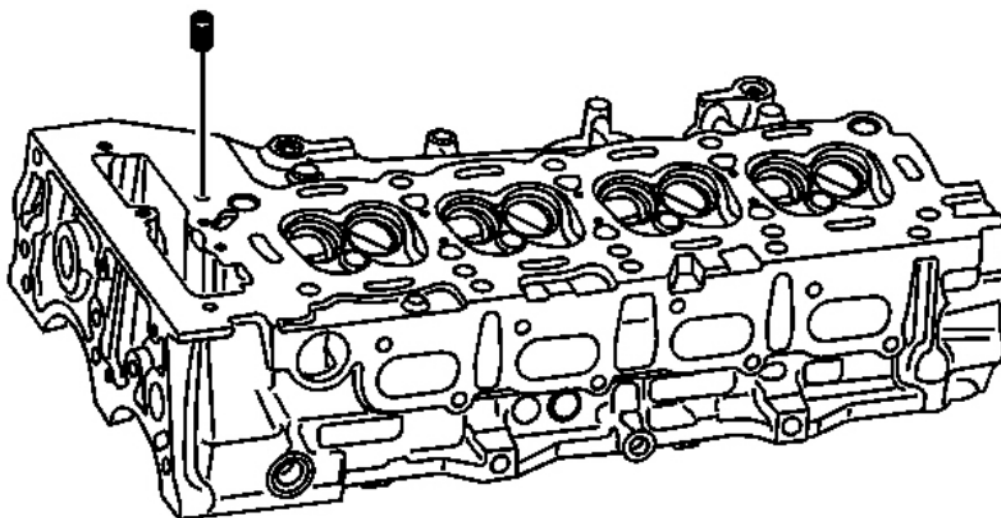


Fig. 96: Locating Right Pressed-In Restrictor

Courtesy of GENERAL MOTORS CORP.

5. The oil passage from the right cylinder head deck face that feeds the stationary hydraulic lifters (SHLAs) and the camshafts has a pressed-in restrictor. The orifice within the restrictor is 3 mm (0.1181 in). DO NOT remove the restrictor. Ensure the restrictor and oil passage are clean and free of any debris.

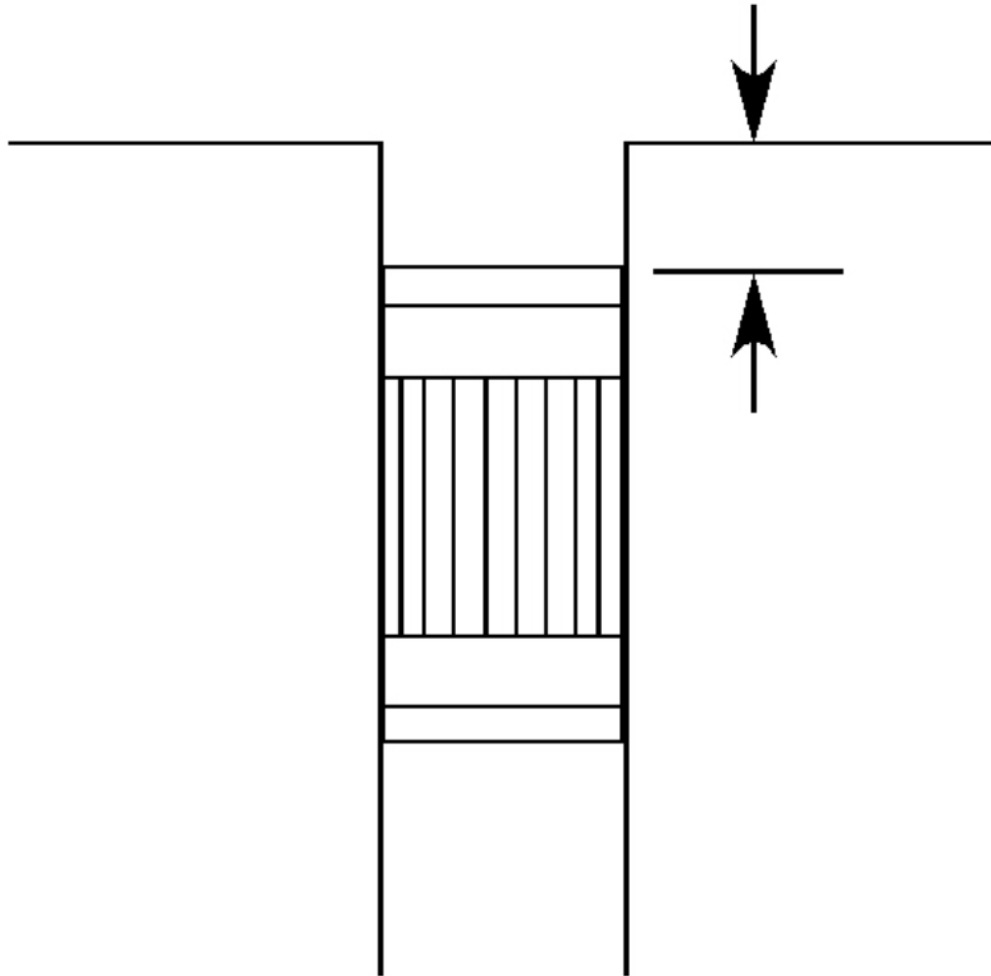


Fig. 97: Insuring Proper Cylinder Head Oil Gallery Restrictor Installation Depth
Courtesy of GENERAL MOTORS CORP.

6. Ensure the right cylinder head oil gallery restrictor is installed to the proper depth of 1.5-5.5 mm (0.059-0.216 in).

Cleaning Procedure

1. Clean all cylinder head surfaces with non-corrosive solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Blow out all the oil galleries using compressed air.
3. Remove any carbon deposits from the combustion chambers using the **J 8358**.
4. Remove any gasket material with the **J 28410**.
5. Clean any debris or build-up from the lifter pockets.
6. Inspect the cylinder head again for the items noted under Visual Inspection.

Cylinder Head Measurement

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Measure the camshaft clearance specification using the following procedure:
 1. Install the camshaft caps.
 2. Install the camshaft caps bolts.

Tighten: Tighten the camshaft bearing caps bolts to 5 N.m (44 lb in).

3. Measure the camshaft bearings using an inside micrometer.
 4. Inspect and measure the camshaft journal diameters. Refer to Camshaft Cleaning and Inspection.
 5. Subtract the camshaft journal diameter from the camshaft bearing diameter in order to obtain the running clearance.
 6. If the running clearance exceeds the specifications and the camshaft journals are within specification, replace the cylinder head. Refer to Engine Mechanical Specifications.
2. Measure the camshaft thrust specification using the following procedure:
 1. Inspect each camshaft cap thrust surface for excessive scoring/wear.
 2. Inspect each camshaft. Refer to Camshaft Cleaning and Inspection.
 3. Install the intake and exhaust camshafts in the cylinder head.
 4. Install the camshaft caps.
 5. Install the camshaft caps bolts.

Tighten: Tighten the camshaft bearing caps bolts to 5 N.m (44 lb in).

6. Measure the camshaft thrust bearing clearance at the front camshaft bearing cap. Refer to Engine Mechanical Specifications.

7. If the camshaft thrust bearing clearance is not to specification repair or replace the cylinder head.

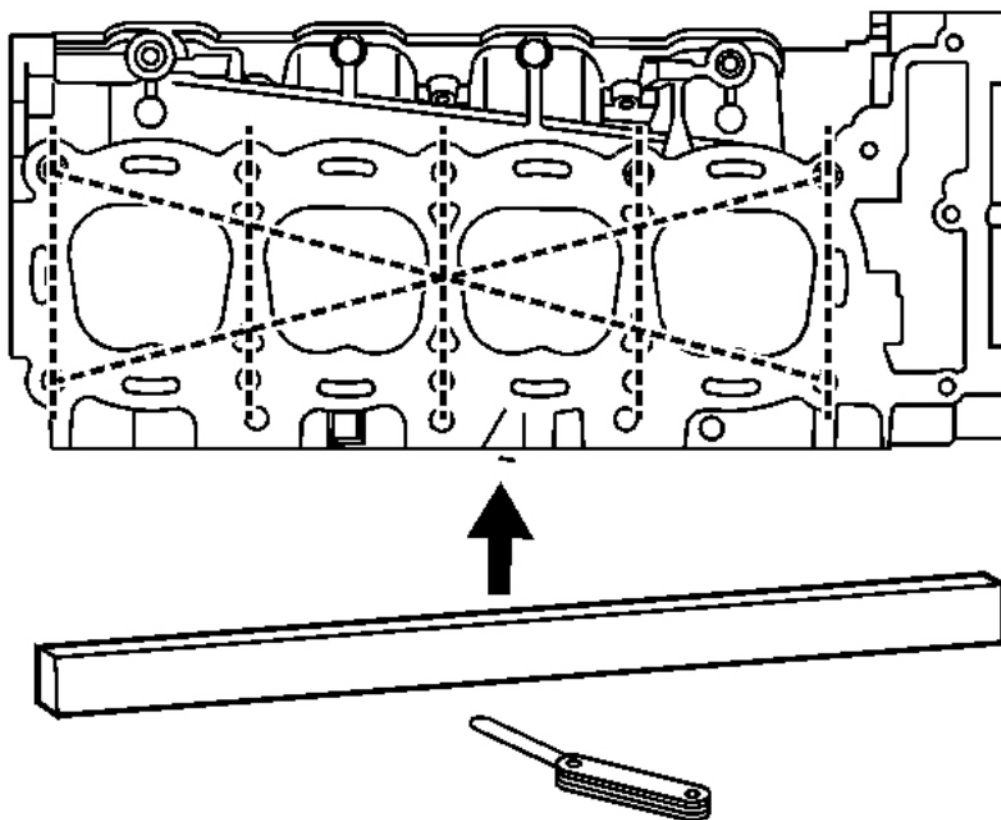


Fig. 98: Measuring Cylinder Head Flatness
Courtesy of GENERAL MOTORS CORP.

3. Measure the cylinder head flatness using the following procedure:
 1. Clean any remaining head gasket material from the cylinder head face.
 2. Place a straight-edge diagonally across the cylinder head face surface.
 3. Measure the clearance between the straight-edge and the cylinder head using a feeler gage at four points along the straight-edge.
 - If warpage is less than 0.05 mm (0.002 in), the cylinder head surface does not require resurfacing.

- If warpage is between 0.05-0.20 mm (0.002-0.008 in), the cylinder head must be resurfaced.

Valve Guide Measurement Procedure

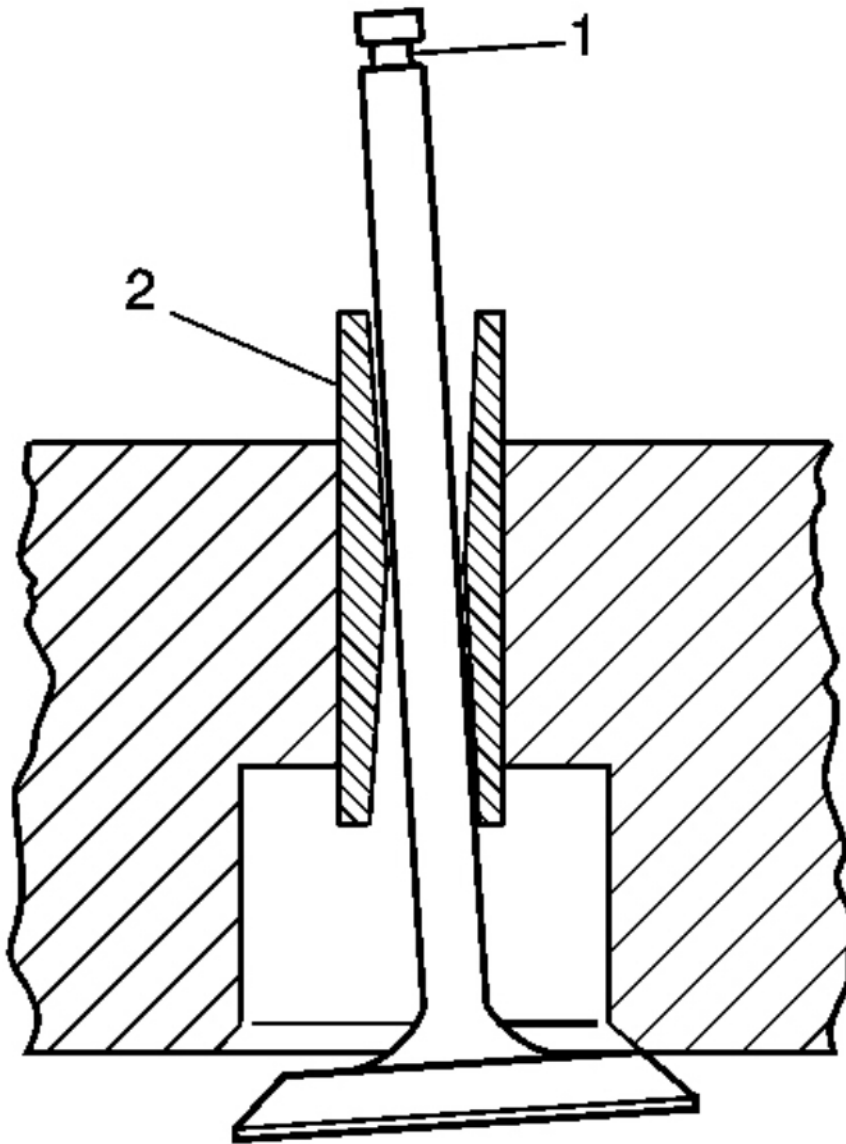


Fig. 99: Inspecting For Excessive Valve Stem To Guide Clearance

Courtesy of GENERAL MOTORS CORP.**1. Measure the valve stem (1)-to-guide (2) clearance as follows:**

- Excessive valve stem-to-guide clearance may cause an excessive oil consumption and may also cause a valve to break. Insufficient clearance will result in noisy and sticky functioning of the valve and will disturb the engine assembly smoothness.
- Clamp the **J 8001** to the cylinder head at the camshaft cover rail.
- Locate the dial indicator so that the movement of the valve stem from side to side, crossways to the cylinder head, will cause a direct movement of the indicator stem.

The dial indicator stem must contact the side of the valve stem just above the valve guide.

- Drop the valve head about 1.6 mm (0.0064 in) off the valve seat.
 - Use light pressure when moving the valve stem from side to side in order to obtain a clearance reading.
2. If the clearance for the intake valve is greater than 0.11 mm (0.0045 in) and a new standard diameter valve stem will not bring the clearance within specifications, the cylinder head must be replaced.
 3. If the clearance for the exhaust valve is greater than 0.12 mm (0.005 in) and a new standard diameter valve stem will not bring the clearance within specifications, the cylinder head must be replaced.
 4. Valve guide wear at the bottom 10 mm (0.39 in) of the valve guide is not significant to normal operation.

VALVE SPRING INSPECTION AND MEASUREMENT**Tools Required:**

J 22738-B Valve Spring Tester

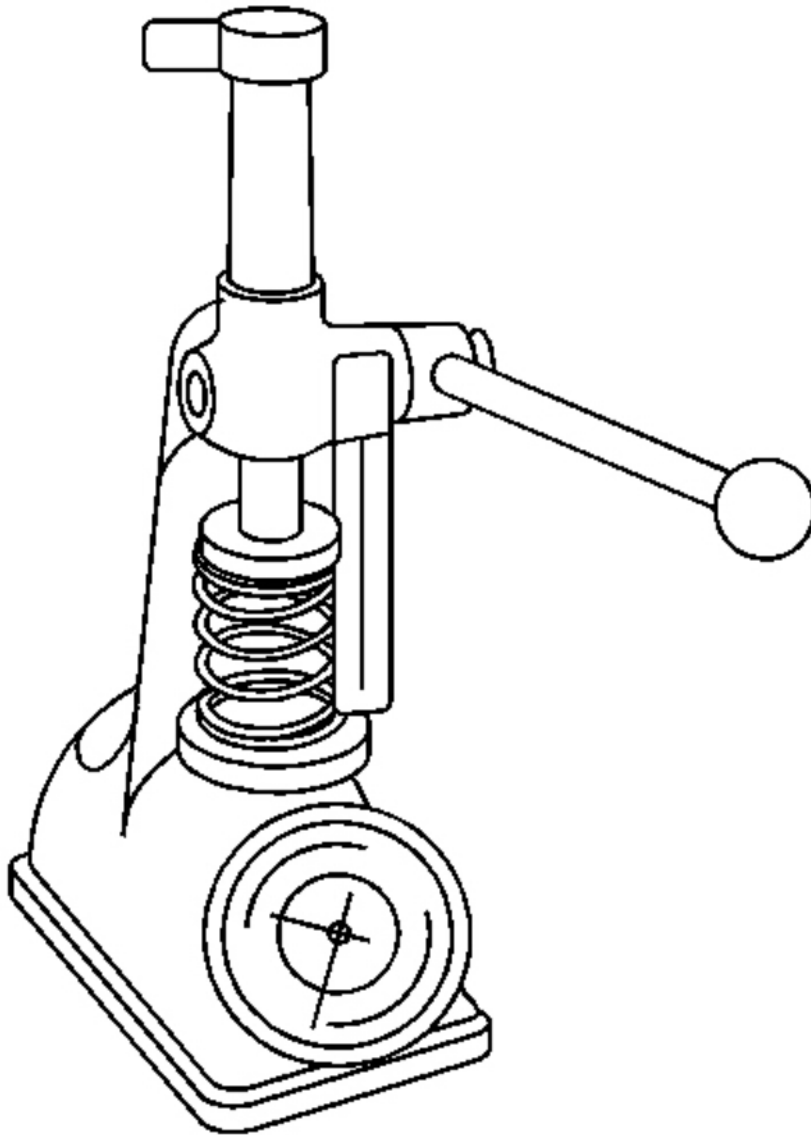


Fig. 100: Inspecting Valve Spring
Courtesy of GENERAL MOTORS CORP.

1. Place the valve spring in the **J 22738-B** .
2. Compress the **J 22738-B** to the valve open, valve spring compressed, dimension listed in the **Engine Mechanical Specifications** .

NOTE: **DO NOT use shims in order to increase valve spring load. The use of shims will cause the valve spring to bottom out before the camshaft lobe is at peak lift and engine damage could result.**

3. If low valve spring load is found to be too low, replace the valve spring, DO NOT shim.

VALVE AND SEAT GRINDING

Valve Cleaning Procedure

1. Use soft bristle wire brush to clean any carbon build-up from the valve head. DO NOT use a wire brush on any part of the valve stem. The valve stem is chrome plated to provide enhanced wear characteristics. Wire brushing the stem could remove the chrome plating.
2. Thoroughly clean the valve with solvent and wipe dry.

Valve Visual Inspection Procedure

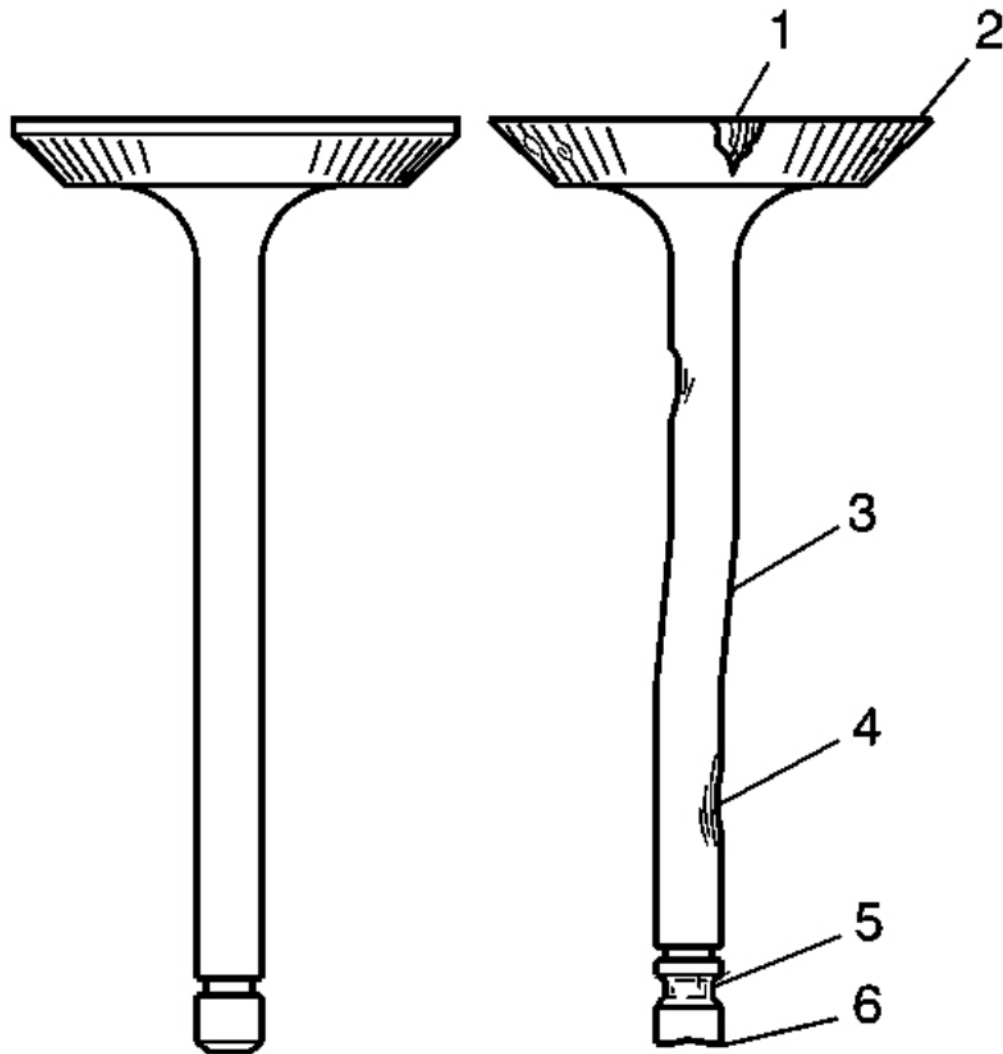


Fig. 101: Identifying Inspection Points For Valves Damage
Courtesy of GENERAL MOTORS CORP.

1. Inspect the valve for damage from the head to tip for the following conditions:
 - Pitting in the valve seat area (1)
 - Lack of valve margin (2)
 - Bending in the valve stem (3)
 - Pitting or excessive wear in the stem (4)

- Worn valve key grooves (5)
- Worn valve tip (6)

2. Replace the valve if any of these conditions exist.

Valve Measurement and Reconditioning Overview

- Proper valve service is critical to engine performance. Therefore, all detailed measurement procedures must be followed to identify components that are out of specification.
- If the measurement procedures reveal that the valve or valve seat must be reconditioned, it is critical to perform the measurement procedures after reconditioning.

Valve Seat Width Measurement Procedure

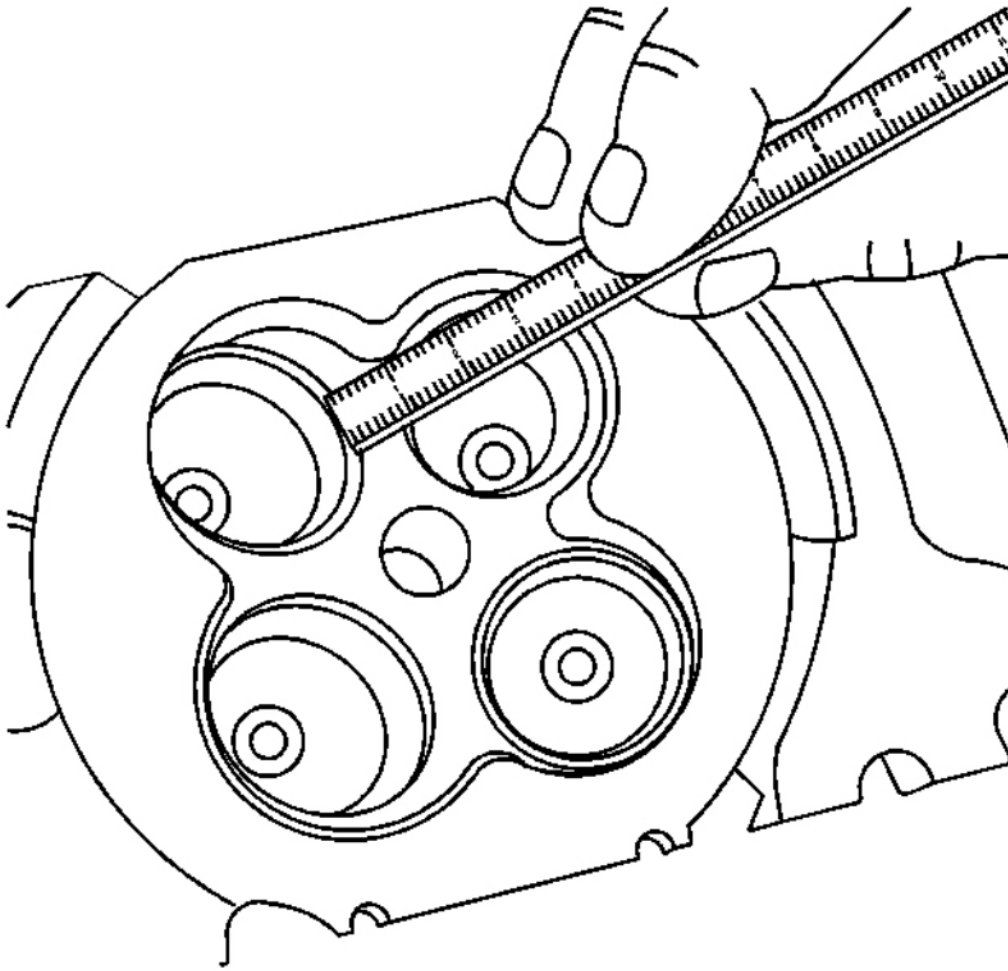


Fig. 102: Measuring Valve Seat Width
Courtesy of GENERAL MOTORS CORP.

1. Measure the valve seat width in the cylinder head using a proper scale.

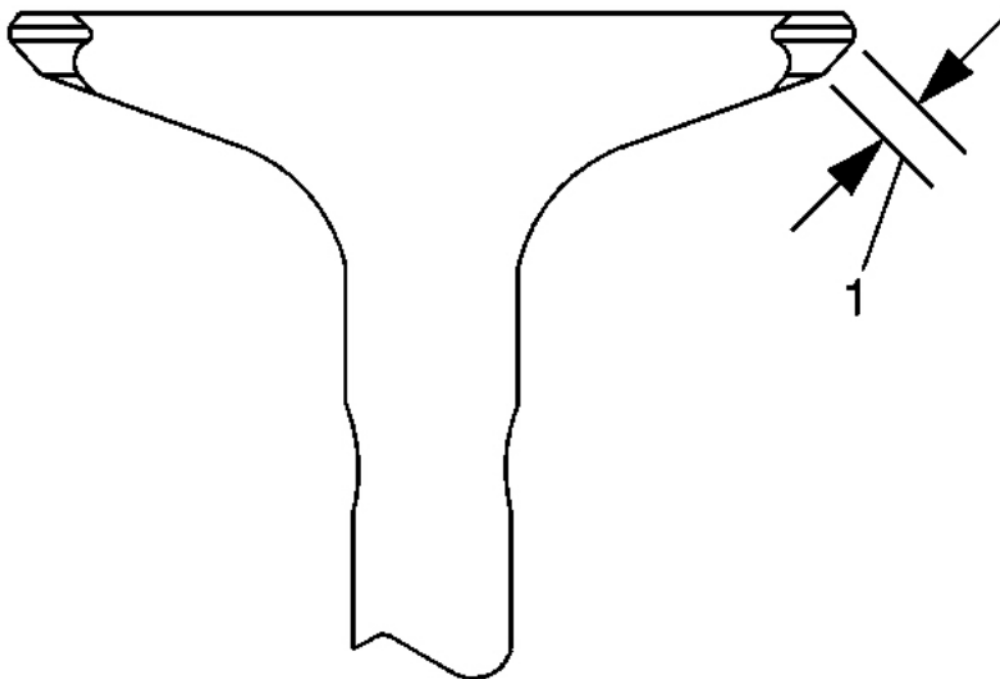


Fig. 103: Measuring Seat Width On Valve Face
Courtesy of GENERAL MOTORS CORP.

2. Measure the seat width on the valve face (1) using a proper scale.

IMPORTANT: The seat contact area must be at least 0.5 mm (0.020 in) from the outer diameter (margin) of the valve. If the contact area is too close to the margins, the seat must be reconditioned to move the contact area away from the margin.

3. Compare your measurements with the specifications listed in Engine Mechanical Specifications.
4. If the seat widths are acceptable, check the valve seat roundness using the Valve Seat Roundness Measurement Procedure.
5. If the seat width is not acceptable, you must grind the valve seat using the Valve and Seat Reconditioning Procedure to bring the width back into specification. Proper valve seat width is critical to providing the correct amount of valve heat dissipation.

Valve Seat Roundness Measurement Procedure

1. Measure the valve seat roundness using a dial indicator attached to a tapered pilot installed in the guide. The pilot should have a slight bind when installed in the guide.

NOTE: **The correct size pilot must be used. Do not use adjustable diameter pilots. Adjustable pilots may damage the valve guides.**

2. Compare your measurements with the specifications listed in **Engine Mechanical Specifications** .
3. If the valve seat exceeds the roundness specification, you must grind the valve and valve seat using the Valve and Seat Reconditioning Procedure.
4. If new valves are being used, the valve seat roundness must be within 0.05 mm (0.002 in).

Valve Margin Measurement Procedure

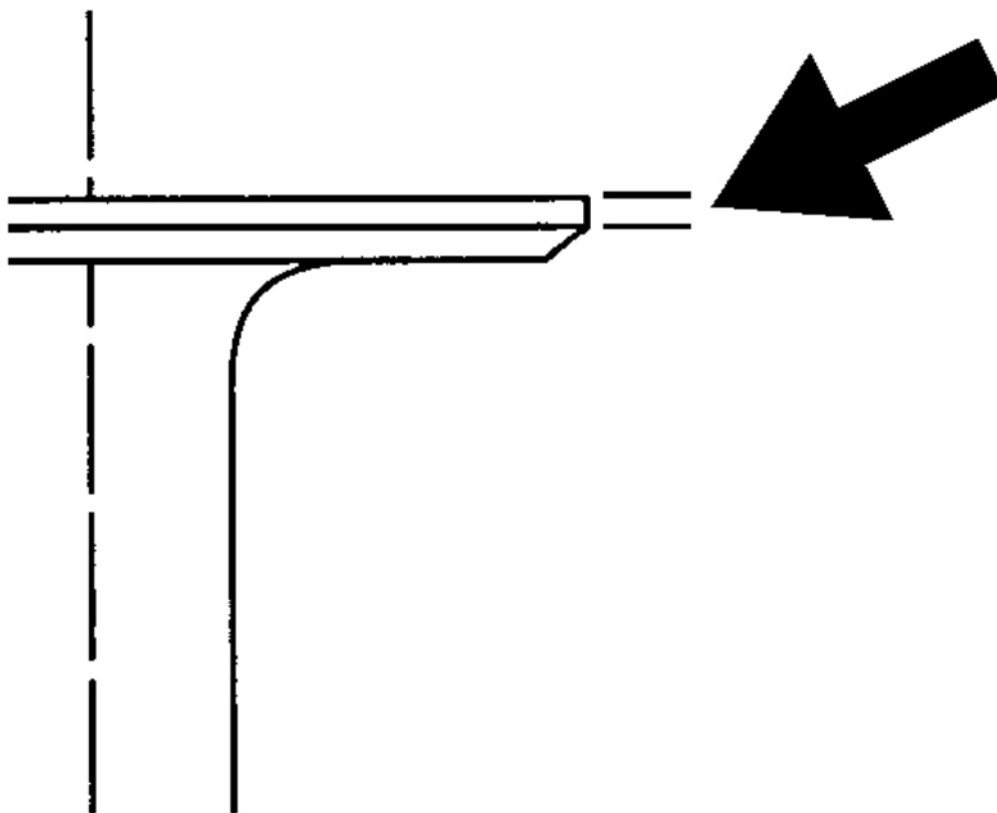


Fig. 104: View Of Valve Margin Measurement
Courtesy of GENERAL MOTORS CORP.

1. Measure the valve margin using an appropriate scale.
2. Reference the specifications in this section for minimum valve margin and compare them to your measurements.
3. If the valve margins are beyond specification, replace the valves.
4. If the valve margins are within specification and do not require refacing, test the valve for seat concentricity using the Valve-to-Seat Concentricity Measurement Procedure.

Valve-to-Seat Concentricity Measurement Procedure

- Checking the valve-to-seat concentricity determines whether the valve and seat are sealing properly.

- You must measure the valve face and the valve seat to ensure proper valve sealing.

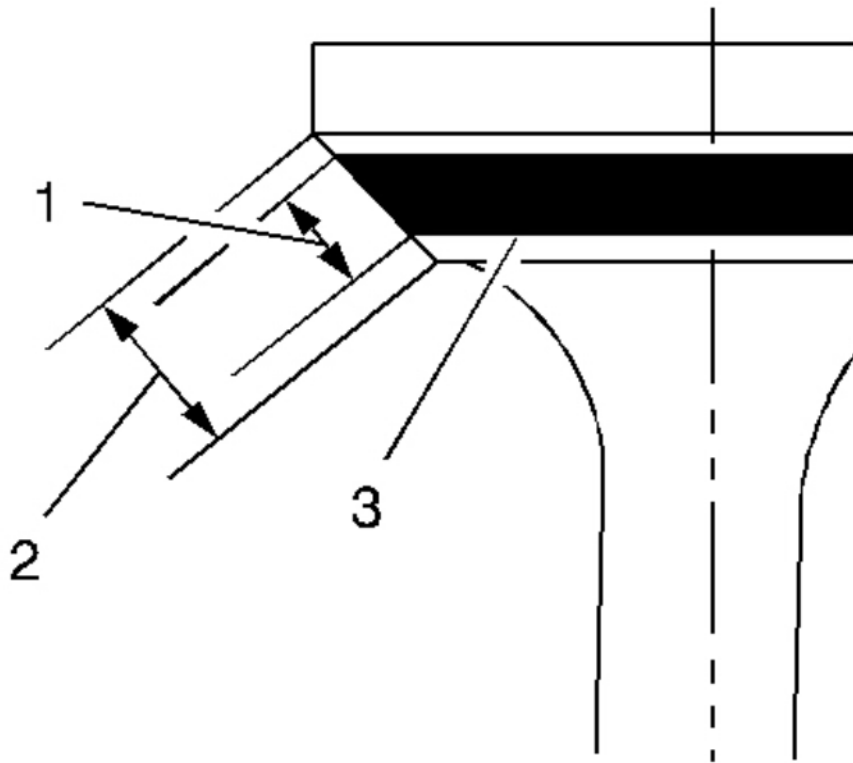


Fig. 105: View Of Valve Contact Face Measurements
Courtesy of GENERAL MOTORS CORP.

1. Coat the valve face lightly with blue dye (3).
2. Install the valve in the cylinder head.
3. Turn the valve against the seat with enough pressure to wear off the dye.
4. Remove the valve from the cylinder head.
5. Inspect the valve face.
 - If the valve face is concentric, providing a proper seal, with the valve stem, a continuous mark will be made around the entire face (1).

IMPORTANT: The wear mark **MUST** be at least 0.5 mm (0.020 in) from the outer diameter, the margin, of the valve. If the wear mark is too close to the margin, the seat must be reconditioned to move the contact area away from the margin.

- If the face is not concentric with the stem, the mark will NOT be continuous around the valve face. The valve should be refaced or replaced and the seat must be reconditioned using the Valve and Seat Reconditioning Procedure.

Valve and Seat Reconditioning Procedure

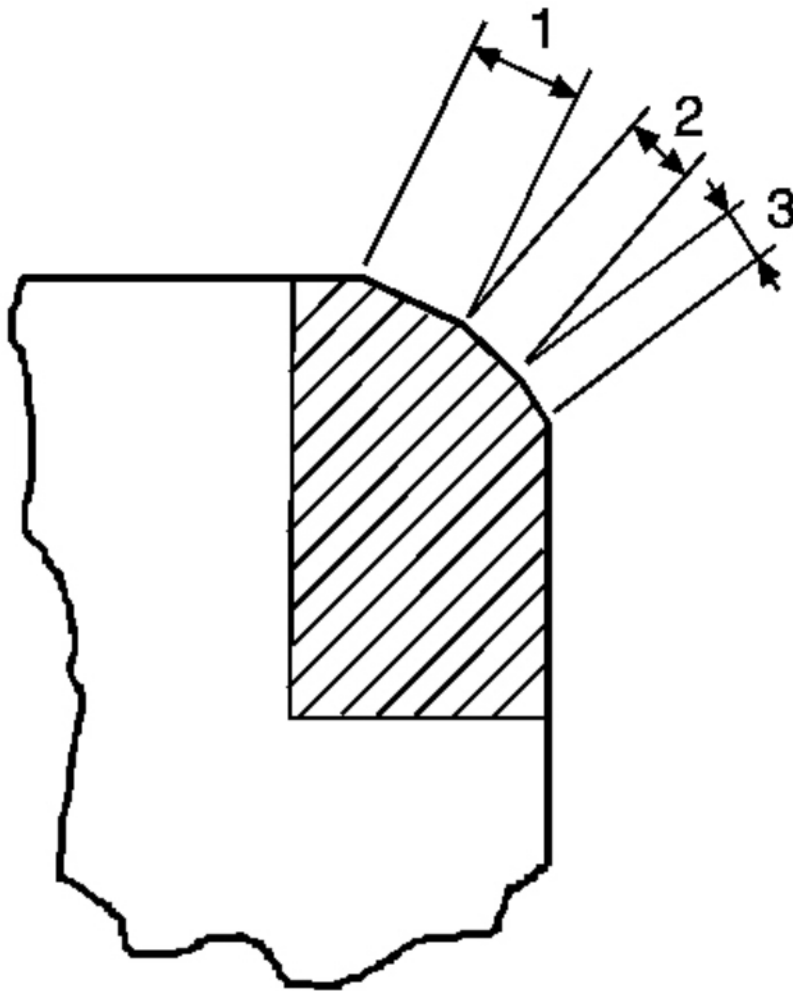


Fig. 106: Reconditioning Valve & Seat
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- If the valve seat width, roundness or concentricity is beyond specifications, you must grind the seats in order to ensure proper heat dissipation and prevent the build up of carbon on the seats.
- It is necessary to reface the valve if seat reconditioning is required unless a new valve is used.

1. Grind the valve seats (2) to the proper angle specification listed in **Engine Mechanical Specifications** .
2. Using the proper angle specification listed in **Engine Mechanical Specifications** , grind, relieve, the valve seats (1) to correctly position the valve seating surface (2) to the valve.
3. Using the proper angle specification listed in **Engine Mechanical Specifications** , grind, undercut, the valve seats (3) to narrow the valve seat widths to the specifications listed in **Engine Mechanical Specifications** .
4. If the original valve is being used, grind the valve to the specifications listed in **Engine Mechanical Specifications** . Measure the valve margin again after grinding using the Valve Margin Measurement Procedure. Replace the valve if the margin is out of specification. New valves do not require grinding.
5. When grinding the valves and seats, grind off as little material as possible. Cutting valve seat results in lowering the valve spring pressure.
6. Install the valve in the cylinder head.
 - If you are using refaced valves, lap the valves into the seats with a fine grinding compound. The refacing and reseating operations should leave the refinished surfaces smooth and true so that minimal lapping is required. Excessive lapping will groove the valve face and prevent a good seat when hot.

IMPORTANT: Be sure to clean any remaining lapping compound from the valve and seat with solvent and compressed air prior to final assembly.

- If you are using new valves, do not lap the valves under any condition.
7. After obtaining the proper valve seat width in the cylinder head, you must re-measure the valve stem height using the Valve Stem Height Measurement Procedure.
 8. If the valve stem height is acceptable, test the seats for concentricity using the Valve-to-Seat Concentricity Measurement Procedure.

Valve Stem Height Measurement Procedure

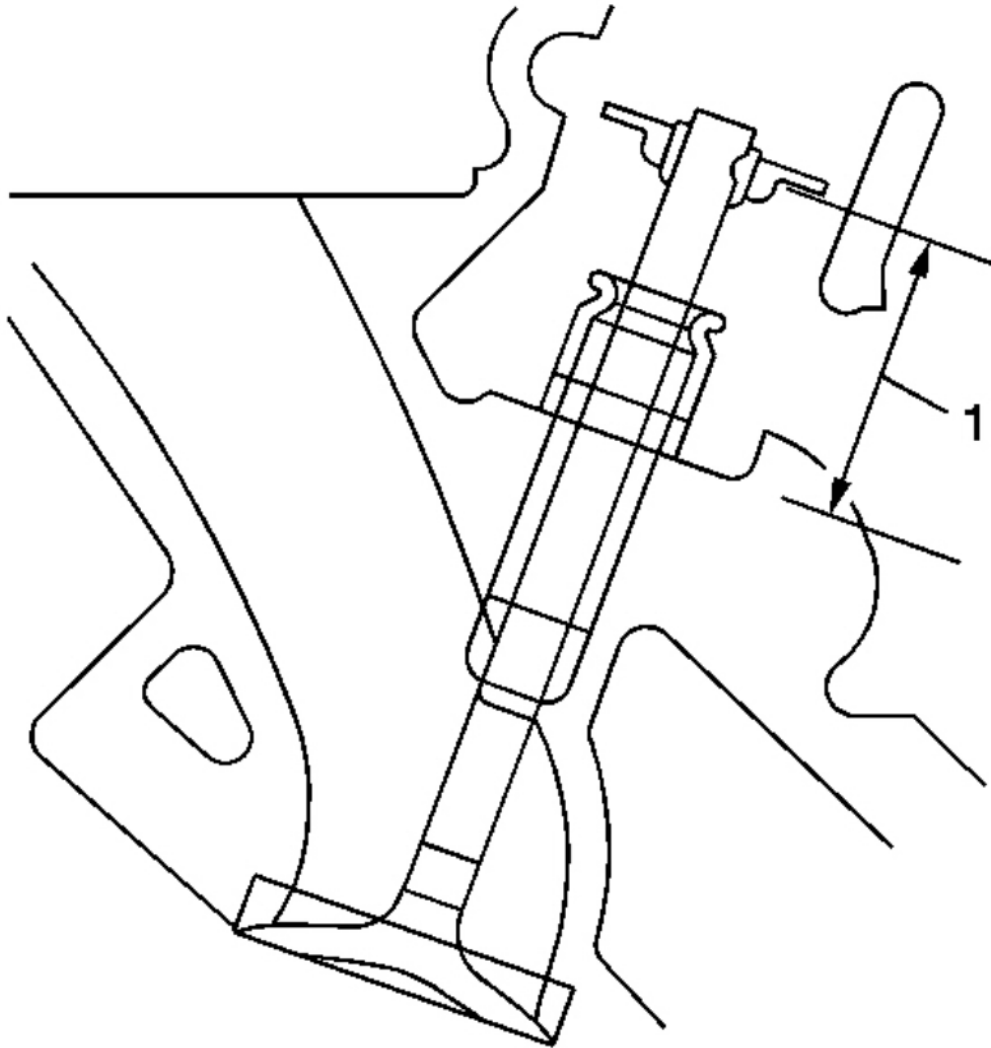


Fig. 107: Measuring Valve Stem Height
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: To determine the valve stem height measurement, measure from the valve spring seat to the valve spring retainer.

1. Install the valve into the valve guide.
2. Ensure the valve is seated to the cylinder head valve seat.

3. Install the valve stem oil seal.
4. Install the valve spring retainer and valve stem locks.
5. Measure the distance (1) between the valve stem oil seal spring seat to the bottom of the valve spring retainer.
6. If the maximum height specification is exceeded, a new valve should be installed and the valve stem height re-measured.

NOTE: **DO NOT grind the valve stem tip. The tip of the valve is hardened and grinding the tip will eliminate the hardened surface causing premature wear and possible engine damage.**

NOTE: **DO NOT use shims in order to adjust valve stem height. The use of shims will cause the valve spring to bottom out before the camshaft lobe is at peak lift and engine damage could result.**

7. If the valve stem height still exceeds the maximum height specification, the cylinder head must be replaced.

CYLINDER HEAD ASSEMBLE

Tools Required

- **J 8062** Valve Spring Compressor
- **J 38820** Valve Stem Seal Installer
- **J 38821** Valve Spring Compressor Adapter
- **J 43059** Valve Retainer Remover/Installer

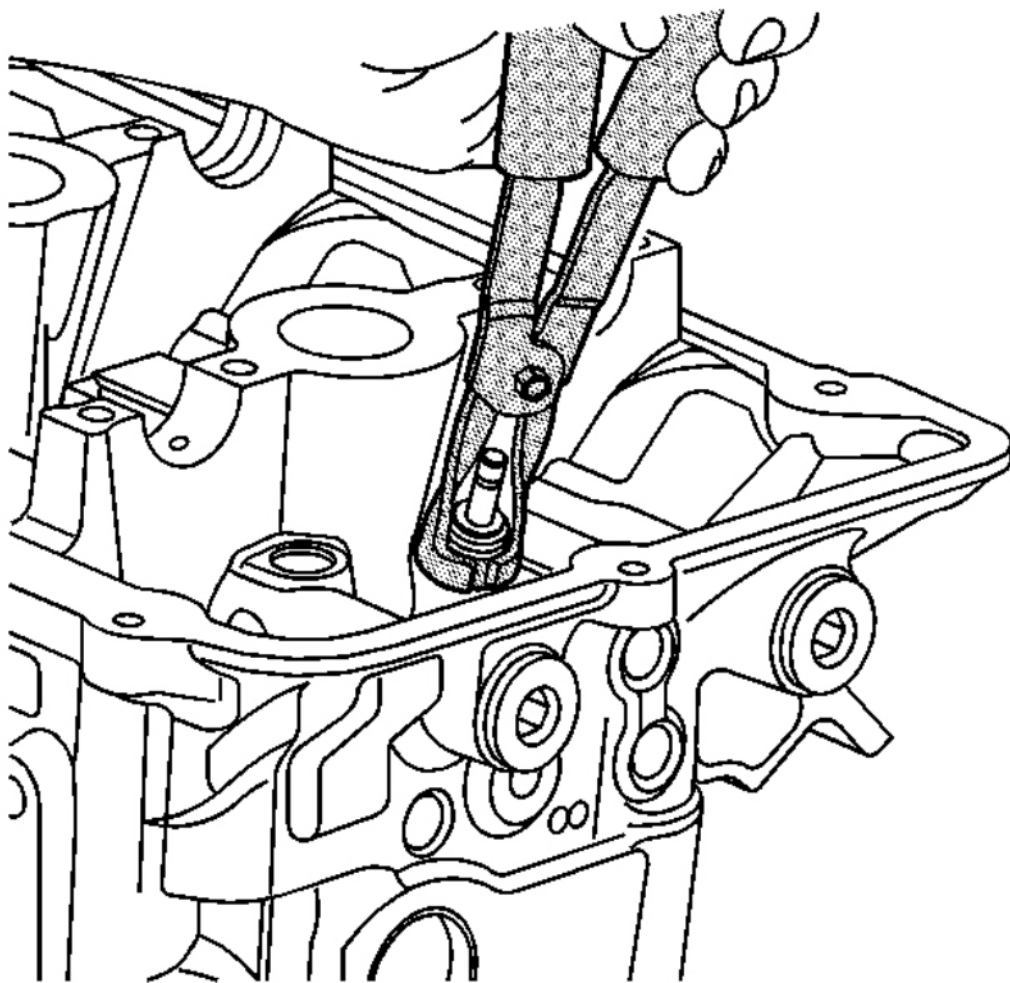


Fig. 108: Removing/Installing Valve Seal
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the valve stem with clean engine oil.
2. Insert the valve into the valve guide until it bottoms on the valve seat.
3. Lubricate the new valve seal with engine oil.
4. Using the **J 38820** , install the new valve seal using the following procedure:
 1. Place the valve lifter bore protector into the lifter bore.
 2. Mount the new valve seal in the **J 38820** .

3. Push and twist the new valve seal into position on the valve guide until the seal positively locks on the guide.

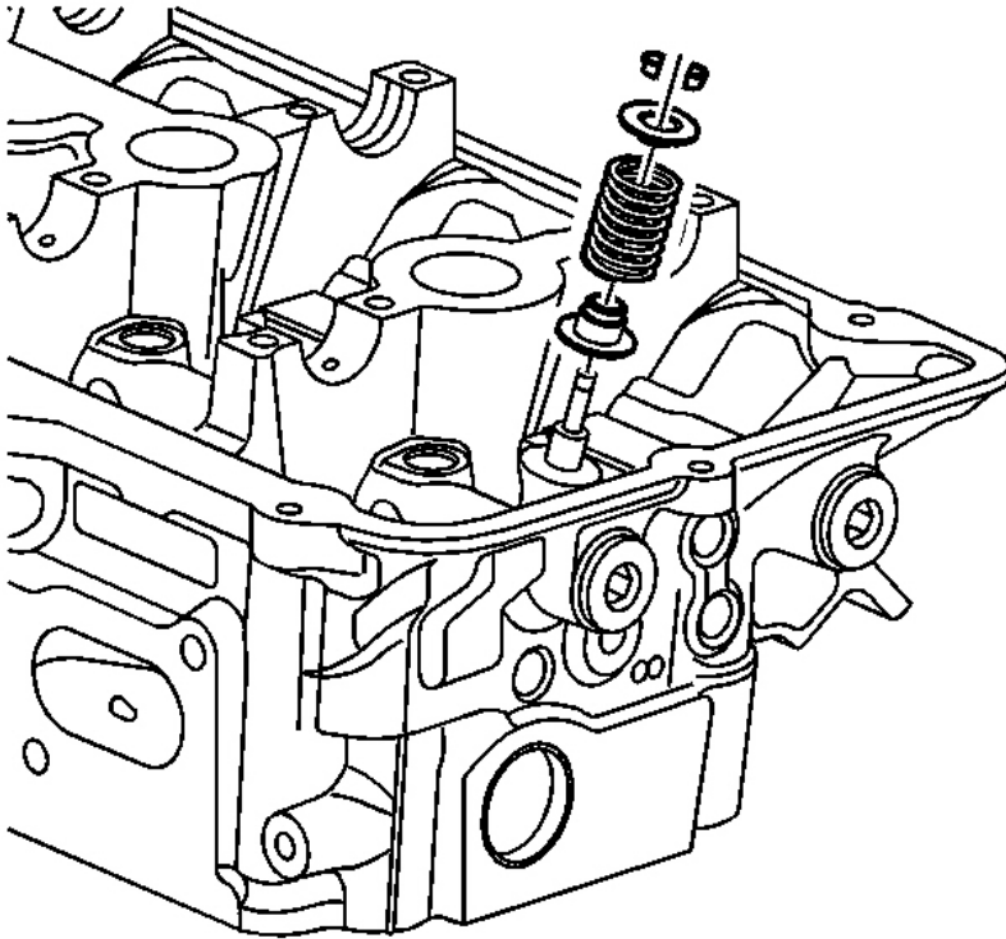


Fig. 109: View Of Valve Spring
Courtesy of GENERAL MOTORS CORP.

5. Position the valve spring on the spring seat.

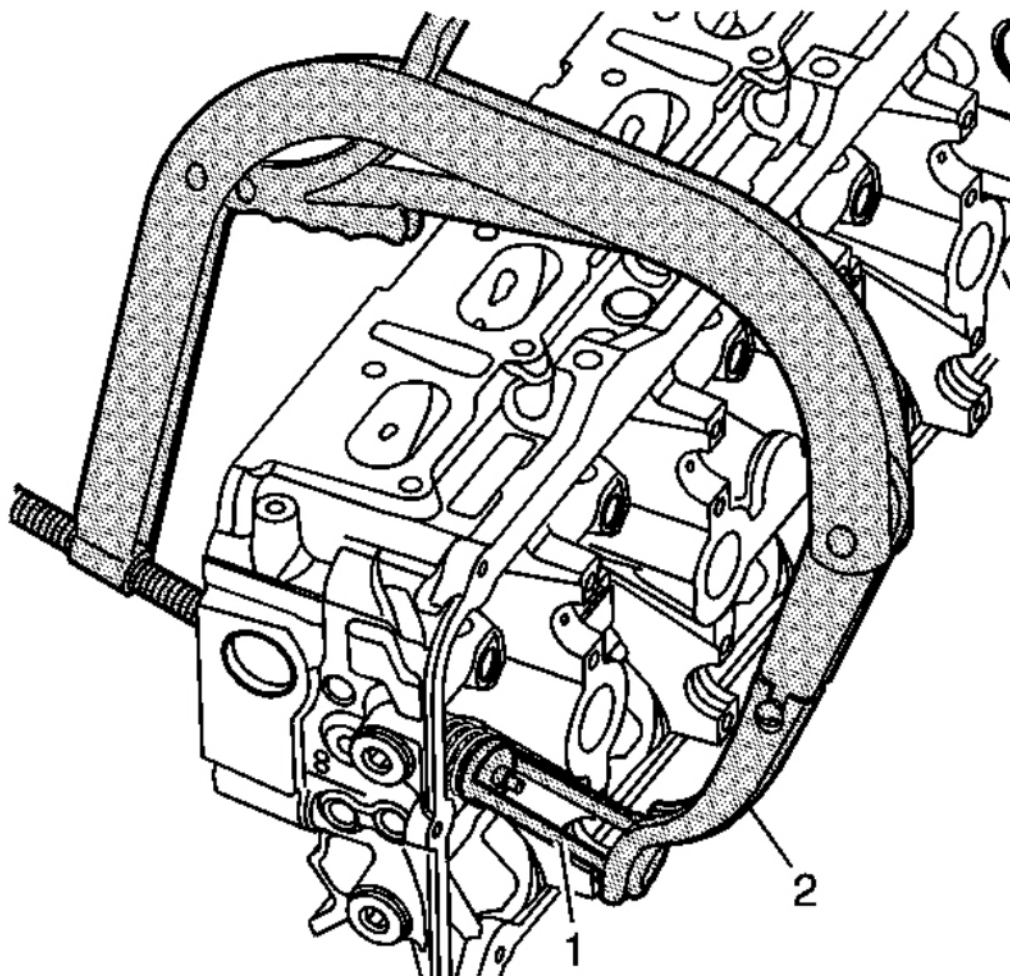


Fig. 110: Compressing Valve Spring
Courtesy of GENERAL MOTORS CORP.

CAUTION: Compressed valve springs have high tension against the valve spring compressor. Valve springs that are not properly compressed by or released from the valve spring compressor can be ejected from the valve spring compressor with intense force. Use care when compressing or releasing the valve spring with the valve spring compressor and when removing or installing the valve stem keys. Failing to use care may cause personal

injury.

NOTE: Do not compress the valve springs less than 24.0 mm (0.943 in). Contact between the valve spring retainer and the valve stem oil seal can cause potential valve stem oil seal damage.

6. Compress the valve spring using the J 8062 (2) and the J 38821 (1).

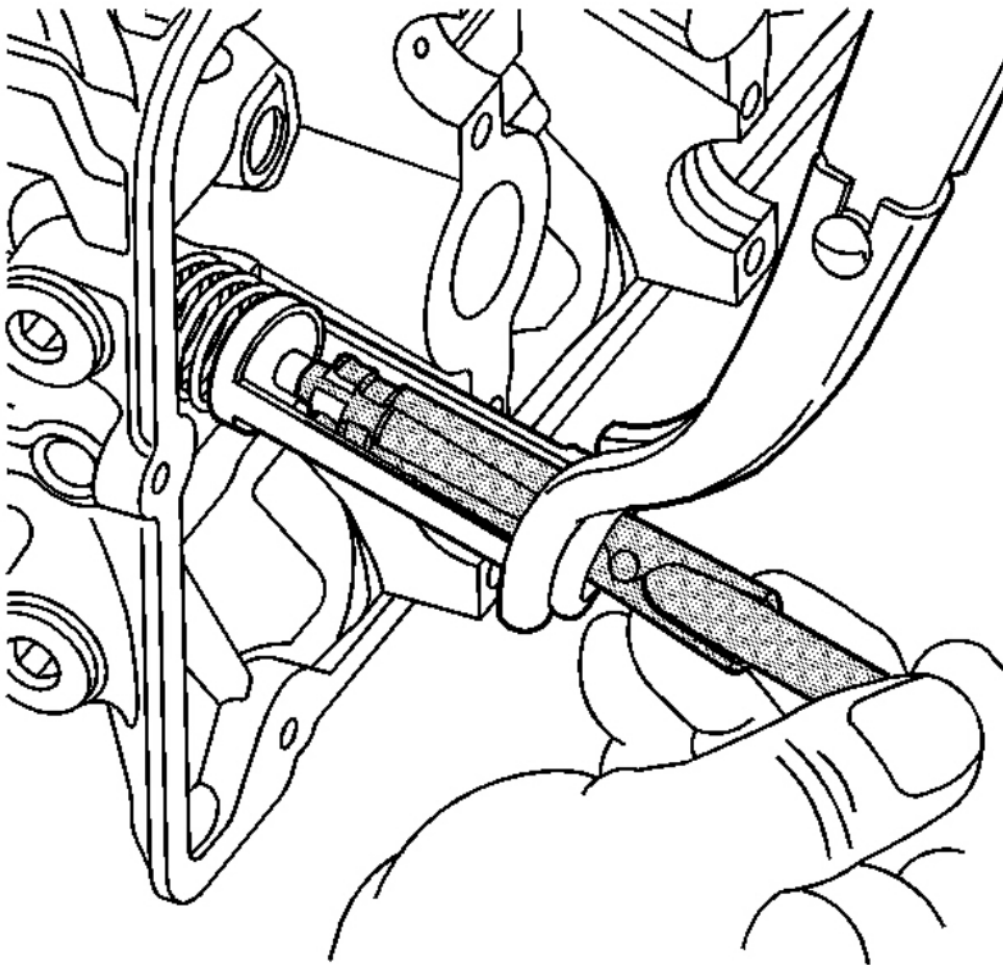


Fig. 111: Installing Valve Keepers
Courtesy of GENERAL MOTORS CORP.

7. With the spring compressed, install the valve keepers into the **J 43059** .
8. Place the keepers into position by pushing the tool downward.
9. Release the tension on the spring compressor and remove the **J 38821** .
10. Verify that the valve keepers are installed by placing a rag over the valve tip and tapping with a dead-blow hammer. The valve keepers and the spring should remain in place.
11. Repeat this procedure for the remaining valves.

CAMSHAFT CLEANING AND INSPECTION

Tools Required

J 7872 Magnetic Base Dial Indicator

Cleaning Procedure

1. Clean the camshaft in solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Dry the camshaft with compressed air.
3. Cover the camshafts with a clean oil soaked towel in order to prevent corrosion.

Visual Inspection Procedure

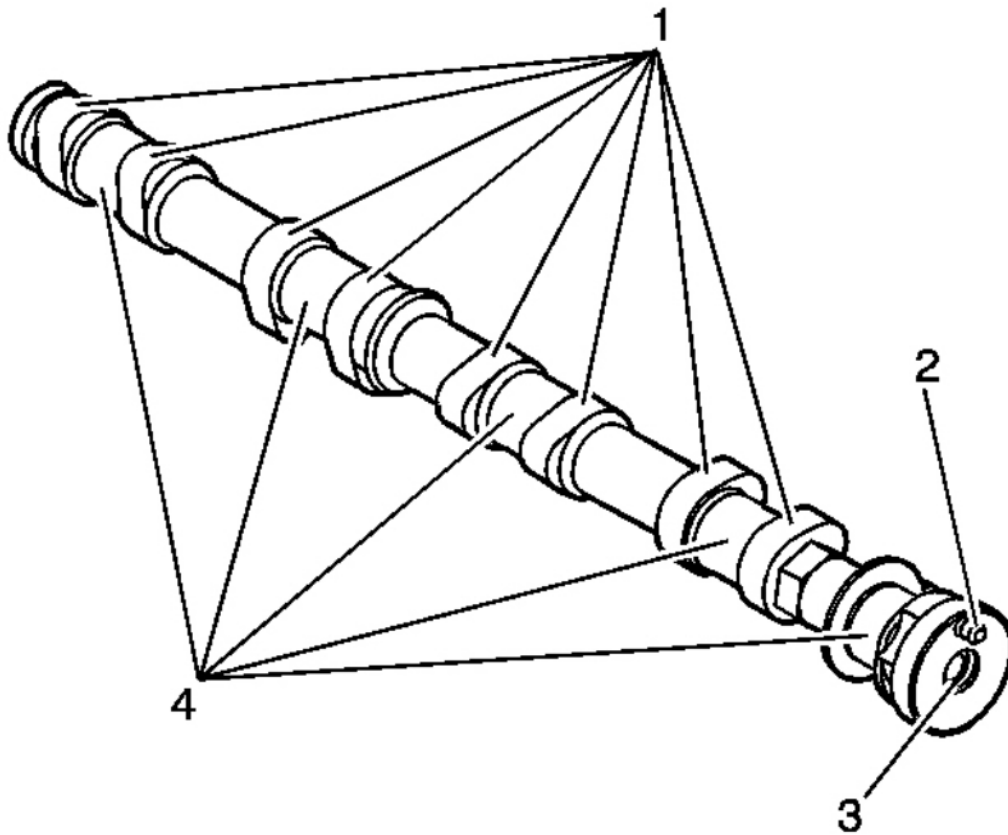


Fig. 112: Inspecting Camshaft
Courtesy of GENERAL MOTORS CORP.

1. Inspect the camshaft sprocket locating pin (2) for damage or wear.
2. Inspect the threads (3) for the camshaft sprocket bolt.
3. Inspect the camshaft lobes (1) and journals (4) for the following conditions:
 - Excessive scoring or pitting
 - Discoloration from overheating
 - Deformation from excessive wear, especially the camshaft lobes

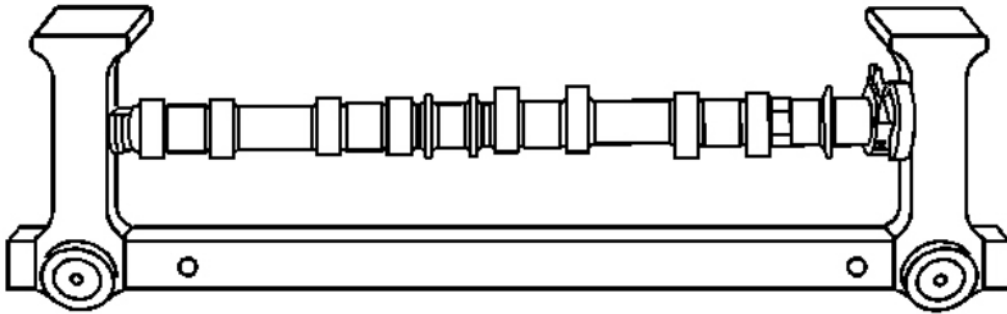


Fig. 113: Supporting Camshaft
Courtesy of GENERAL MOTORS CORP.

1. With the camshaft in a suitable fixture, measure the camshaft for wear.

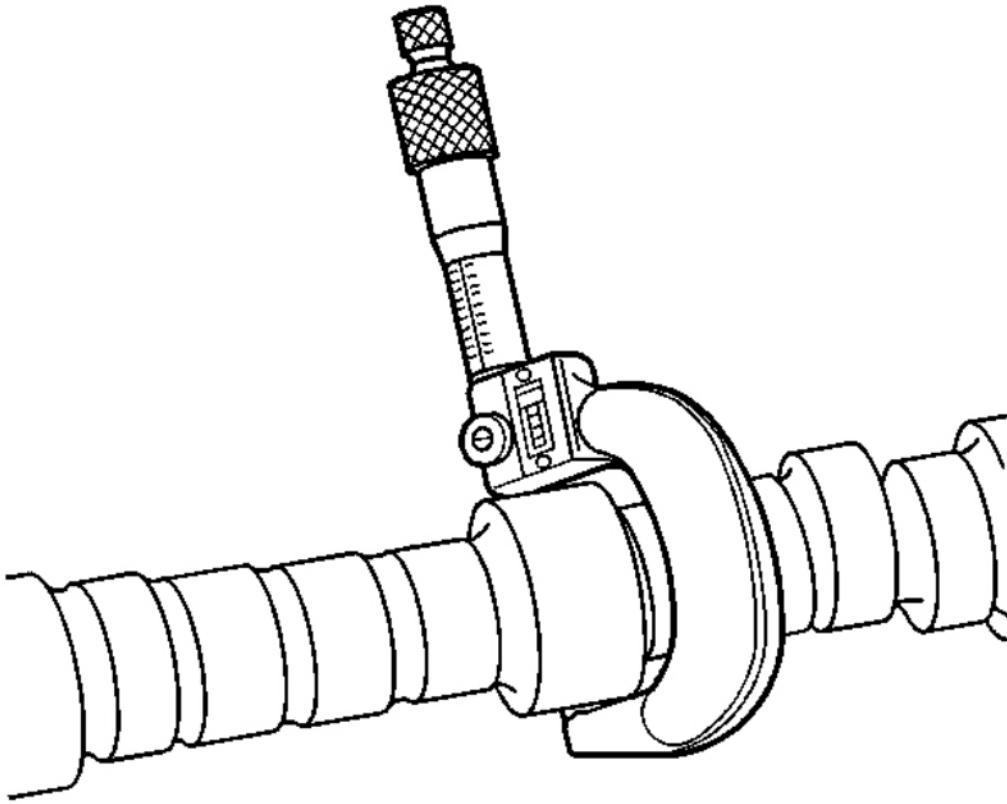


Fig. 114: Measure Camshaft Journals With Micrometer
Courtesy of GENERAL MOTORS CORP.

2. Measure the camshaft journals for diameter and out-of-round using an outside micrometer.
 - If the diameter is smaller than 26.948 mm (1.061 in), replace the camshaft.
 - If the out-of-round exceeds 0.022 mm (0.0009 in), replace the camshaft.

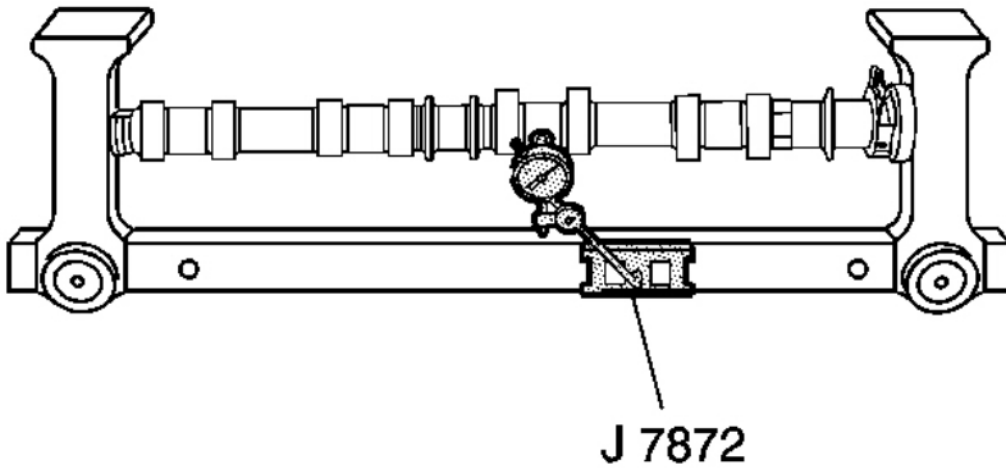


Fig. 115: Measuring Camshaft Runout
Courtesy of GENERAL MOTORS CORP.

3. Measure the camshaft runout using **J 7872** . Refer to **Engine Mechanical Specifications** .

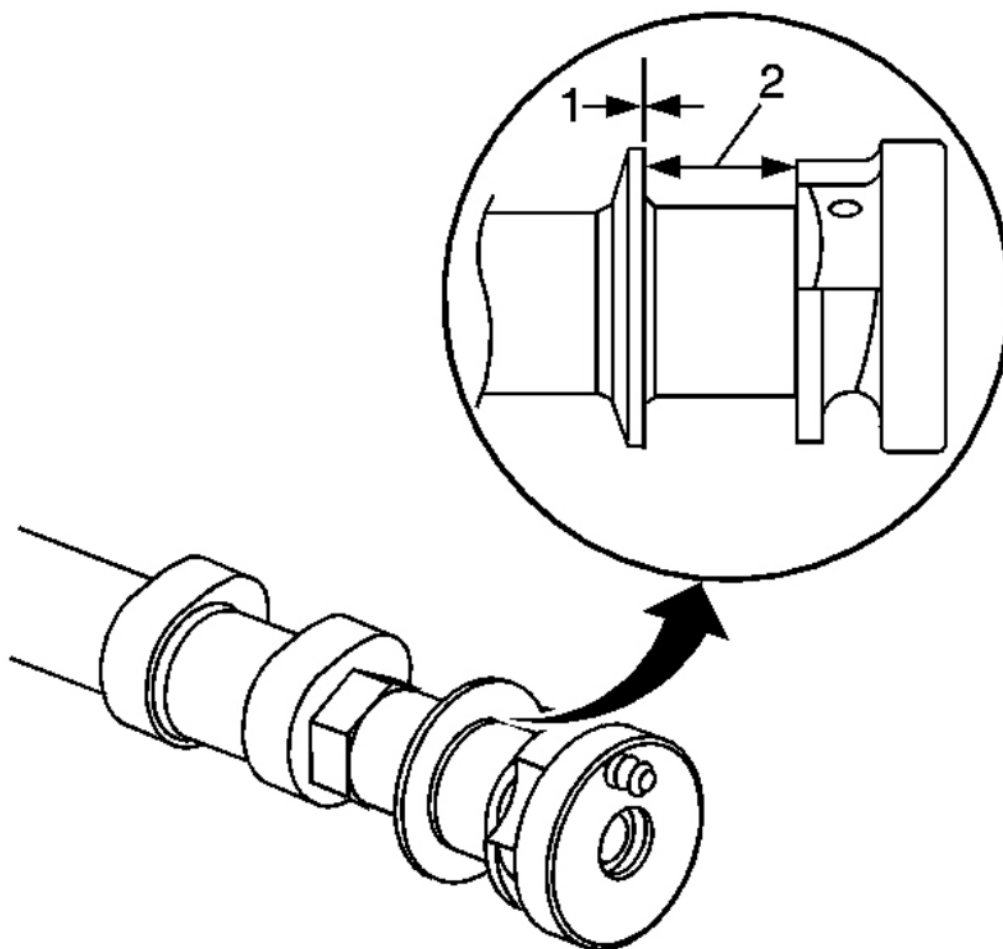


Fig. 116: Measuring Camshaft Thrust Wall Width & Surface Runout
Courtesy of GENERAL MOTORS CORP.

4. Measure the camshaft thrust wall width (1) for wear using an inside micrometer. Refer to **Engine Mechanical Specifications** .
5. Measure the camshaft thrust wall surface (2) for runout using **J 7872** . Refer to **Engine Mechanical Specifications** .
6. If the camshaft is damaged or worn beyond specifications, replace the camshaft. No machining of the camshaft is allowed.

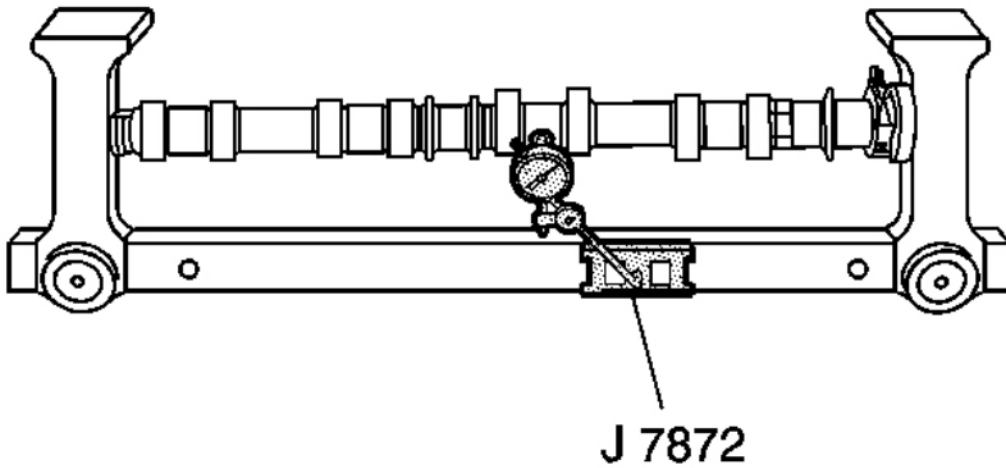


Fig. 117: Measuring Camshaft Lobes For Wear
Courtesy of GENERAL MOTORS CORP.

7. Measure the camshaft lobes for wear using the **J 7872** .

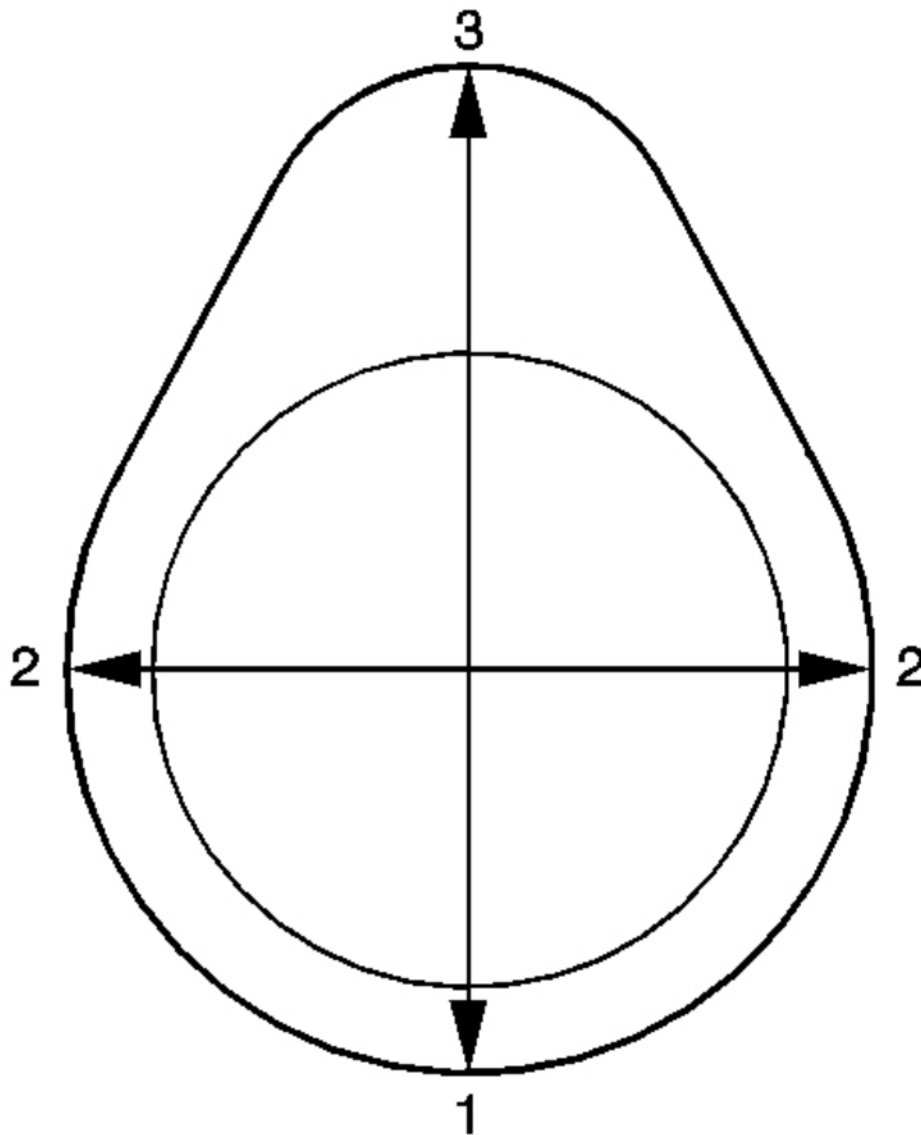


Fig. 118: Measuring Lift Of Camshaft Lobe
Courtesy of GENERAL MOTORS CORP.

8. Place the **J 7872** with the indicator tip on the base circle (1) of the camshaft lobe.
 1. Place the **J 7872** dial at zero.
 2. Rotate the camshaft until the indicator tip is at the highest point on the lobe. This

reading is the lift (3) of the camshaft lobe. Refer to **Engine Mechanical Specifications** .

3. If the indicated measurement is significantly lower than these specifications, replace the camshaft or engine performance will be reduced.

VALVE LIFTERS CLEANING AND INSPECTION

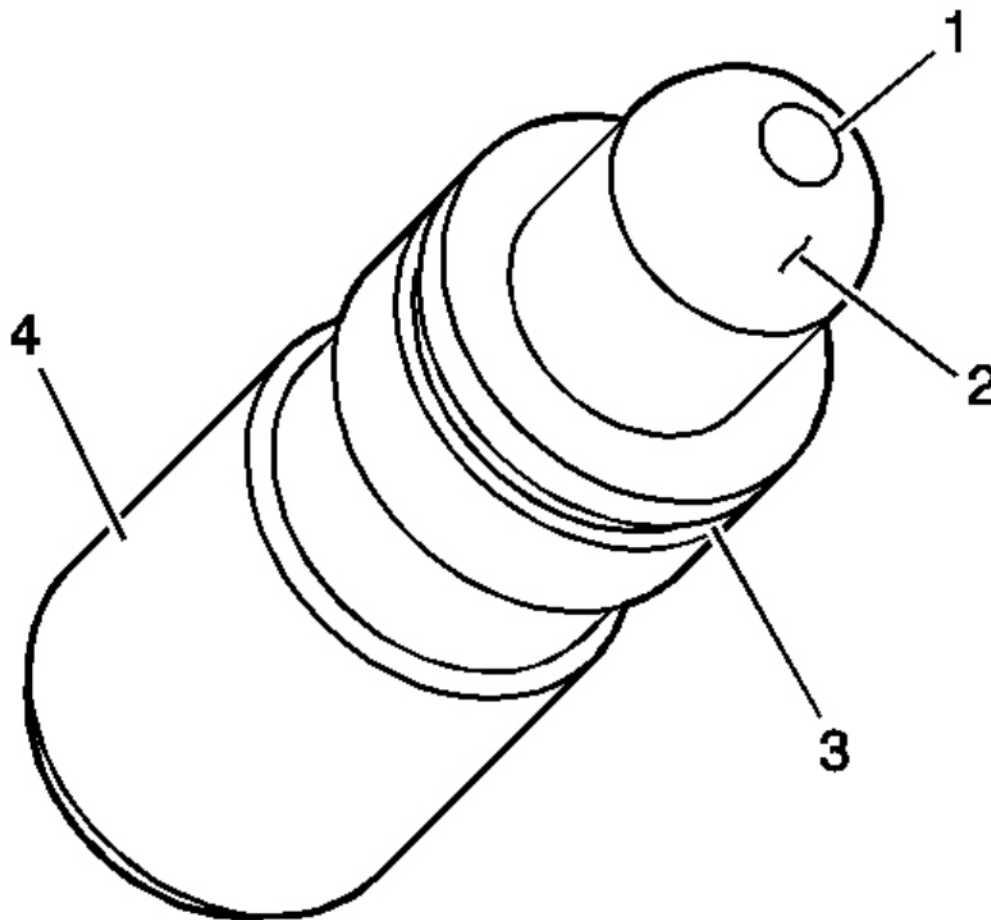


Fig. 119: Inspecting Valve Lifter
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to **Valve Lifter Priming Notice** in Cautions and Notices.

1. Inspect the stationary hydraulic lash adjuster (SHLA) in the following areas:
 - A plugged oil passage (1)
 - A scored or worn camshaft follower pivot area (2)
 - A damaged or broken retainer (3)
 - A severely scuffed or worn SHLA body (4)
2. Replace the SHLA or SHLAs as necessary.

VALVE ROCKER ARMS CLEANING AND INSPECTION

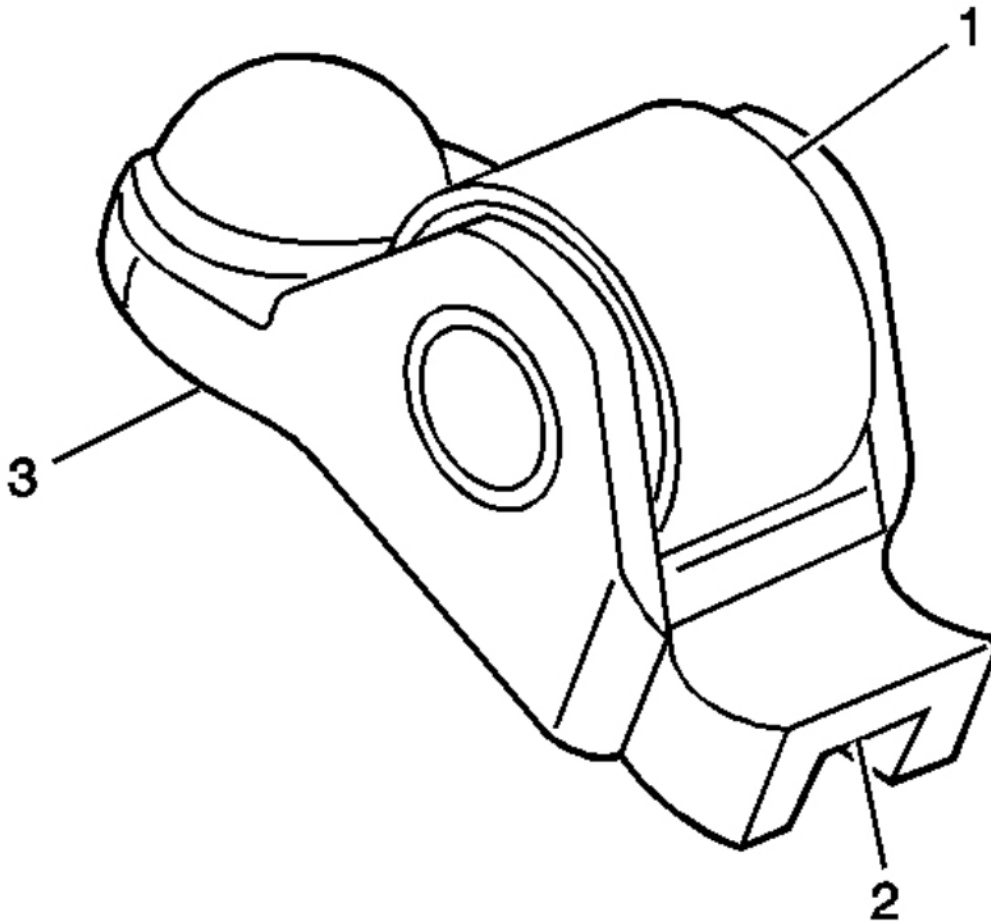


Fig. 120: Inspecting Valve Rocker Arm
Courtesy of GENERAL MOTORS CORP.

1. Inspect the camshaft follower roller (1) for the following:
 - Flat spots
 - Excessive scoring and pitting
 - Ensure the roller spins freely
2. Inspect the camshaft follower valve tip area (2).
3. Inspect the camshaft follower stationary hydraulic lash adjuster (SHLA) pivot area (3).
4. Replace the camshaft follower or followers as necessary.

CAMSHAFT INTERMEDIATE DRIVE SHAFT CLEANING AND INSPECTION

Cleaning Procedure

1. Clean the camshaft intermediate drive shaft in solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Dry the camshaft intermediate drive shaft with compressed air.

Inspection Procedure

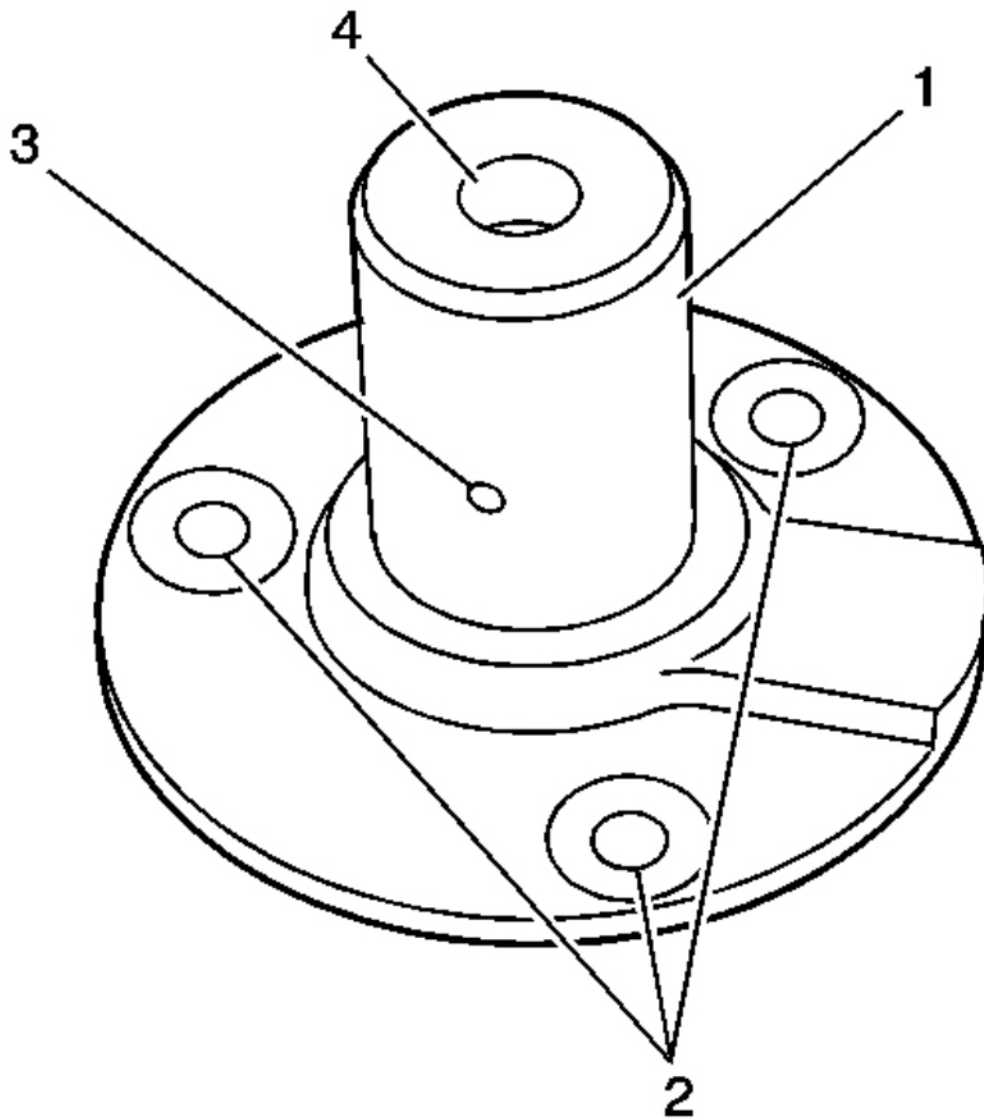


Fig. 121: Inspecting Camshaft Intermediate Drive Shaft
Courtesy of GENERAL MOTORS CORP.

1. Inspect the camshaft intermediate drive shaft for the following:
 - Worn or damaged hub-to-camshaft intermediate drive shaft sprocket bearing surface (1)

- Cracks or damage to the camshaft intermediate drive shaft fastener holes (2)
 - Restrictions to the oil passage (3)
 - Damaged or stripped thread (4)
2. Repair or replace the camshaft intermediate drive shaft as necessary.

CAMSHAFT TIMING DRIVE COMPONENTS CLEANING AND INSPECTION

Cleaning Procedure

1. Clean all the following components with solvent:
 - Camshaft position actuator - exterior only
 - Camshaft position actuator oil control valve
 - Intermediate sprocket
 - Crankshaft sprocket
 - Primary timing chain
 - Secondary timing chains
 - Primary timing chain guide
 - Secondary timing chain guides
 - Primary timing chain shoe
 - Secondary timing chain shoes
 - Primary timing chain tensioner
 - Secondary timing chain tensioners
 - Timing component fastening bolts

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Dry the timing components with compressed air.

Visual Inspection

Camshaft Position Actuators

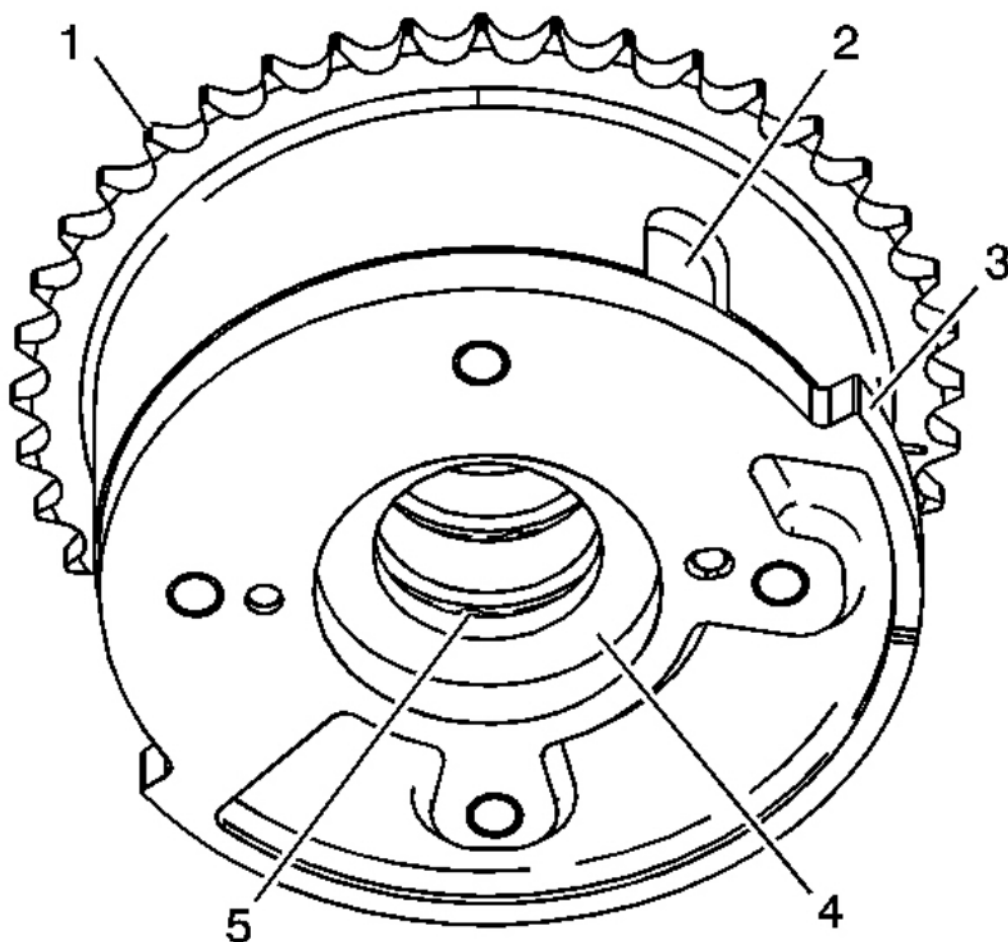


Fig. 122: Inspecting Front Of Exhaust Camshaft Position Actuator
Courtesy of GENERAL MOTORS CORP.

1. Inspect the front of the exhaust camshaft position actuators for the following:
 - Sprocket damage (1)
 - Loose or missing lock pin cover (2)
 - Reluctor/sensor wheel damage (3)
 - Camshaft position actuator oil control valve seating/sealing inner hub flange damage (4)
 - Blockage to the oil passages (5)

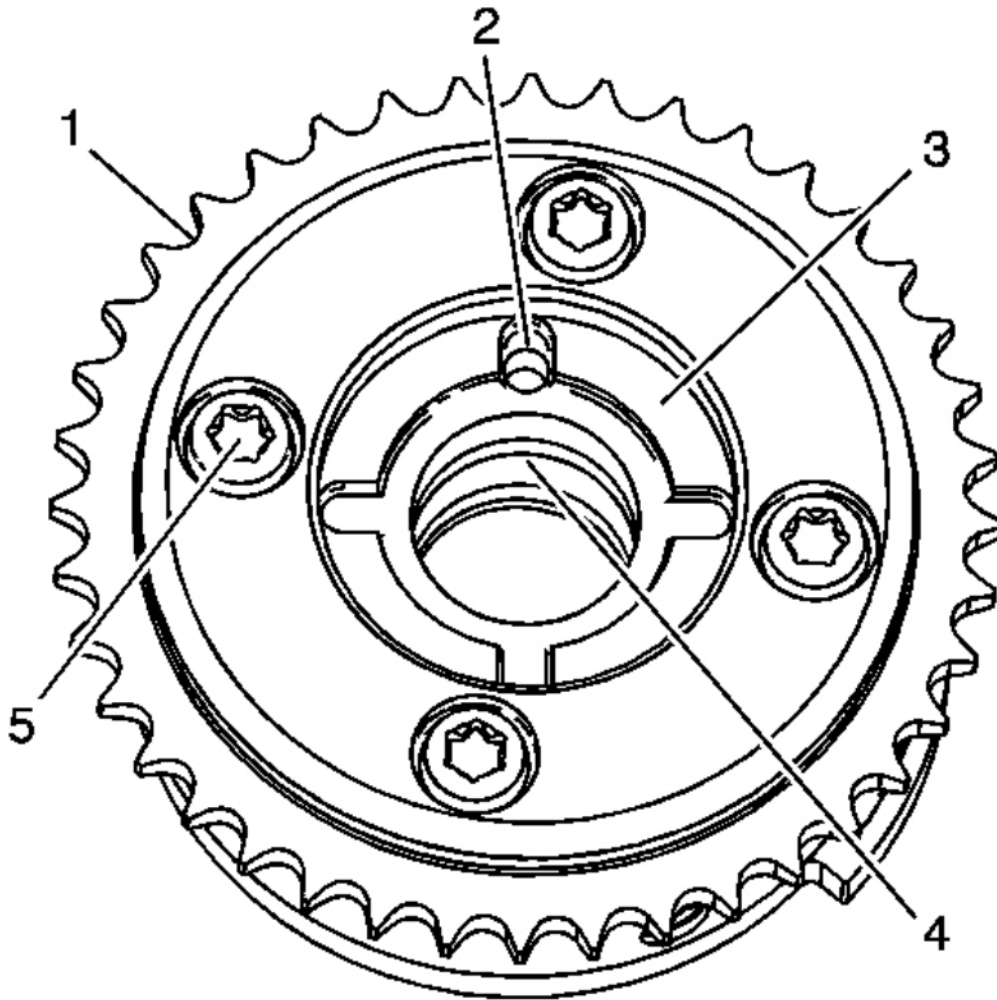


Fig. 123: Inspecting Back Of Exhaust Camshaft Position Actuator
Courtesy of GENERAL MOTORS CORP.

2. Inspect the back of the exhaust camshaft position actuators for the following:
 - Sprocket damage (1)
 - Camshaft locating pin hole (2)
 - Camshaft seating/sealing inner hub flange damage (3)
 - Blockage to the oil passages (4)
 - Loose or missing housing bolts (5)

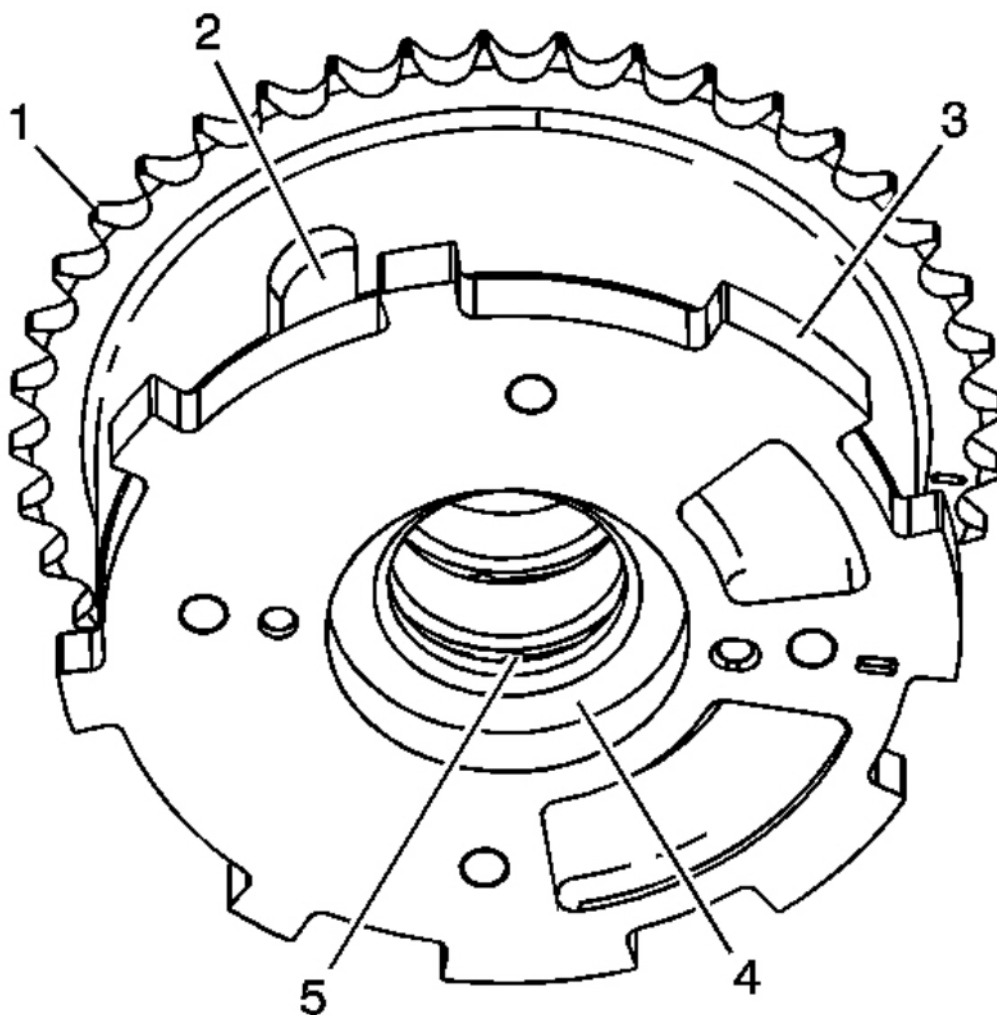


Fig. 124: Inspecting Front Of Intake Camshaft Position Actuator
Courtesy of GENERAL MOTORS CORP.

3. Inspect the front of the intake camshaft position actuators for the following:
 - Sprocket damage (1)
 - Loose or missing lock pin cover (2)
 - Reluctor/sensor wheel damage (3)
 - Camshaft position actuator oil control valve seating/sealing inner hub flange damage (4)

- Blockage to the oil passages (5)

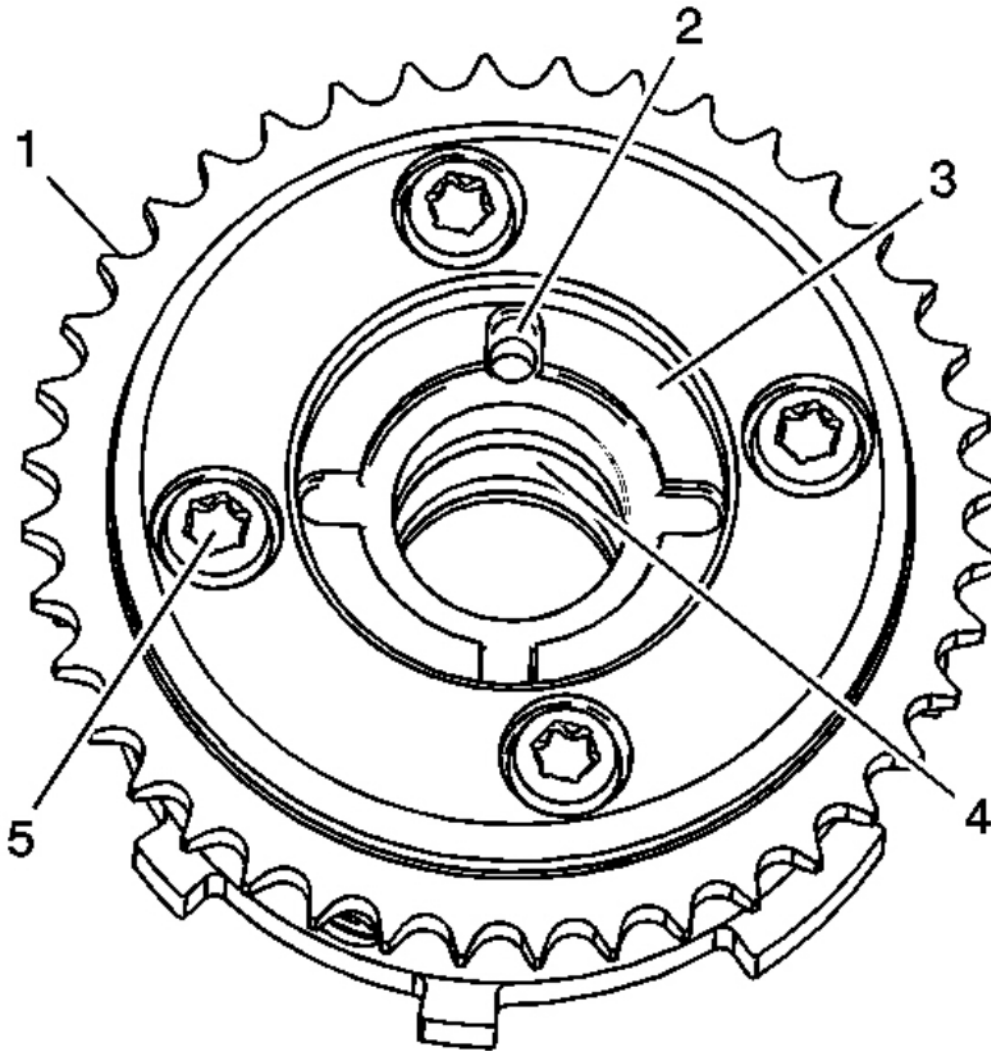


Fig. 125: Inspecting Back Of Intake Camshaft Position Actuator
Courtesy of GENERAL MOTORS CORP.

4. Inspect the back of the intake camshaft position actuators for the following:
 - Sprocket damage (1)
 - Camshaft locating pin hole (2)

- Camshaft seating/sealing inner hub flange damage (3)
 - Blockage to the oil passages (4)
 - Loose or missing housing bolts (5)
5. Replace a damaged camshaft position actuator.

Camshaft Position Actuator Oil Control Valve

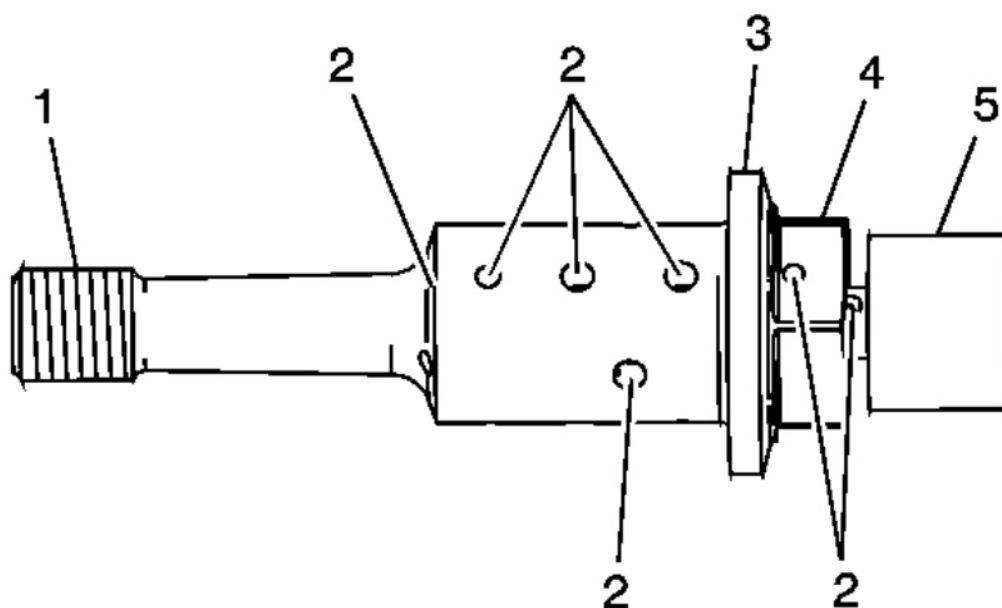


Fig. 126: Inspecting Camshaft Position Actuator Oil Control Valves
Courtesy of GENERAL MOTORS CORP.

1. Inspect the camshaft position actuator oil control valves for the following:
 - Thread damage (1)
 - Blockage to the oil passages (2)
 - Camshaft position actuator oil control valve seating/sealing flange damage (3)
 - Hex damage (4)
 - Spool valve head damage (5)
2. Replace a damaged camshaft position actuator oil control valve.

Intermediate Sprocket

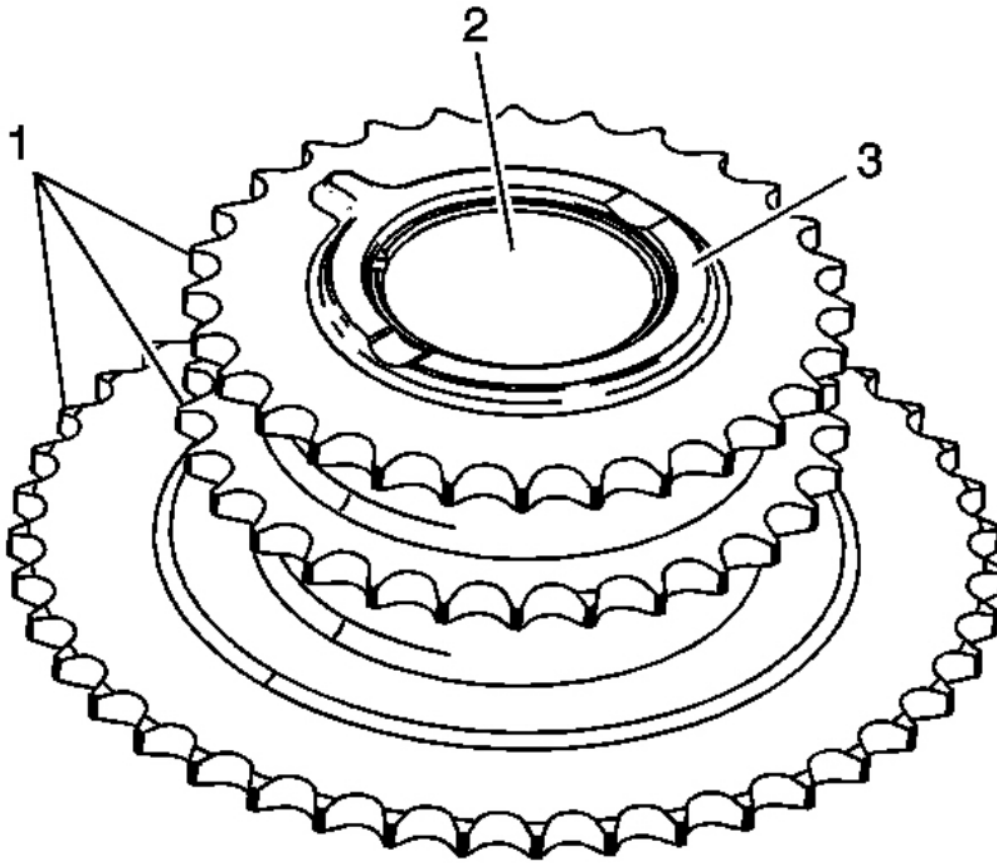


Fig. 127: Inspecting Front Of Intermediate Sprocket
Courtesy of GENERAL MOTORS CORP.

1. Inspect the front of the intermediate sprocket for the following:
 - Sprocket damage (1)
 - Bearing bore damage (2)
 - Thrust surface damage (3)

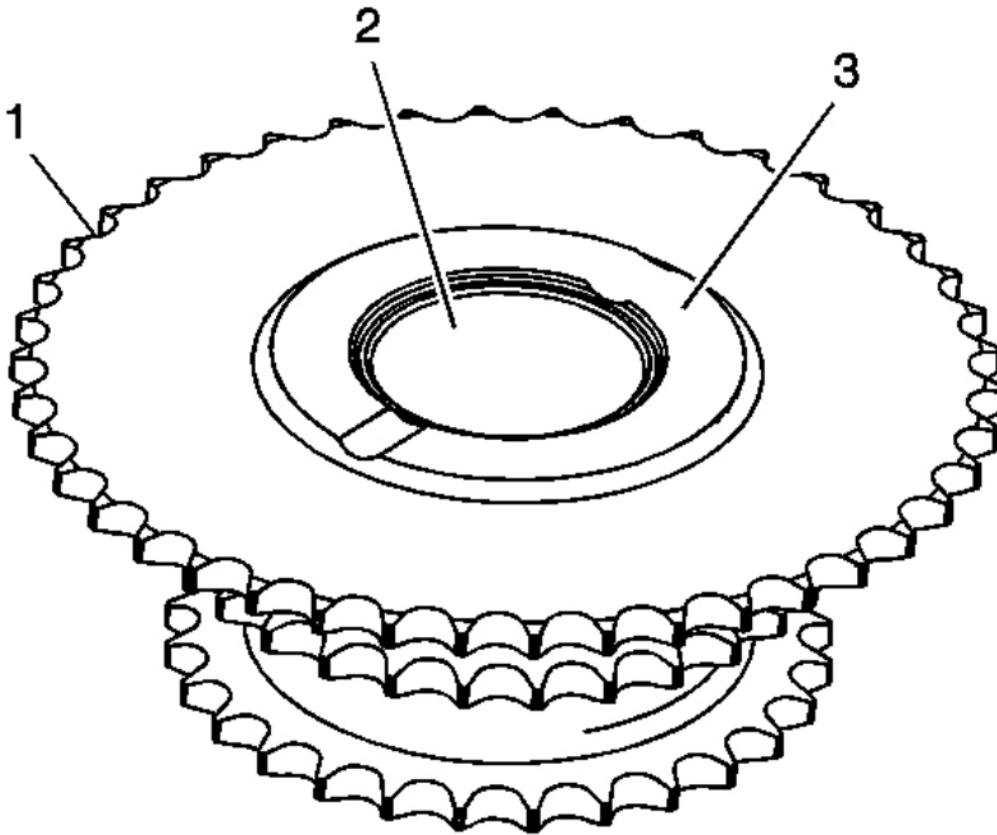


Fig. 128: Inspecting Back Of Intermediate Sprocket
Courtesy of GENERAL MOTORS CORP.

2. Inspect the back of the intermediate sprocket for the following:
 - Sprocket damage (1)
 - Bearing bore damage (2)
 - Thrust surface damage (3)
3. Replace a damaged intermediate sprocket.

Crankshaft Sprocket

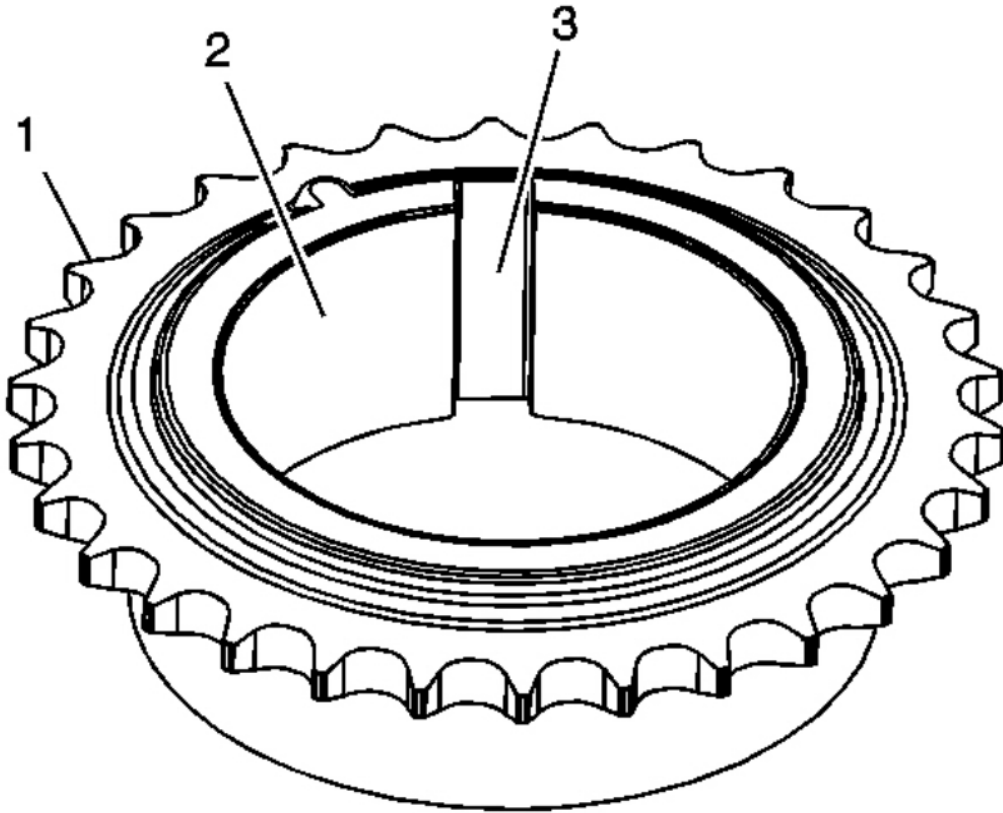


Fig. 129: Inspecting Intermediate Sprocket
Courtesy of GENERAL MOTORS CORP.

1. Inspect the intermediate sprocket for the following:
 - Sprocket damage (1)
 - Bore damage (2)
 - Keyway damage (3)
2. Replace a damaged crankshaft sprocket.

Primary and Secondary Timing Chains

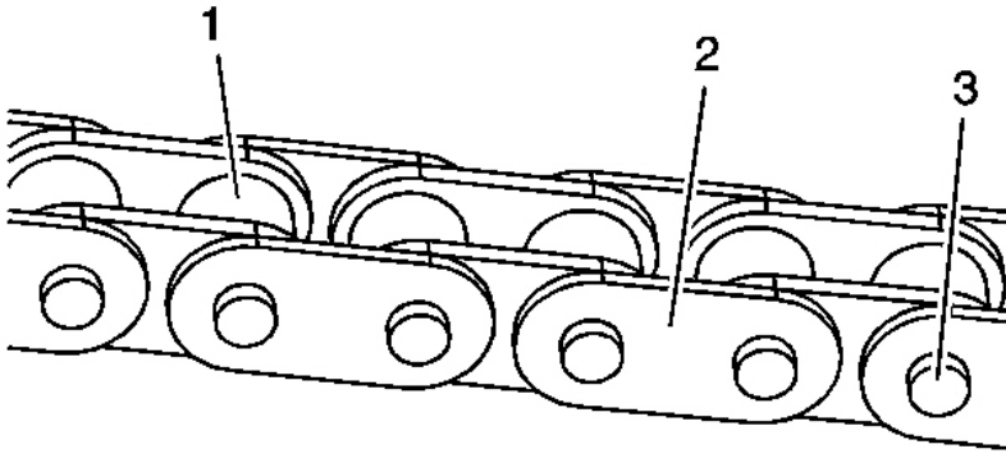


Fig. 130: Inspecting Primary/Secondary Timing Chain
Courtesy of GENERAL MOTORS CORP.

1. Inspect the primary and/or secondary timing chain for the following:
 - Binding or worn rollers (1)
 - Loose links (2)
 - Loose pins (3)
2. Replace a damaged primary and/or secondary timing chains.

Primary Timing Chain Guide

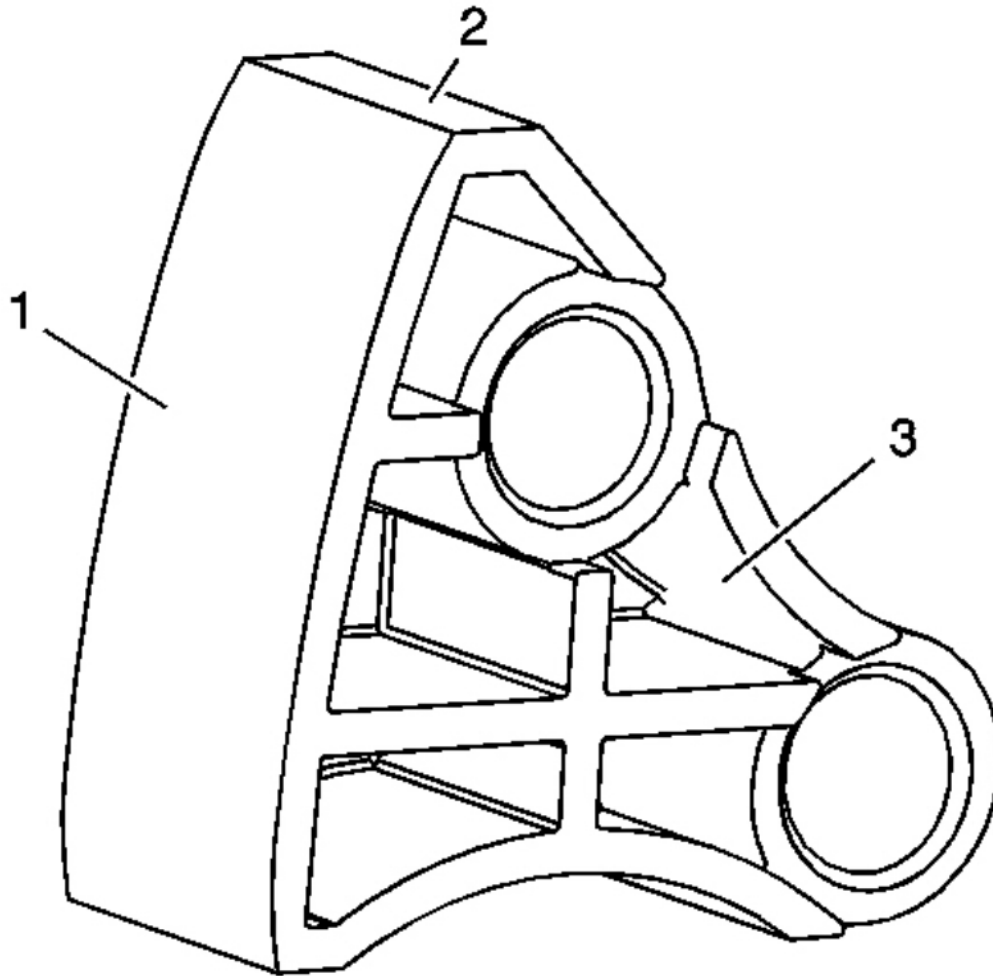


Fig. 131: Inspecting Primary Timing Chain Guide
Courtesy of GENERAL MOTORS CORP.

1. Inspect the primary timing chain guide for the following:
 - Worn guide surface (1)
 - Cracked or broken guide surface (2)
 - Cracked or damaged guide base (3)
2. Replace a damaged primary timing chain guide.

Secondary Timing Chain Guides

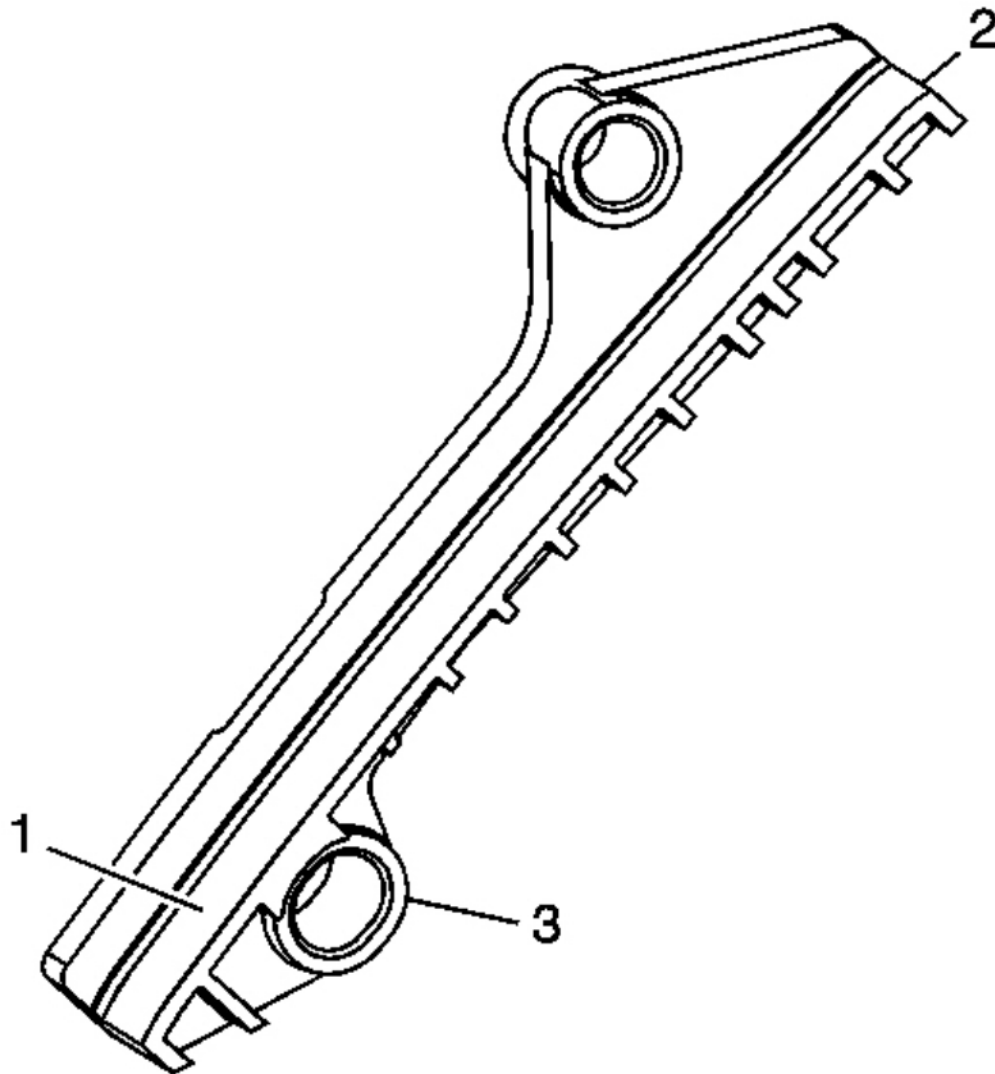


Fig. 132: Inspecting Secondary Timing Chain Guide
Courtesy of GENERAL MOTORS CORP.

1. Inspect the secondary timing chain guides for the following:
 - Worn guide surface (1)

- Cracked or broken guide surface (2)
 - Cracked or damaged guide base (3)
2. Replace a damaged secondary timing chain guide.

Secondary Timing Chain Shoes

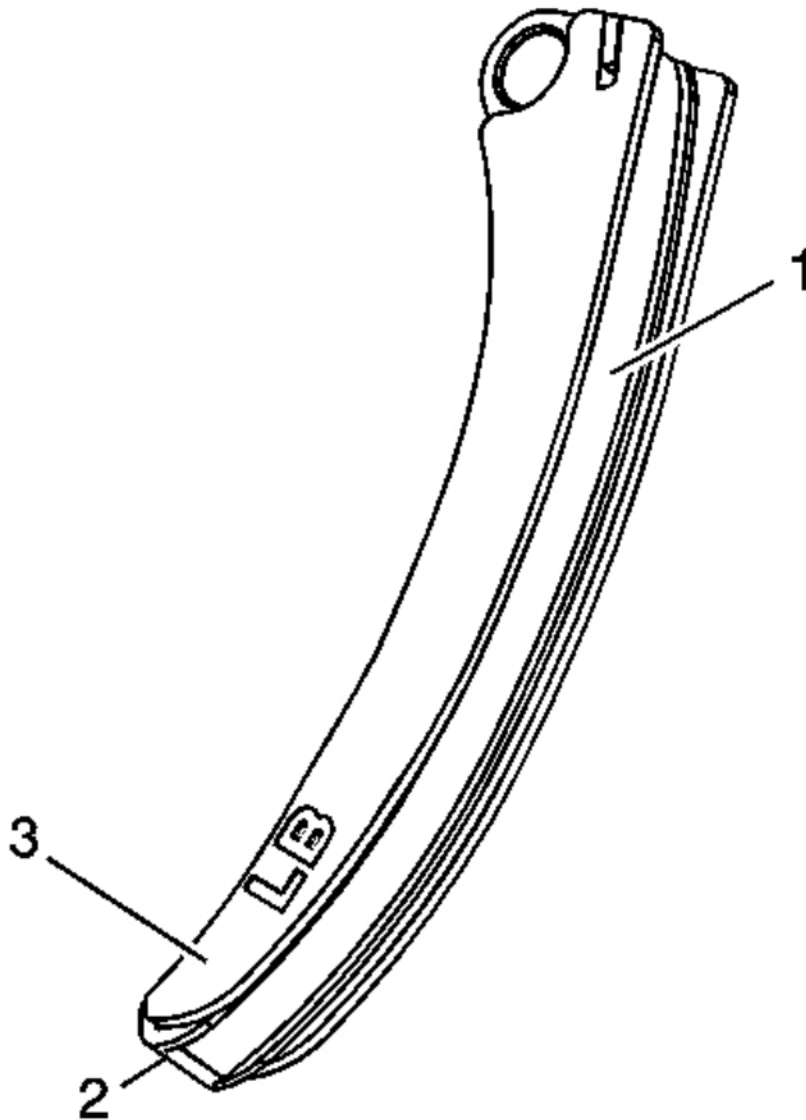


Fig. 133: Inspecting Secondary Timing Chain Shoes
Courtesy of GENERAL MOTORS CORP.

1. Inspect the secondary timing chain shoes for the following:
 - Worn shoe surface (1)
 - Cracked or broken shoe surface (2)
 - Cracked or damaged shoe (3)
2. Replace a damaged secondary timing chain shoe.

Primary Timing Chain Tensioner

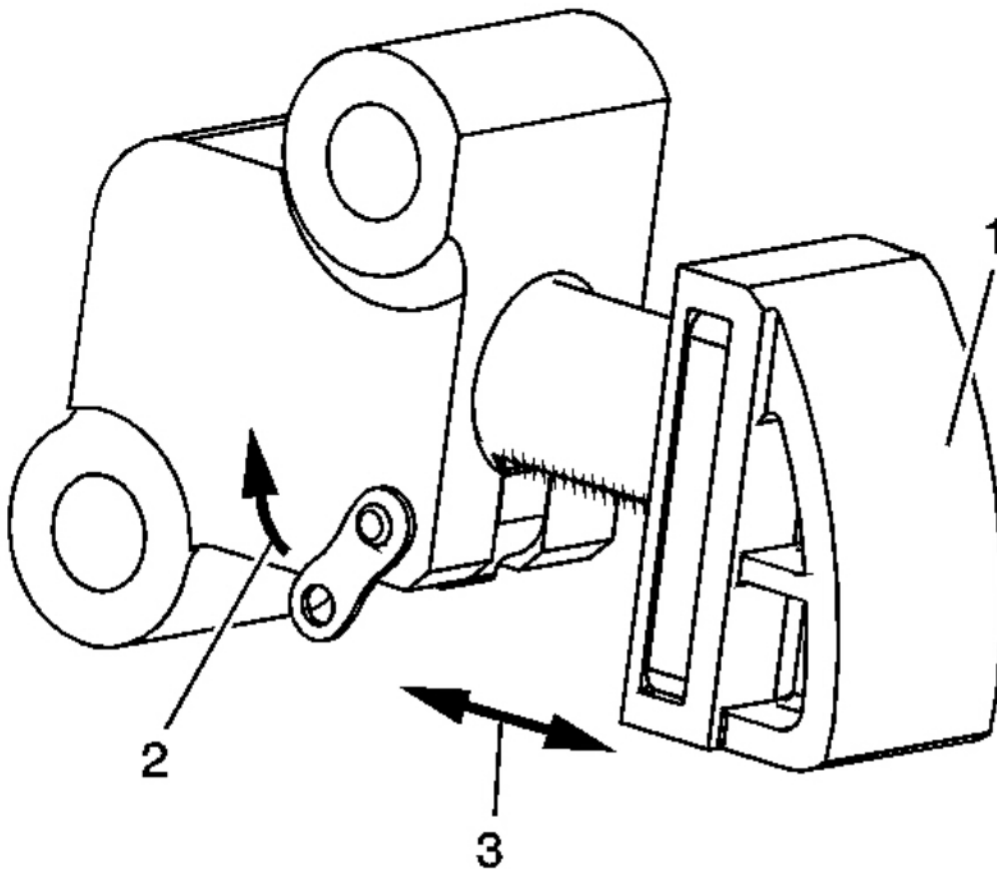


Fig. 134: Inspecting Primary Timing Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Inspect the primary timing chain tensioner for worn primary timing chain tensioner shoe surface (1).
2. Inspect the primary timing chain tensioner for locked or binding timing chain tensioner. Release the locking lever (2) and ensure the plunger moves freely (3) in and out of the body of the tensioner.
3. Replace a damaged primary timing chain tensioner.

Secondary Timing Chain Tensioners

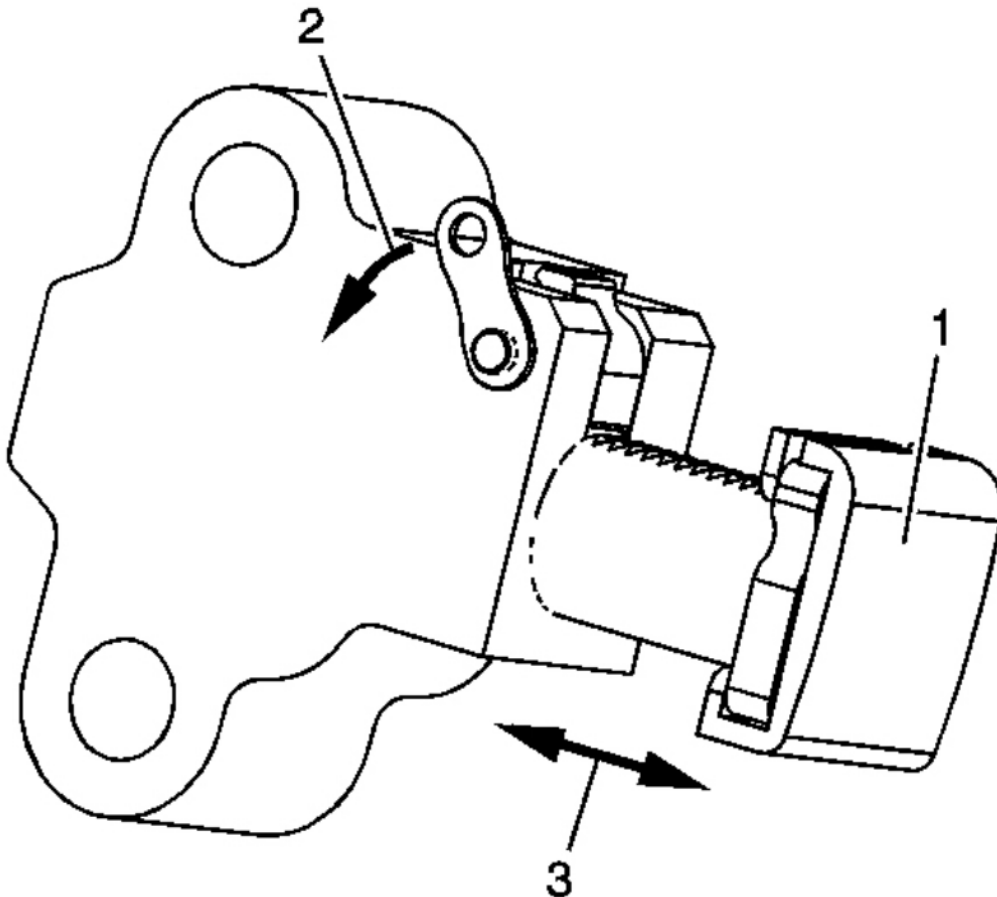


Fig. 135: Inspecting Secondary Timing Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Inspect the secondary timing chain tensioner for damaged plunger-to-shoe contact surface (1).
2. Inspect the secondary timing chain tensioner for locked or binding timing chain tensioner. Release the locking lever (2) and ensure the plunger moves freely (3) in and out of the body of the tensioner.
3. Replace a damaged primary and/or secondary timing chain tensioner.

Timing Component Fasteners

1. Inspect the timing component fasteners.
2. Replace any damaged timing component fasteners, do not repair.

Mechanical Inspection

Camshaft Position Actuators

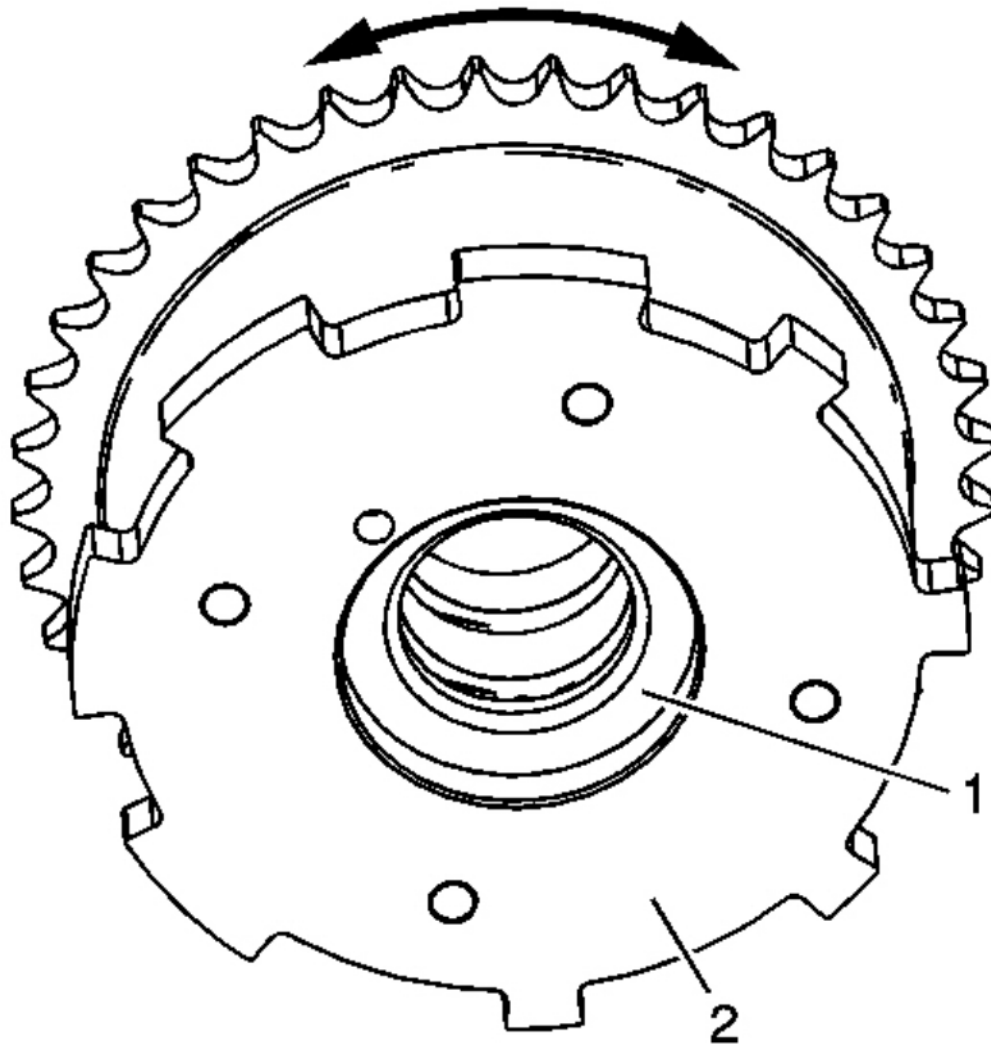


Fig. 136: Locating Intake Camshaft Position Actuator Inner Rotor Hub & Outer Housing

Courtesy of GENERAL MOTORS CORP.

CAUTION: When removing, handling or installing this component wear protective gloves. The sharp edges on the component may be very sharp and may cause injury.

NOTE: **DO NOT clamp the component in any clamping device such as a vise or gripping tool. Clamping the component can cause external and internal damage that can affect engine and/or component performance.**

1. Inspect the intake camshaft position actuator to ensure the internal lock pin is engaged and the camshaft position actuator is parked in the home position. Attempt to rotate the inner rotor hub (1) within the outer housing (2).

If the intake camshaft position actuator can be turned in either direction the camshaft position actuator must be replaced.

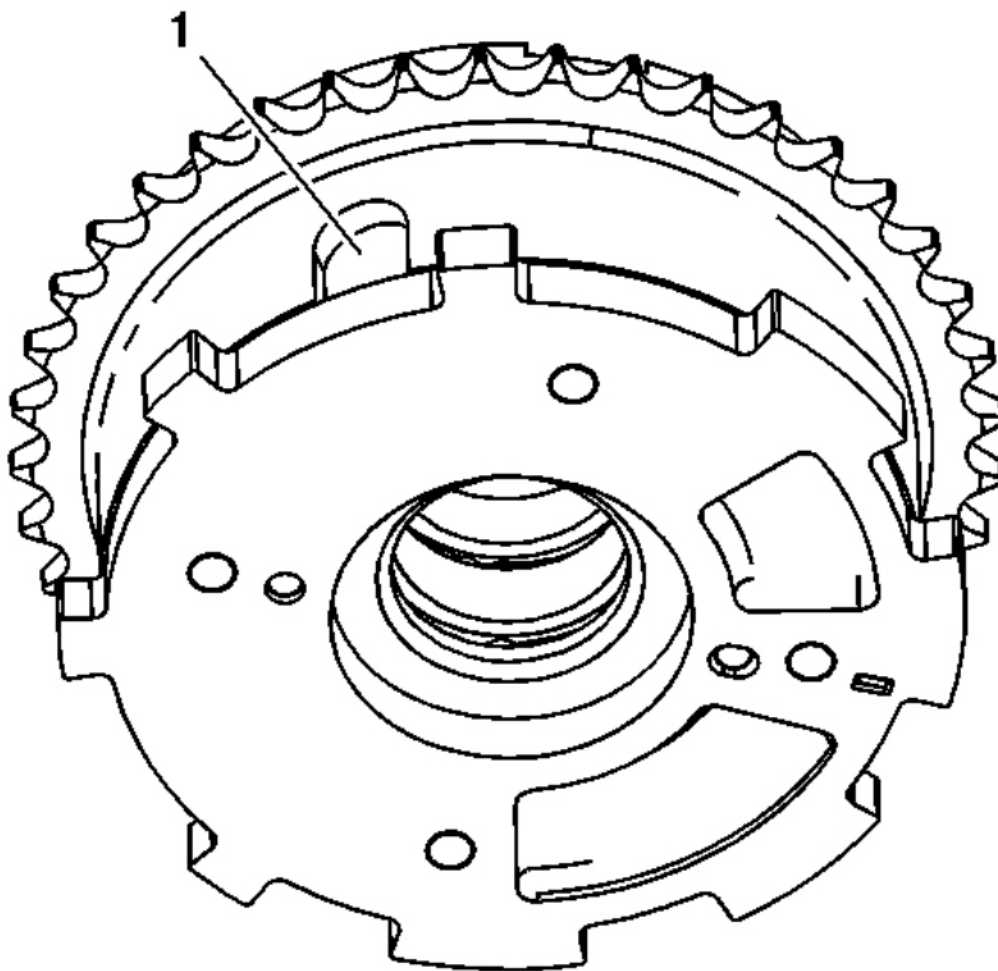


Fig. 137: Locating Intake Camshaft Position Actuator External Housing Locking Pin Cover

Courtesy of GENERAL MOTORS CORP.

2. Locate the internal hub oil passage for the locking pin by observing the external housing locking pin cover (1). The oil passage in the hub for the locking pin is inline with the location of the locking pin cover.

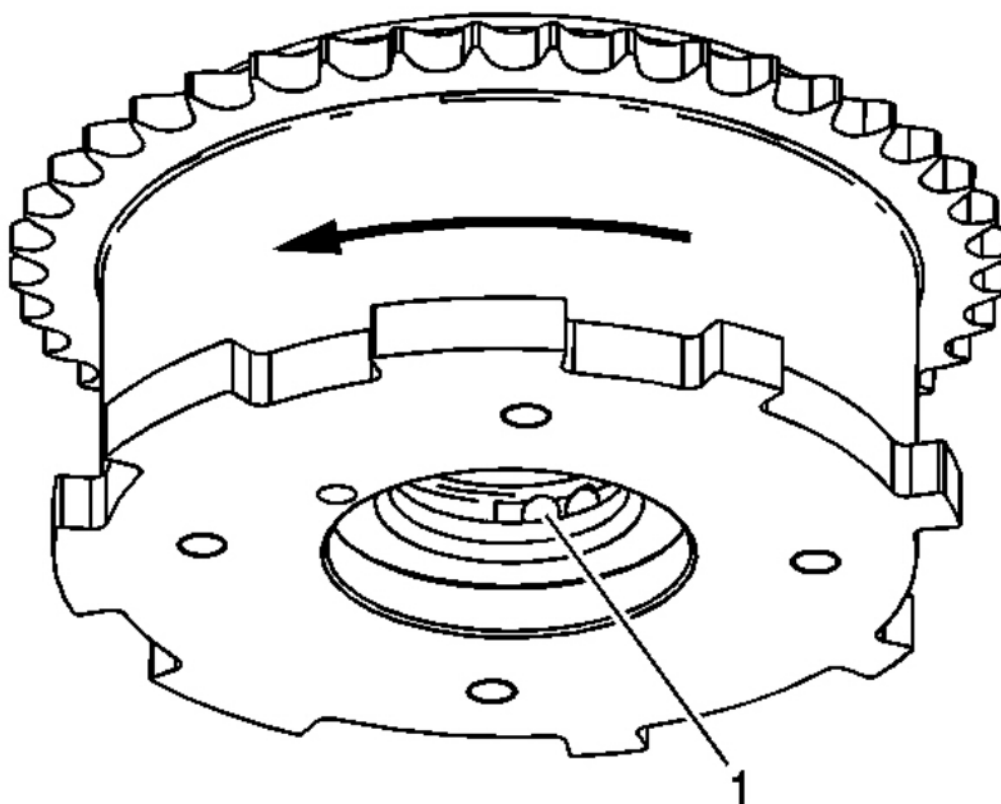


Fig. 138: Locating Intake Camshaft Position Actuator Internal Lock Pin
Courtesy of GENERAL MOTORS CORP.

3. Inspect the intake camshaft position actuator for smooth and even movement. Using a pre-bent hex key, smaller than the oil passage, depress the internal lock pin through the oil passage (1) located within the hub of the camshaft position actuator. While viewing the intake camshaft position actuator from the front and with the lock pin depressed, the outer housing should be manually moved in the clockwise direction from the inner rotor hub.

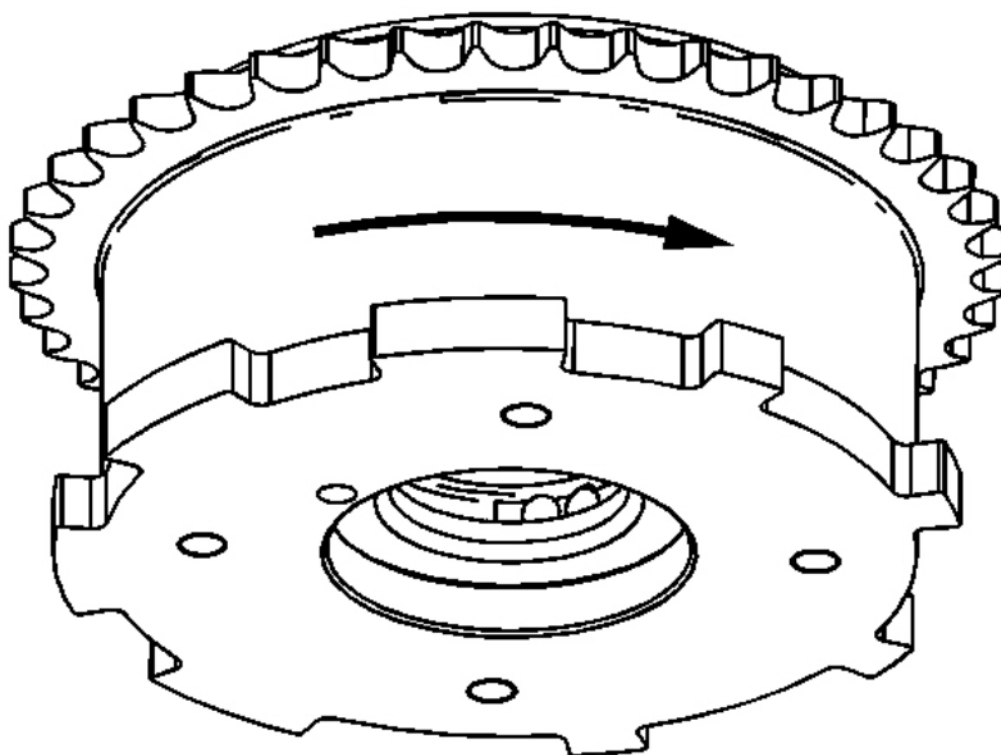


Fig. 139: Rotating Intake Camshaft Position Actuator Outer Housing Clockwise
Courtesy of GENERAL MOTORS CORP.

4. Remove the hex key from the oil passage and manually return the outer housing clockwise back to the home position. Ensure the lock pin engages when the outer housing returns to the home position.
5. If the intake camshaft position actuator does not move, the movement is not smooth and even, or the lock pin does not engage in the home position replace the intake camshaft position actuator.

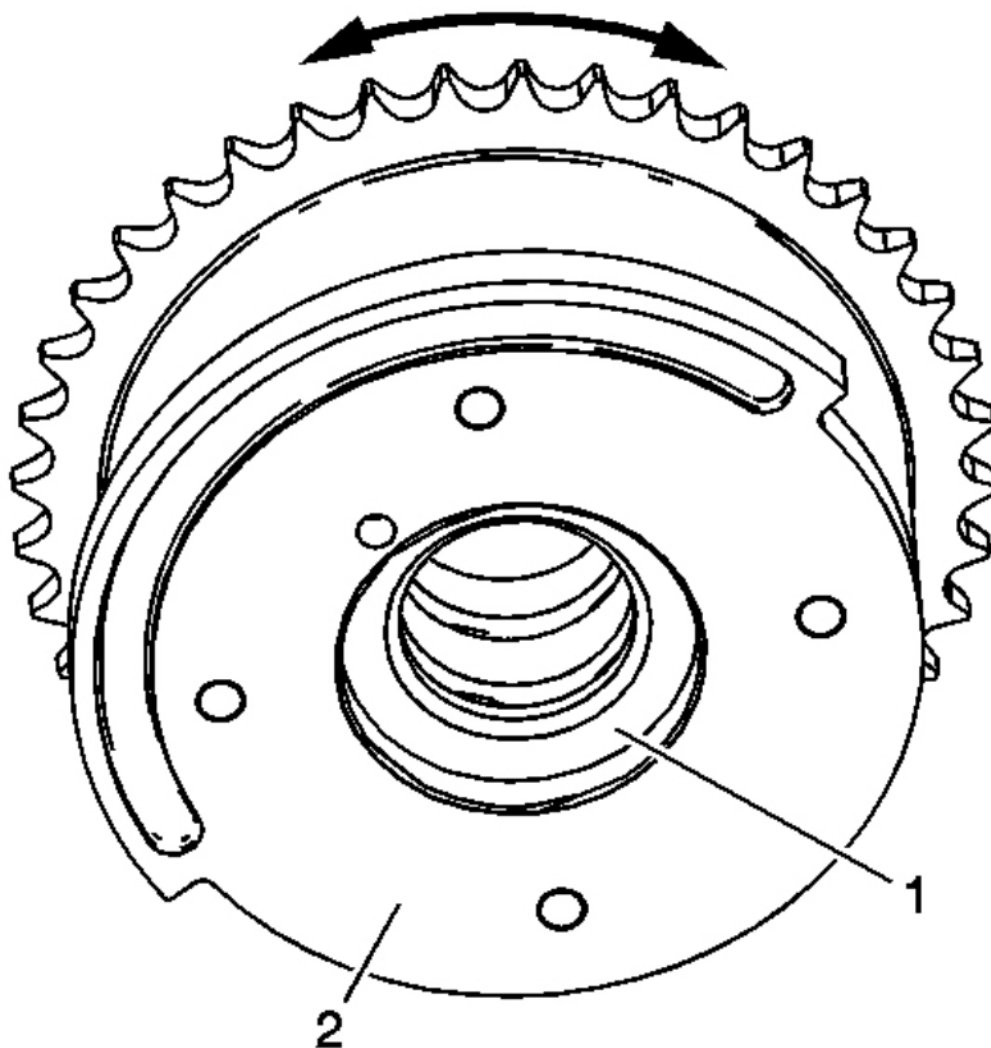


Fig. 140: Locating Exhaust Camshaft Position Actuator Inner Rotor Hub & Outer Housing

Courtesy of GENERAL MOTORS CORP.

6. Inspect the exhaust camshaft position actuator to ensure the internal lock pin is engaged and the camshaft position actuator is parked in the home position. Attempt to rotate the inner rotor hub (1) within the outer housing (2).

If the exhaust camshaft position actuator can be turned in either direction the camshaft

position actuator must be replaced.

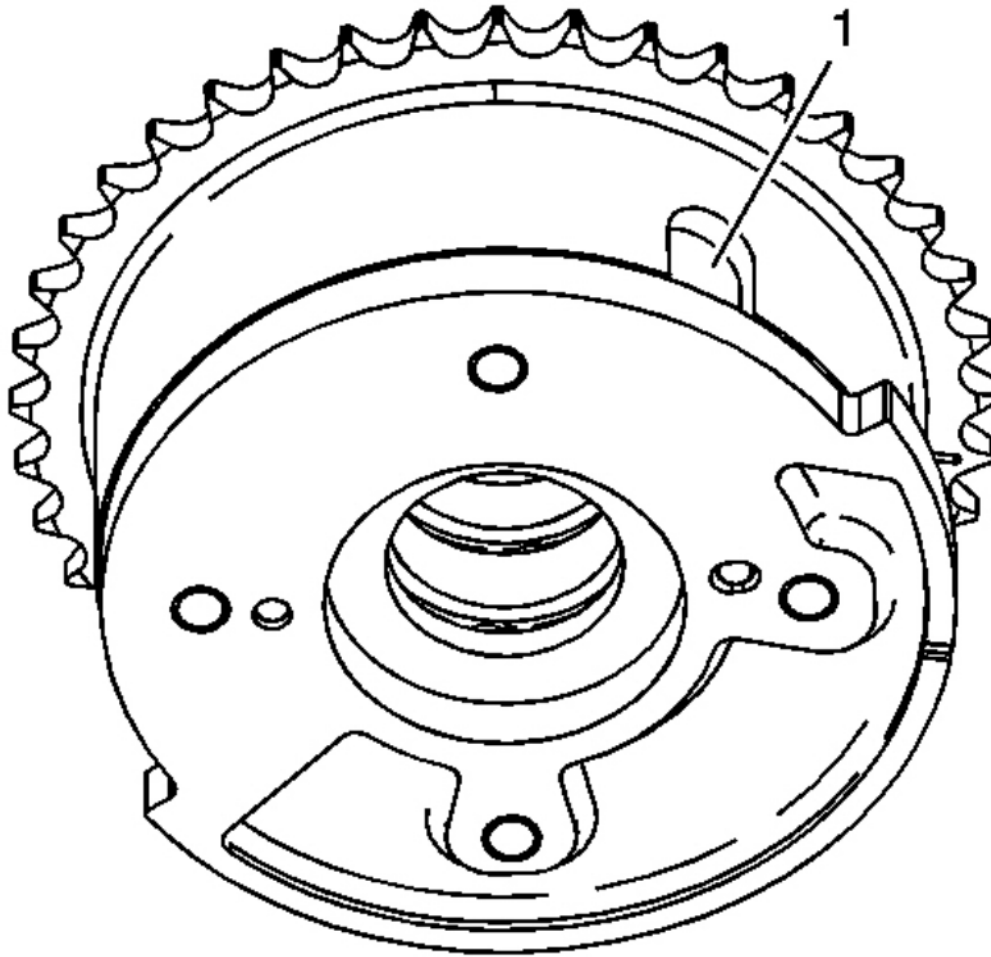


Fig. 141: Locating Exhaust Camshaft Position Actuator External Housing Locking Pin Cover

Courtesy of GENERAL MOTORS CORP.

7. Locate the internal hub oil passage for the locking pin by observing the external housing locking pin cover (1). The oil passage in the hub for the locking pin is inline with the location of the locking pin cover.

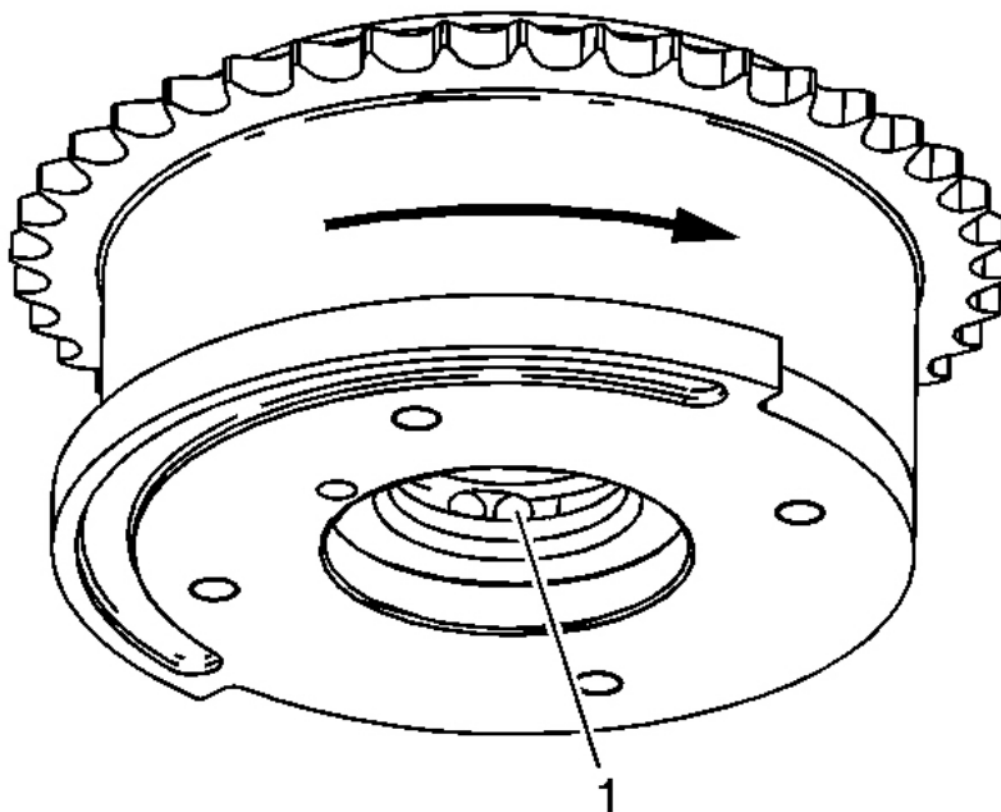


Fig. 142: Locating Exhaust Camshaft Position Actuator Internal Lock Pin
Courtesy of GENERAL MOTORS CORP.

8. Inspect the exhaust camshaft position actuators for smooth and even movement. The exhaust camshaft position actuator has return springs and the inspection will require additional assistance to perform. Using a pre-bent hex key, smaller than the oil passage, depress the internal lock pin through the oil passage (1) located within the hub of the camshaft position actuator. While viewing the exhaust camshaft position actuator from the front and with the lock pin depressed, the outer housing should be manually moved in the clockwise direction from the inner rotor hub.

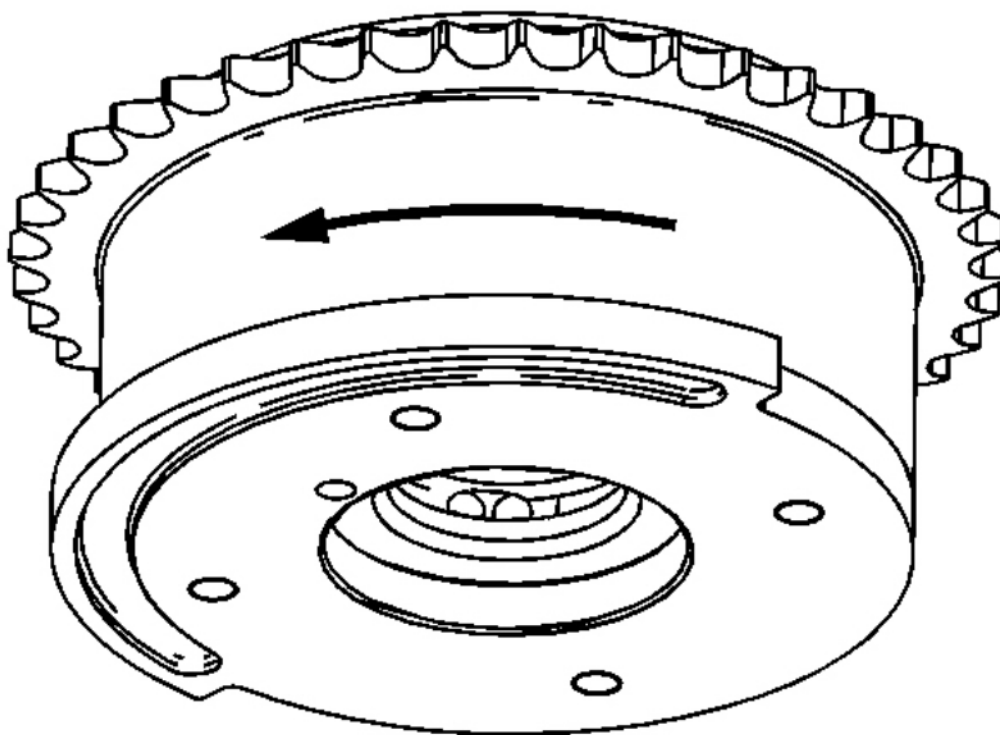


Fig. 143: Rotating Exhaust Camshaft Position Actuator Outer Housing Clockwise
Courtesy of GENERAL MOTORS CORP.

9. Remove the hex key from the oil passage and allow the outer housing to move counter clockwise back to the home position. Ensure the return springs bring the outer housing back to the home position and the lock pin engages.
10. If the exhaust camshaft position actuator does not move, the movement is not smooth and even, the return springs do not return the outer housing to the home position, or the lock pin does not engage in the home position replace the exhaust camshaft position actuator.

Camshaft Position Actuator Oil Control Valve

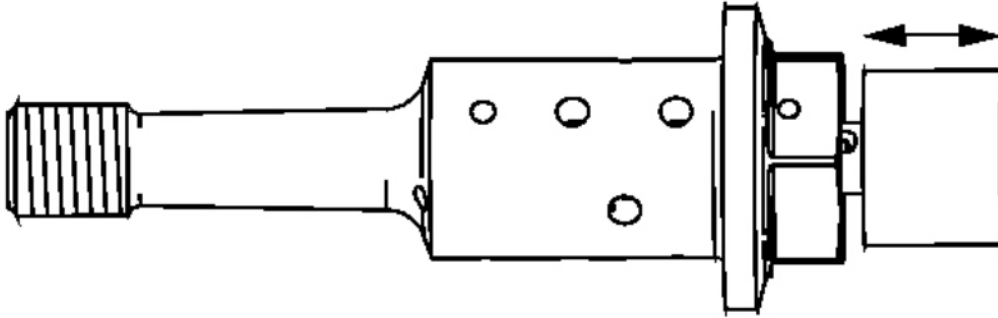


Fig. 144: Inspecting Camshaft Position Actuator Oil Control Valve For Smooth Spool Valve Movement

Courtesy of GENERAL MOTORS CORP.

NOTE: **DO NOT** clamp the component in any clamping device such as a vise or gripping tool. Clamping the component can cause external and internal damage that can affect engine and/or component performance.

1. Inspect the camshaft position actuator oil control valves for smooth and even movement of the spool valve within the camshaft position actuator oil control valve body.

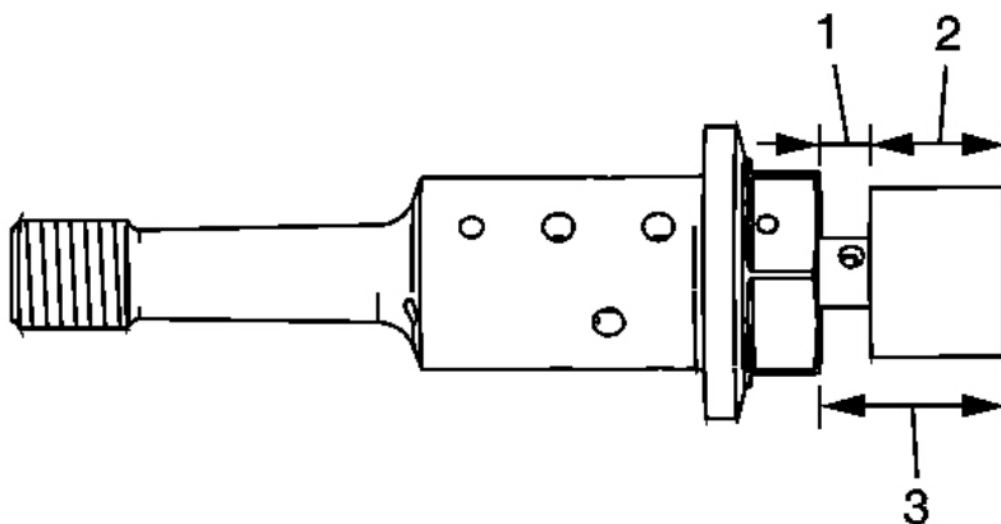


Fig. 145: Inspecting Camshaft Position Actuator Oil Control Valve For Proper Spool Valve Movement

Courtesy of GENERAL MOTORS CORP.

2. Inspect the camshaft position actuator oil control valves for proper movement of the spool valve. The valve should move a distance (2) of 4.35 mm (0.1713 in). Measure from the underside of the spool valve head. The home position is 2.25 mm (0.0886 in) above (1) the hex and the fully extended position measures 6.60 mm (0.2598 in) above (3) the hex.

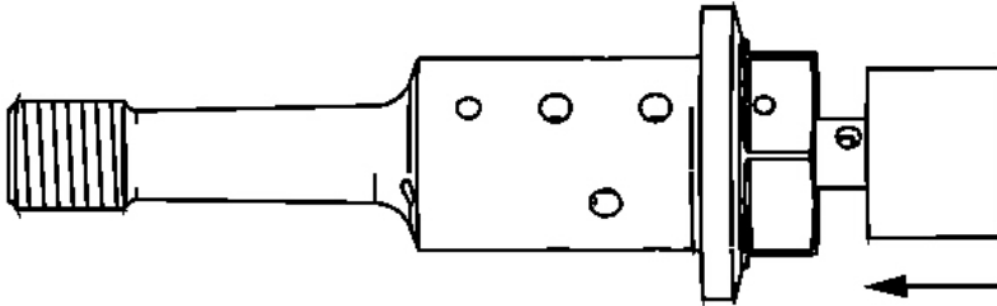


Fig. 146: Inspecting Camshaft Position Actuator Oil Control Valve For Proper Spool Valve Return

Courtesy of GENERAL MOTORS CORP.

3. Inspect the camshaft position actuator oil control valves for proper return of the spool valve to the home position by the internal spring.

CAMSHAFT POSITION (CMP) ACTUATOR HOUSING DISASSEMBLE

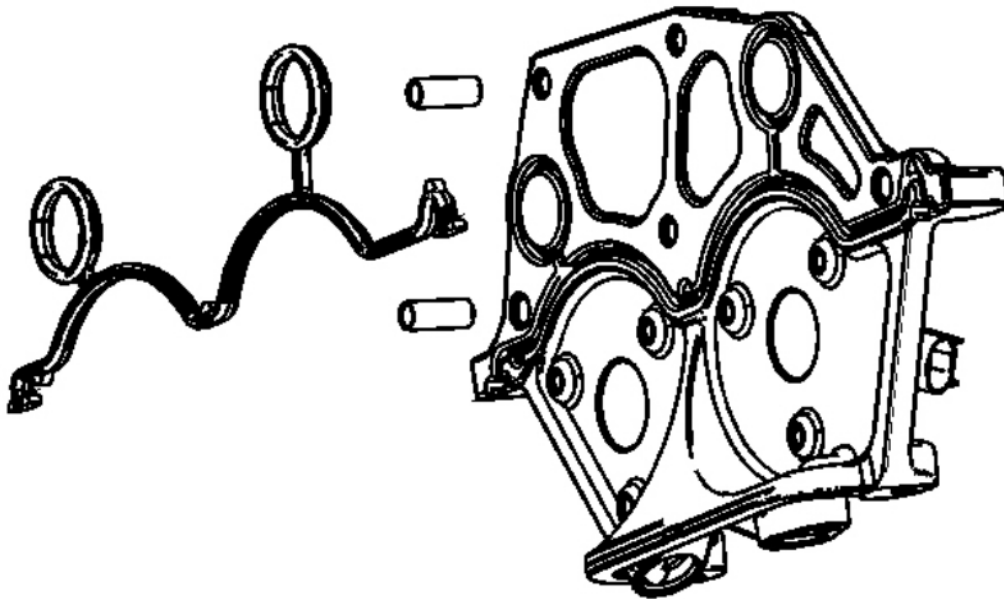


Fig. 147: View Of Camshaft Position Actuator Housing Gasket & Alignment Pins
Courtesy of GENERAL MOTORS CORP.

1. Remove the camshaft position actuator housing gasket and discard.
2. Remove the camshaft position actuator housing alignment pins.

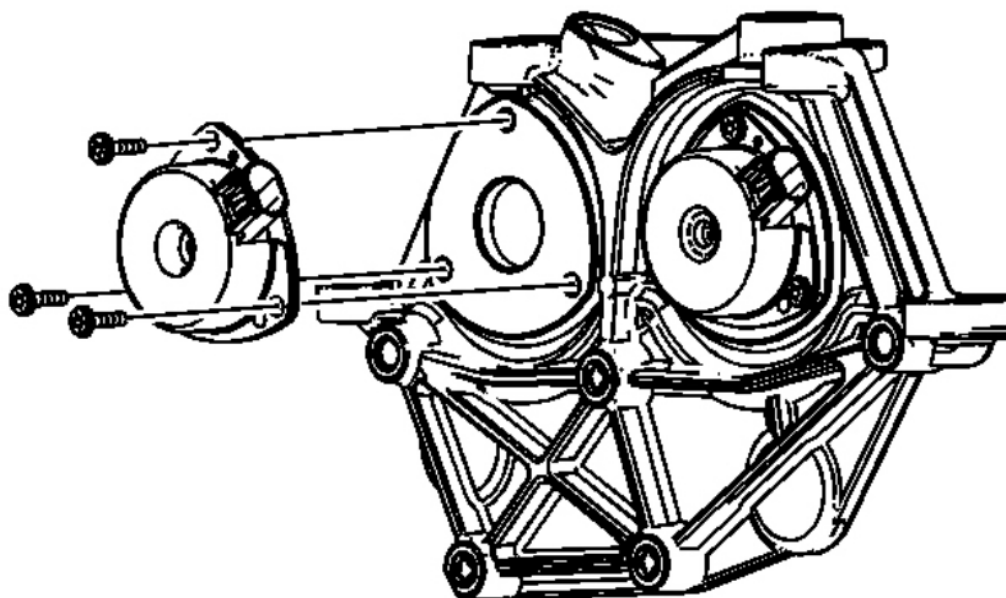


Fig. 148: View Of Camshaft Position Actuator Magnet & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT remove the camshaft position actuator magnet unless it needs to be replaced. The camshaft position actuator magnet is precisely aligned to the camshaft position actuator oil control valve on the end of the camshaft during engine assembly. If the camshaft position actuator magnet is removed and/or needs to be replaced, it will be necessary to realign the camshaft position actuator magnet to the camshaft position actuator oil control valve after the camshaft position actuator housing is installed to the cylinder head. Failure to realign the camshaft position actuator magnet to the camshaft position actuator oil control valve can lead to poor engine performance and engine component damage.

3. If required, remove the camshaft position actuator magnet bolts.
4. If required, remove the camshaft position actuator magnet.
5. Remove the camshaft position actuator magnet alignment plug and discard.

CAMSHAFT POSITION (CMP) ACTUATOR HOUSING CLEANING AND INSPECTION**Cleaning Procedure**

1. Clean the camshaft position actuator housing components, except the camshaft position actuator magnets, with solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Dry the camshaft position actuator housing components with compressed air.

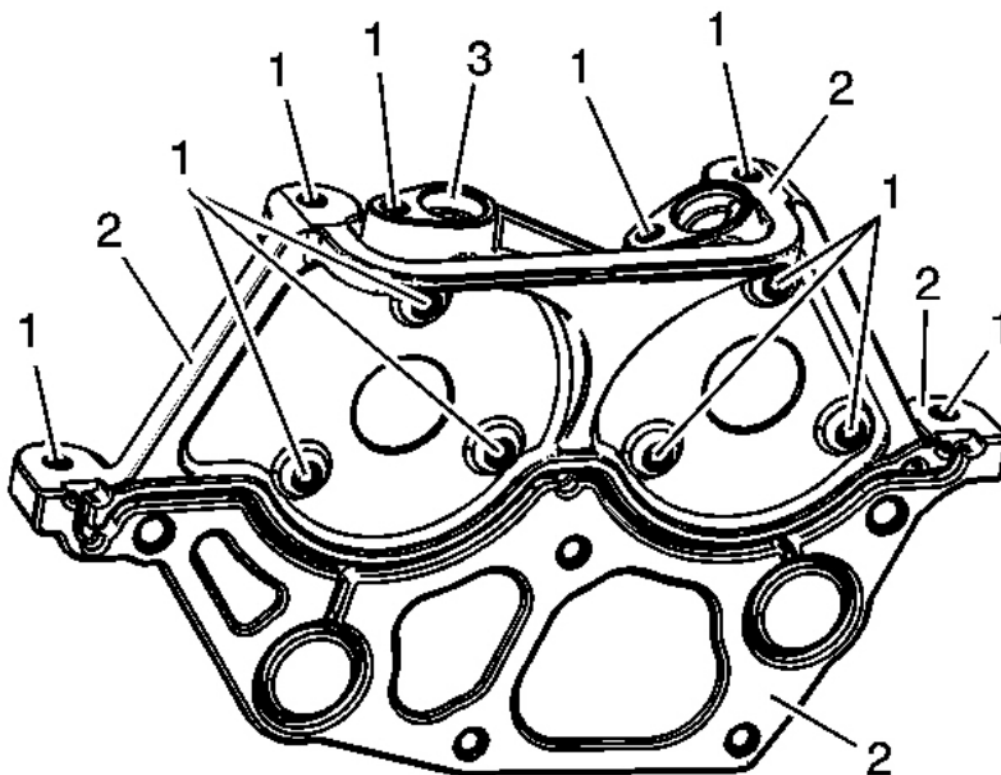
Inspection Procedure

Fig. 149: Inspecting Camshaft Position Actuator Housing
Courtesy of GENERAL MOTORS CORP.

1. Inspect the camshaft position actuator housing for the following conditions:
 - The camshaft position actuator housing for damaged threads (1)
 - The camshaft position actuator housing sealing surface (2) for damage
 - The camshaft position sensor mounting bores (3) for damage

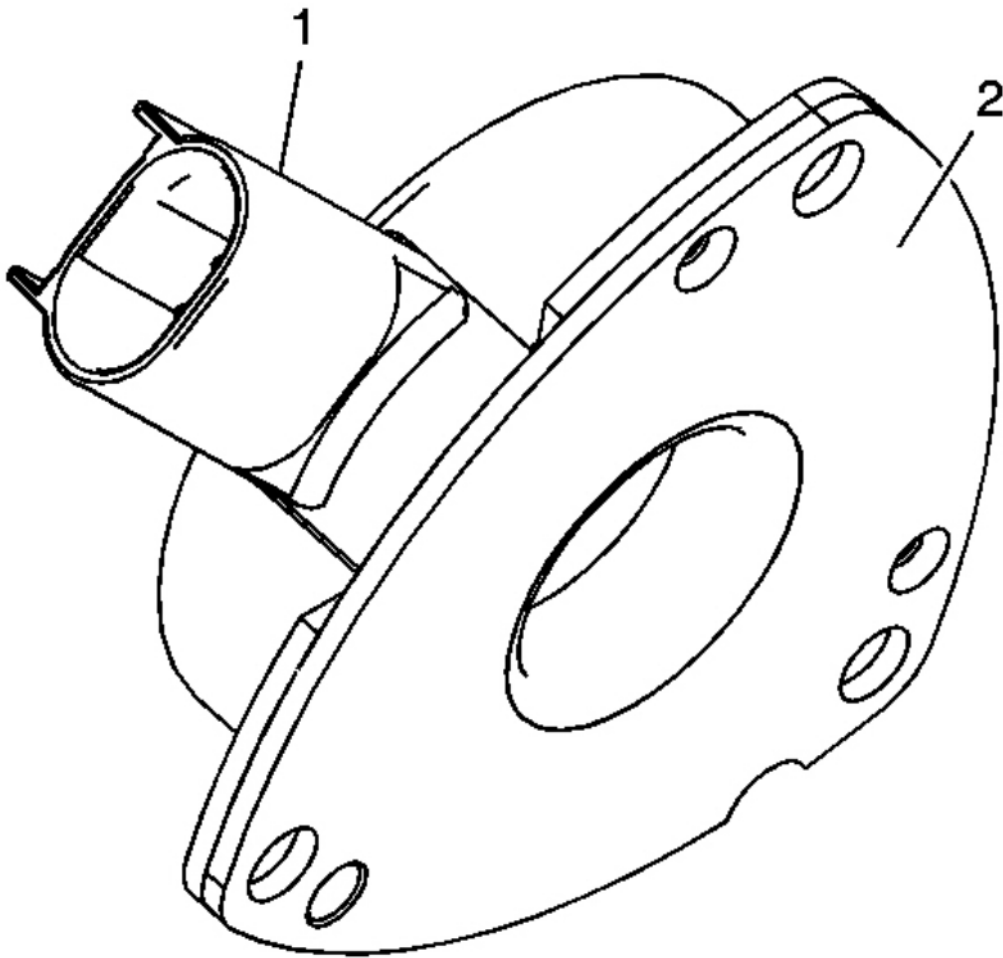


Fig. 150: Inspecting Camshaft Position Actuator Magnets
Courtesy of GENERAL MOTORS CORP.

2. Inspect the camshaft position actuator magnets for the following conditions:
 - The camshaft position actuator magnet wiring connector (1) for damage

- The camshaft position actuator magnet sealing surface (2) for damage
3. Repair or replace the camshaft position actuator housing and/or components as necessary.

CAMSHAFT POSITION (CMP) ACTUATOR HOUSING ASSEMBLE

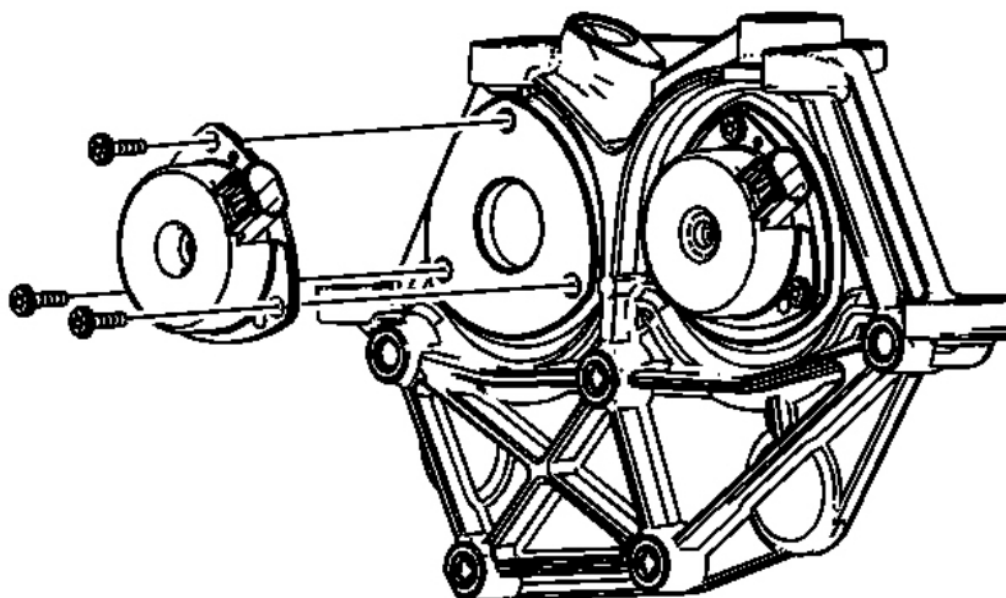


Fig. 151: View Of Camshaft Position Actuator Magnet & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT remove the camshaft position actuator magnet unless it needs to be replaced. The camshaft position actuator magnet is precisely aligned to the camshaft position actuator oil control valve on the end of the camshaft during engine assembly. If the camshaft position actuator magnet is removed and/or needs to be replaced, it will be necessary to realign the camshaft position actuator magnet to the camshaft position actuator oil control valve after the camshaft position actuator housing is installed to the cylinder head. Failure to realign the camshaft position actuator magnet to the camshaft position actuator oil control valve can lead to poor engine performance

and engine component damage.

1. If removed, loosely mount the camshaft position actuator magnet and bolts.
2. In order to allow for camshaft position actuator magnet to camshaft position actuator oil control valve alignment, DO NOT install the NEW camshaft position actuator magnet alignment plugs.

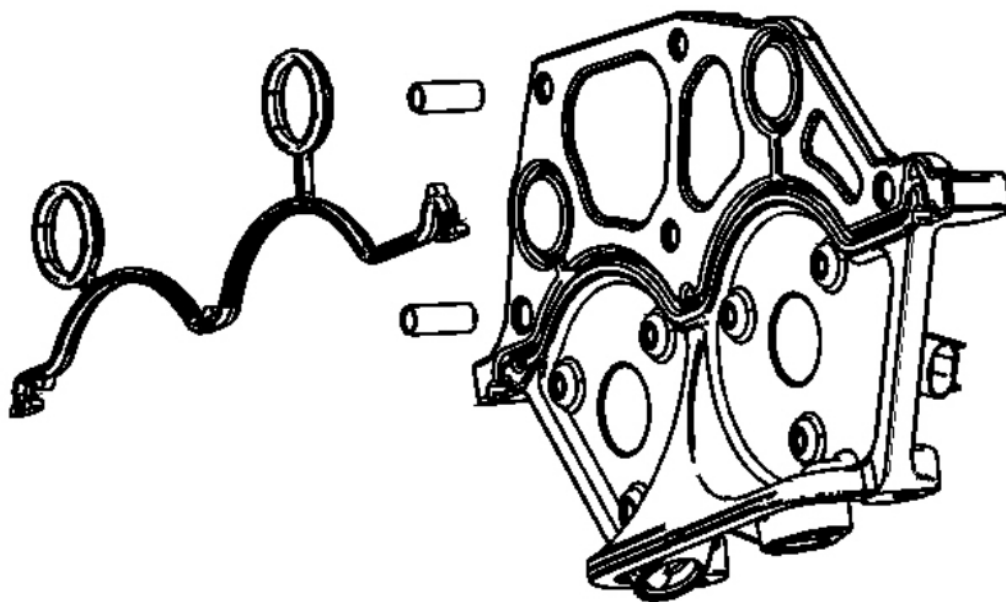


Fig. 152: View Of Camshaft Position Actuator Housing Gasket & Alignment Pins
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The camshaft position actuator housing alignment pins must be installed in order to precisely align the camshaft position actuator housing to the cylinder head.

3. Install the camshaft position actuator housing alignment pins.
4. Install the NEW camshaft position actuator housing gasket.

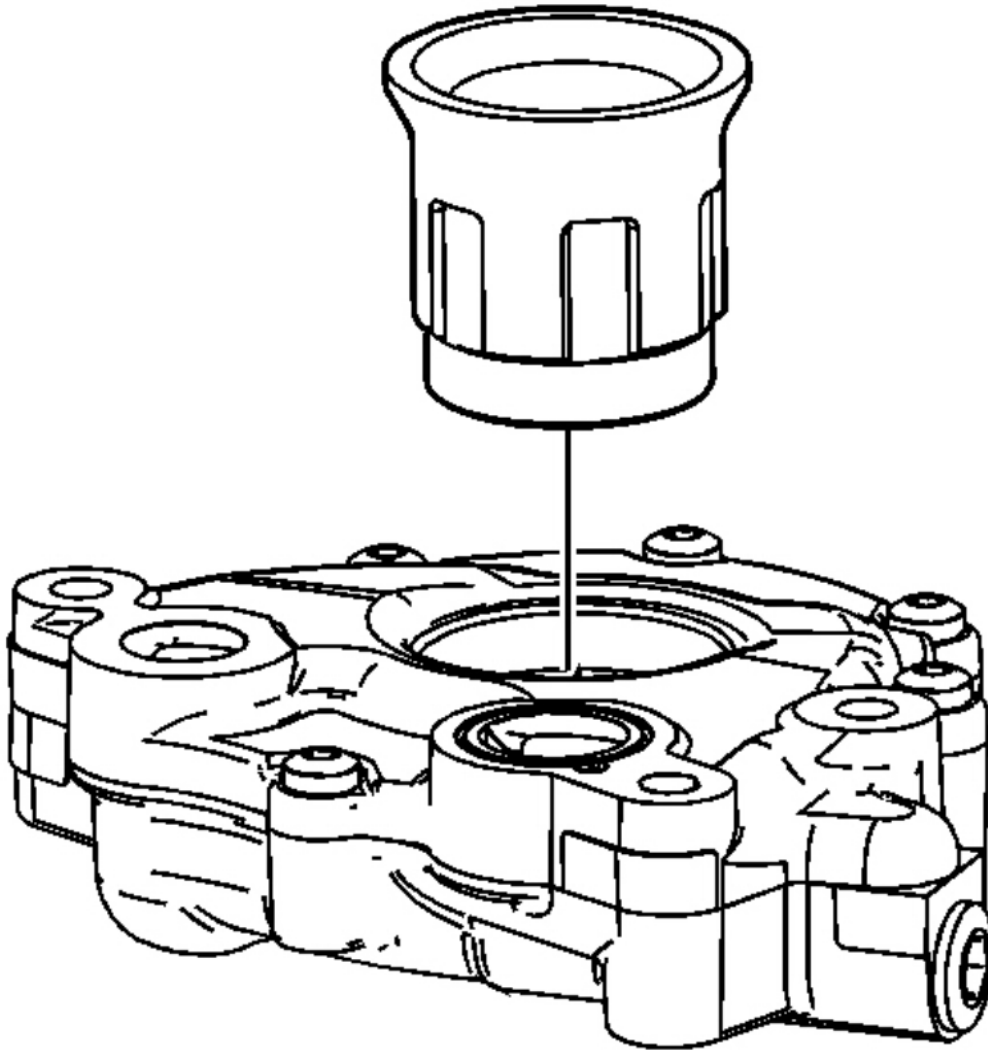


Fig. 153: View Of Oil Pump Drive Spacer
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil pump drive spacer.

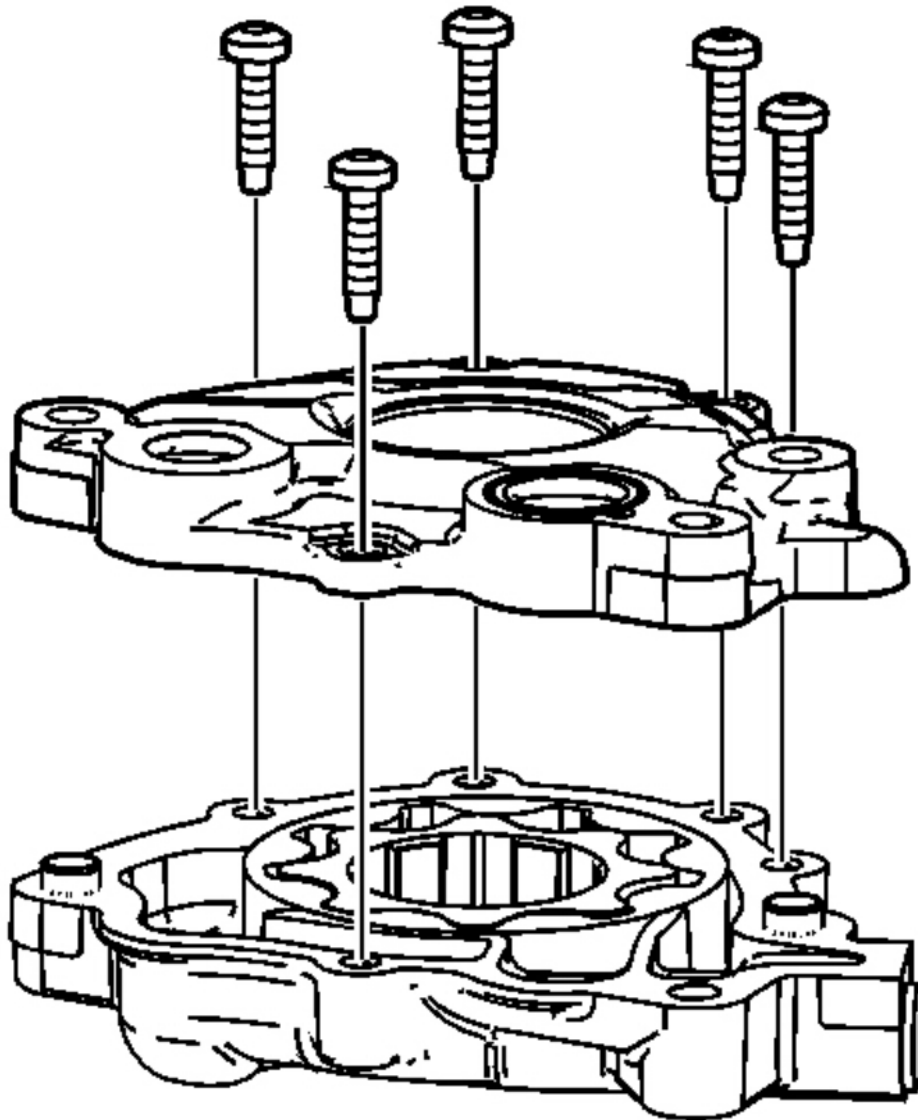


Fig. 154: View Of Oil Pump Body Cover
Courtesy of GENERAL MOTORS CORP.

2. Remove the oil pump body bolts.
3. Remove the oil pump body cover.

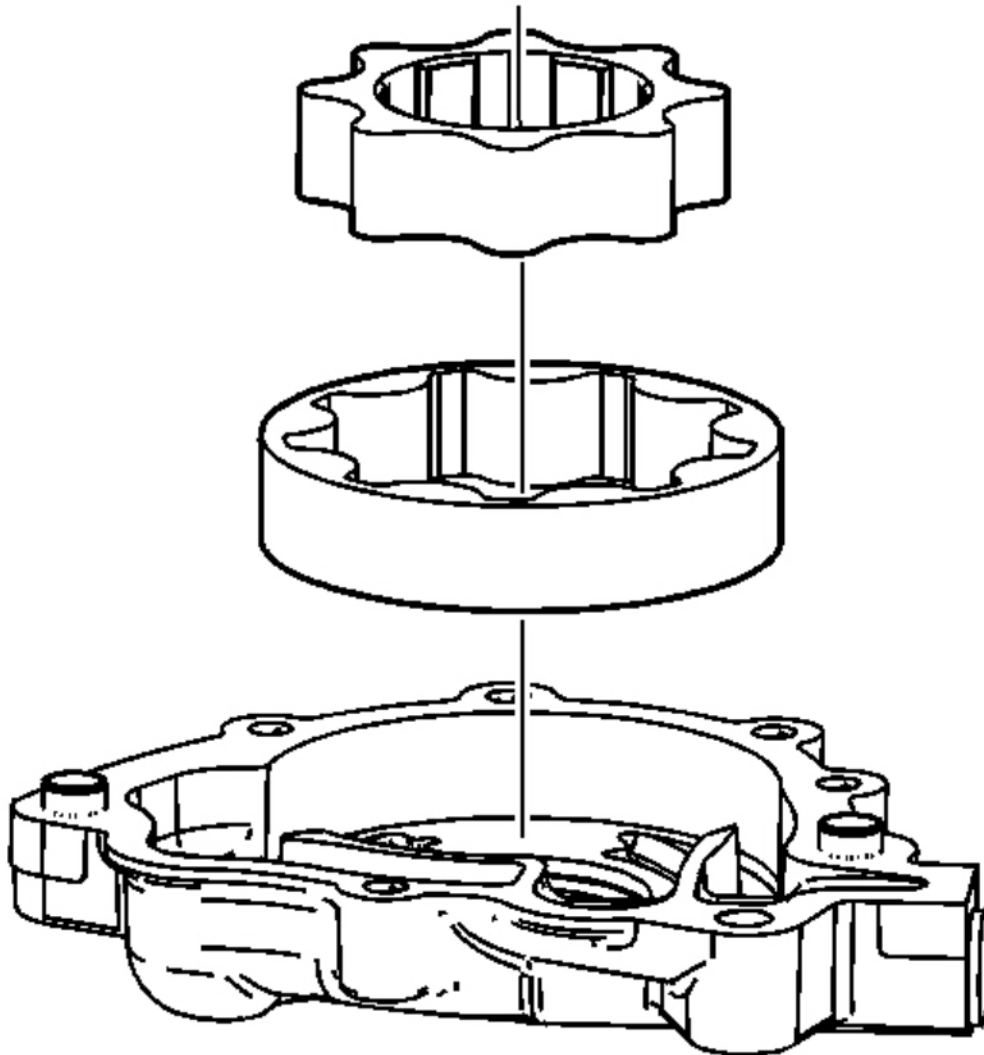


Fig. 155: View Of Oil Pump Drive & Driven Gears
Courtesy of GENERAL MOTORS CORP.

4. Remove the oil pump drive and driven gears.

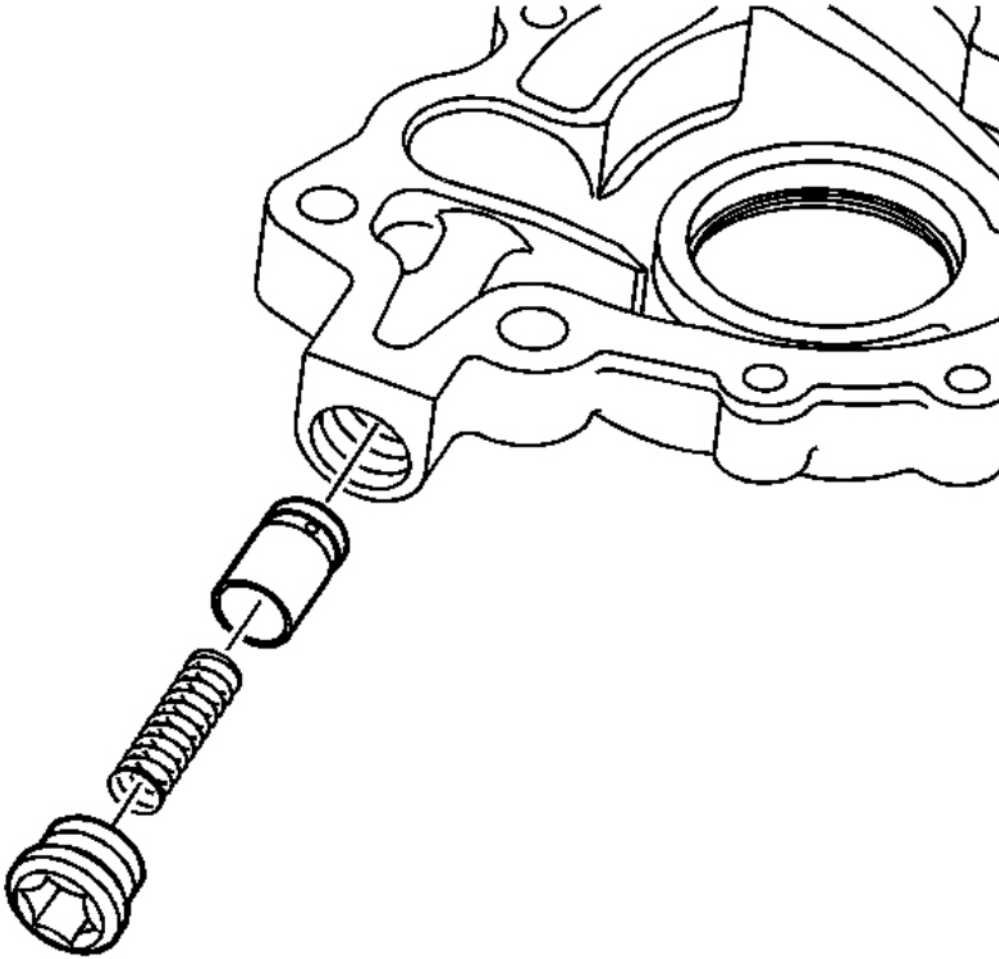


Fig. 156: View Of Oil Pump Drive Relief Valve Plug, Spring & Plunger
Courtesy of GENERAL MOTORS CORP.

5. Remove the oil pump drive relief valve plug, relief valve spring and relief valve plunger.

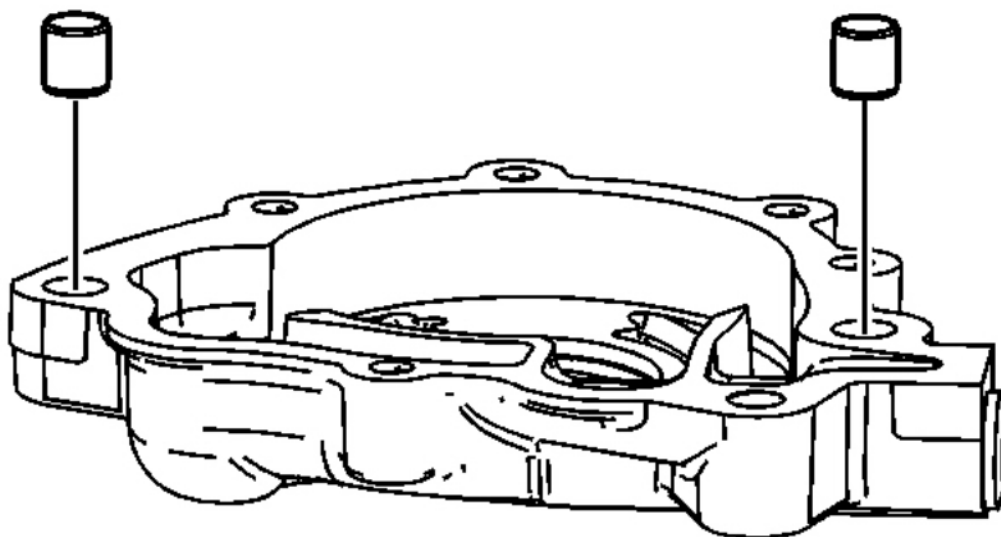


Fig. 157: View Of Oil Pump Body-To-Oil Pump Cover Alignment Dowels
Courtesy of GENERAL MOTORS CORP.

6. Remove the oil pump body to oil pump cover alignment dowels.

OIL PUMP CLEANING AND INSPECTION

Cleaning Procedure

1. Clean the oil pump components with non-corrosive solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Dry the oil pump components with compressed air.

Inspection Procedure

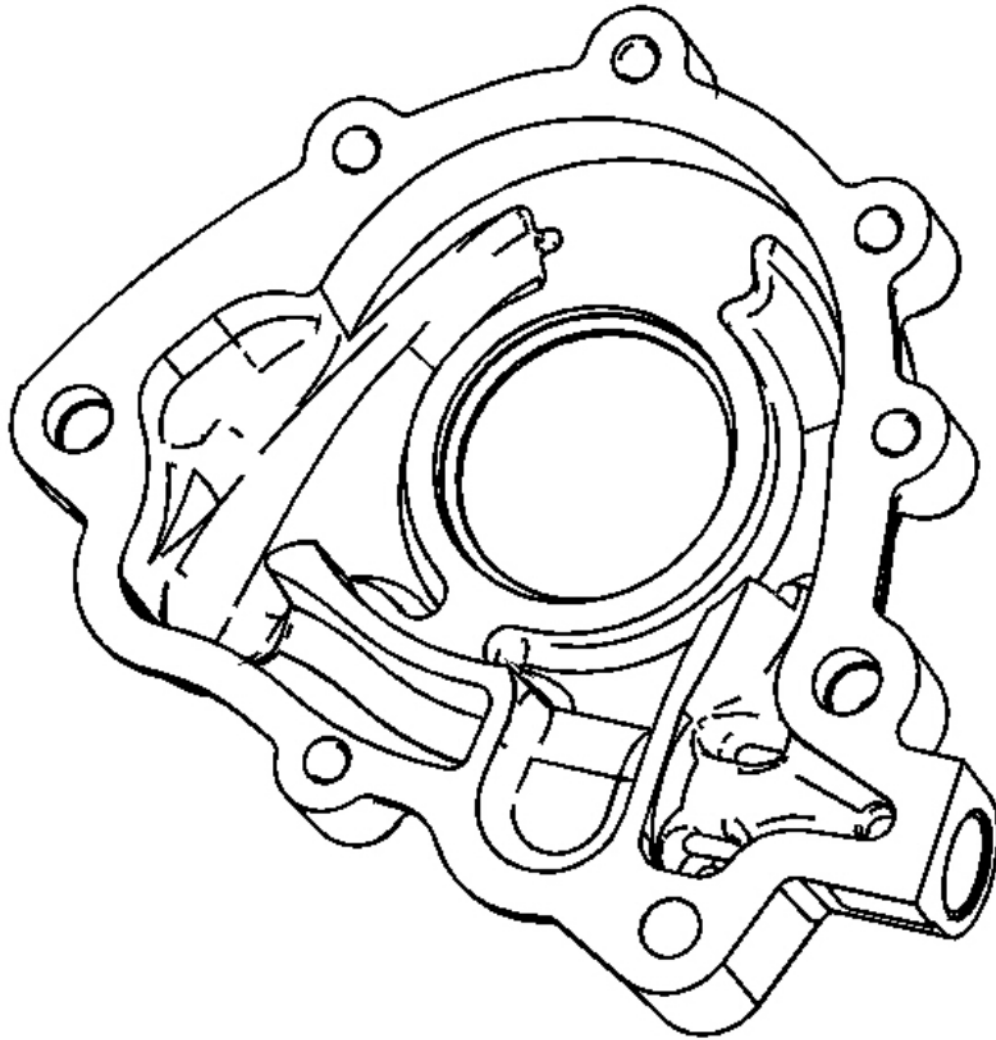


Fig. 158: Inspecting Oil Pump Body
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The internal parts of the oil pump are not serviced separately. If wear or damage is noted, replace the entire pump assembly.

1. Inspect the oil pump body for cracks, scoring, casting imperfections and damaged threads.

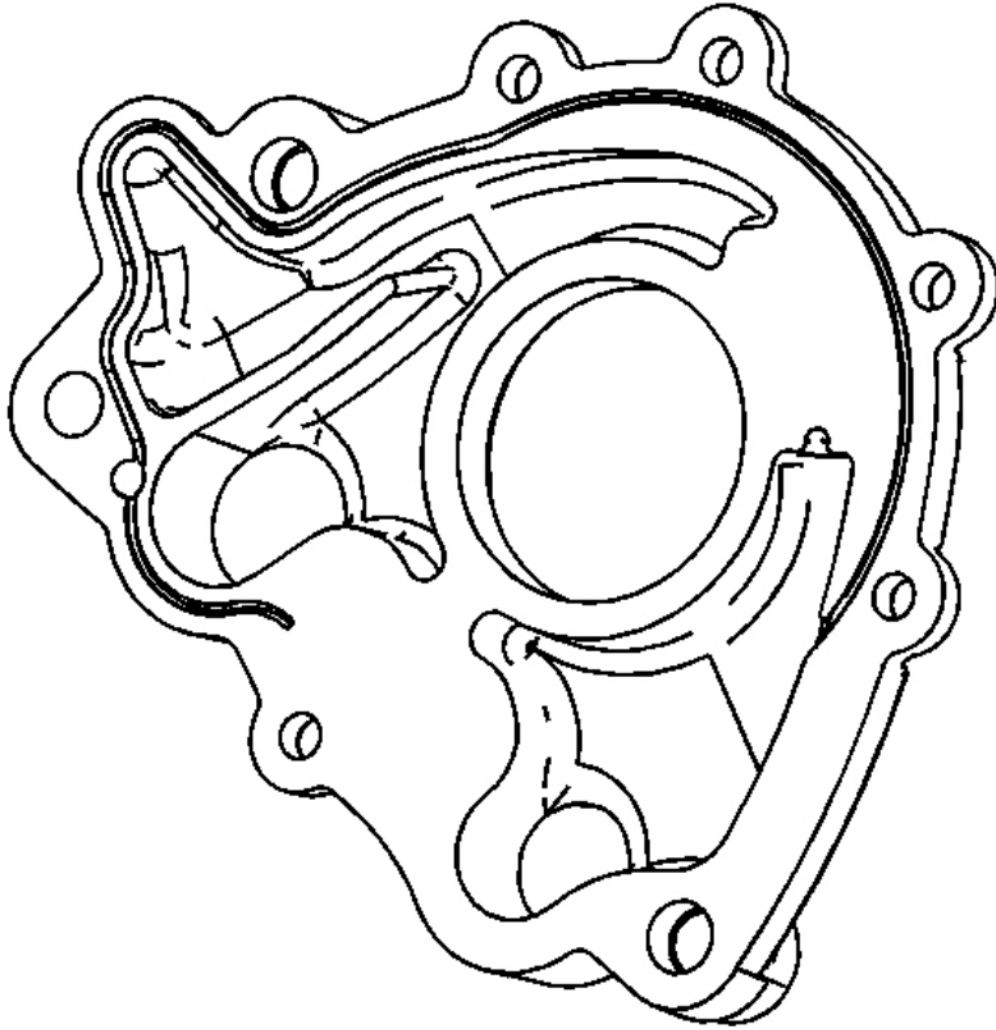


Fig. 159: Inspecting Oil Pump Cover
Courtesy of GENERAL MOTORS CORP.

2. Inspect the oil pump cover for cracks, scoring and casting imperfections.

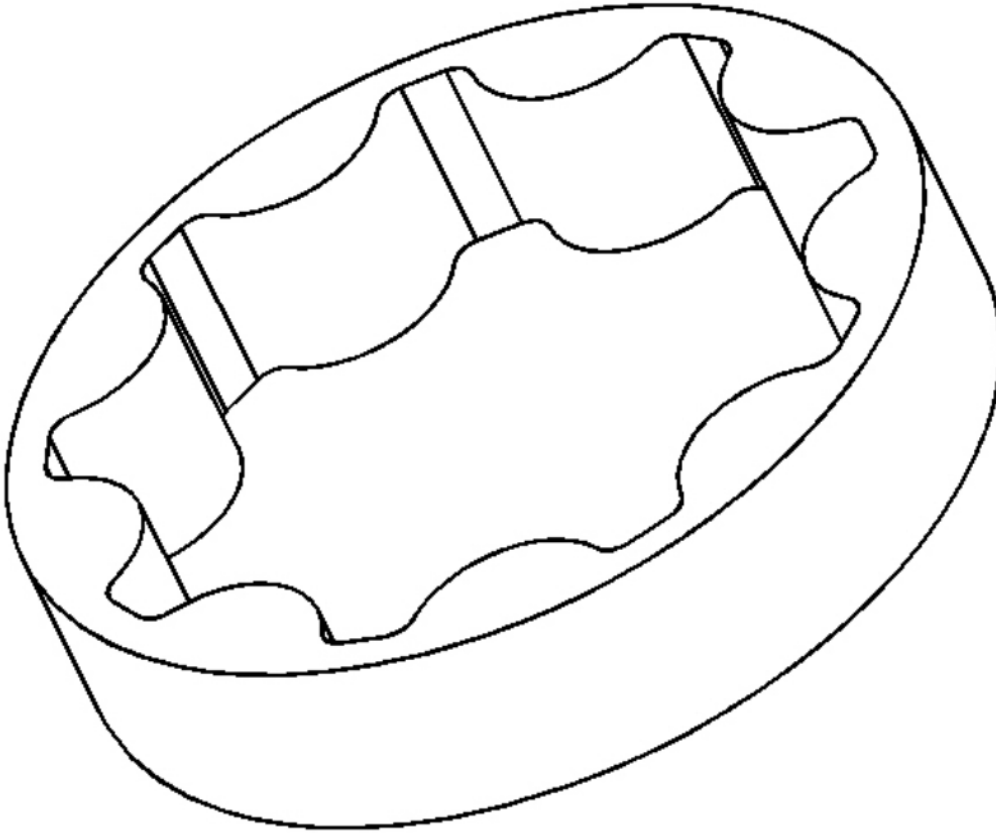


Fig. 160: Inspecting Oil Pump Driven Gear
Courtesy of GENERAL MOTORS CORP.

3. Inspect the oil pump driven gear for chipping, galling or wear.

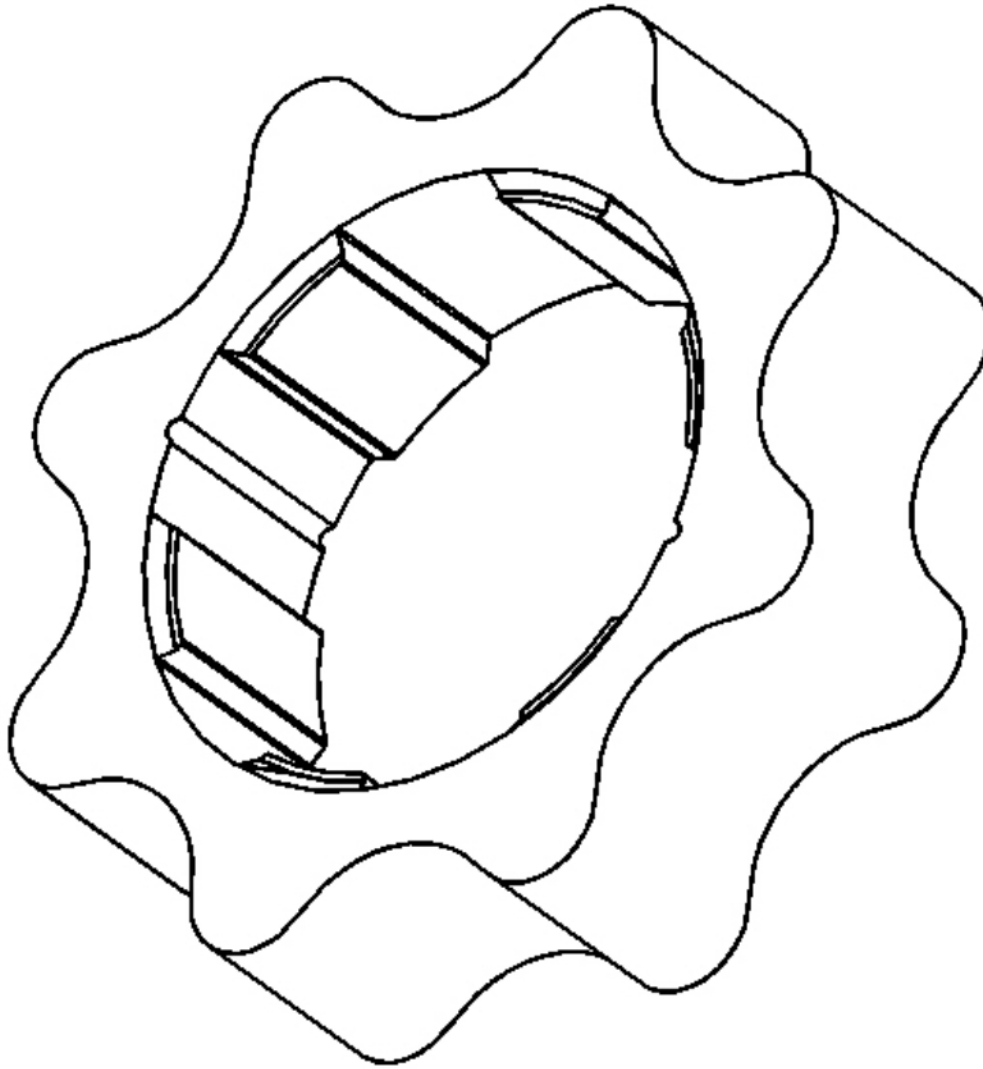


Fig. 161: Inspecting Oil Pump Drive Gear
Courtesy of GENERAL MOTORS CORP.

4. Inspect the oil pump drive gear for chipping, galling or wear.

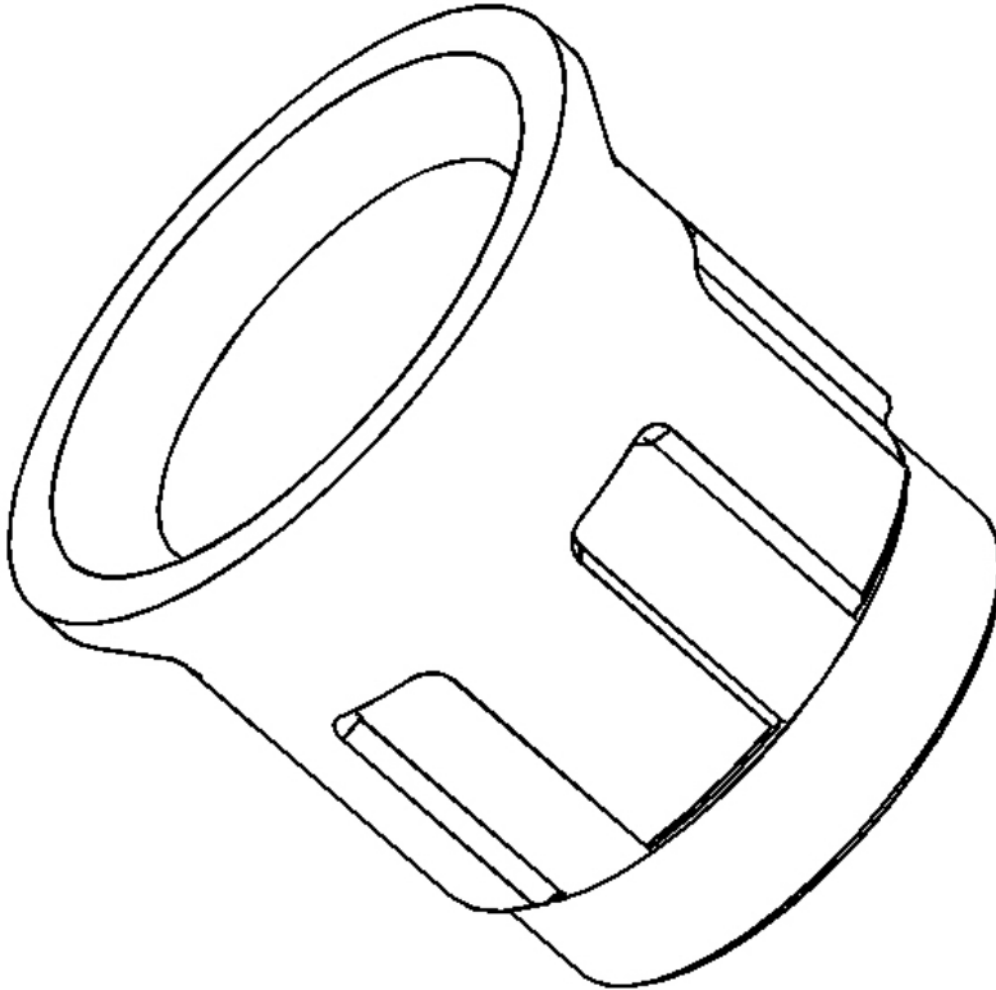


Fig. 162: Inspecting Oil Pump Drive Spacer
Courtesy of GENERAL MOTORS CORP.

5. Inspect the oil pump drive spacer for chipping, galling or wear.

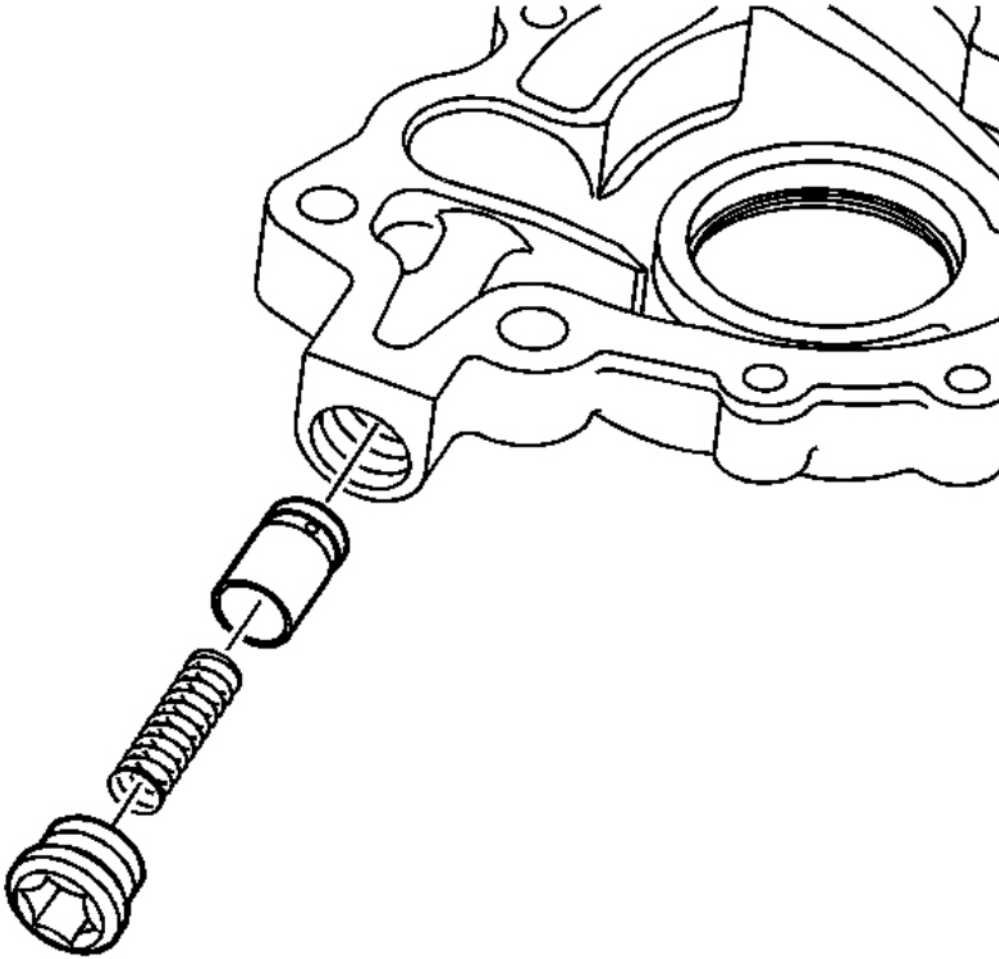


Fig. 163: Inspecting Oil Pump Relief Components
Courtesy of GENERAL MOTORS CORP.

6. Inspect the oil pump relief components for embedded particles and/or damage.

OIL PUMP ASSEMBLY

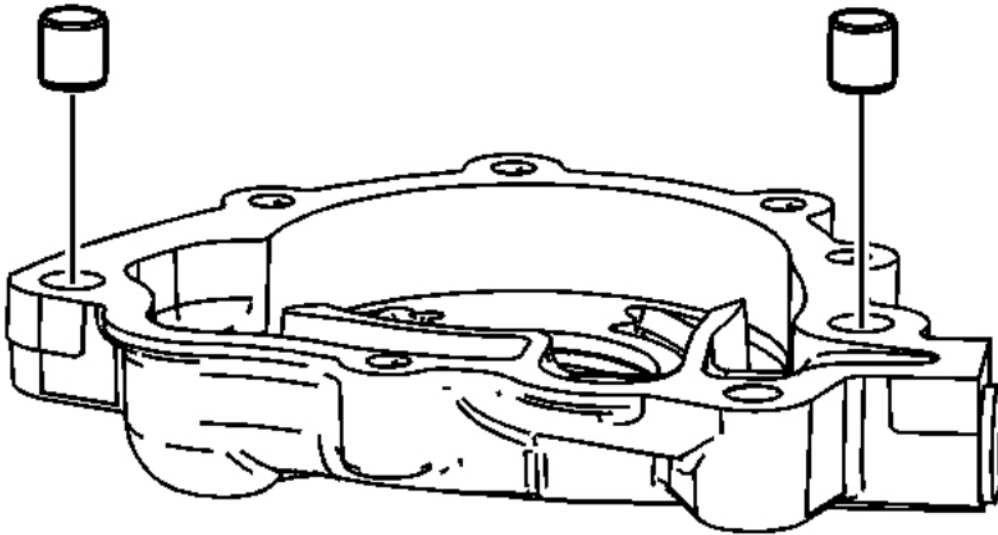


Fig. 164: View Of Oil Pump Body-To-Oil Pump Cover Alignment Dowels
Courtesy of GENERAL MOTORS CORP.

1. Install the oil pump body to oil pump cover alignment dowels.

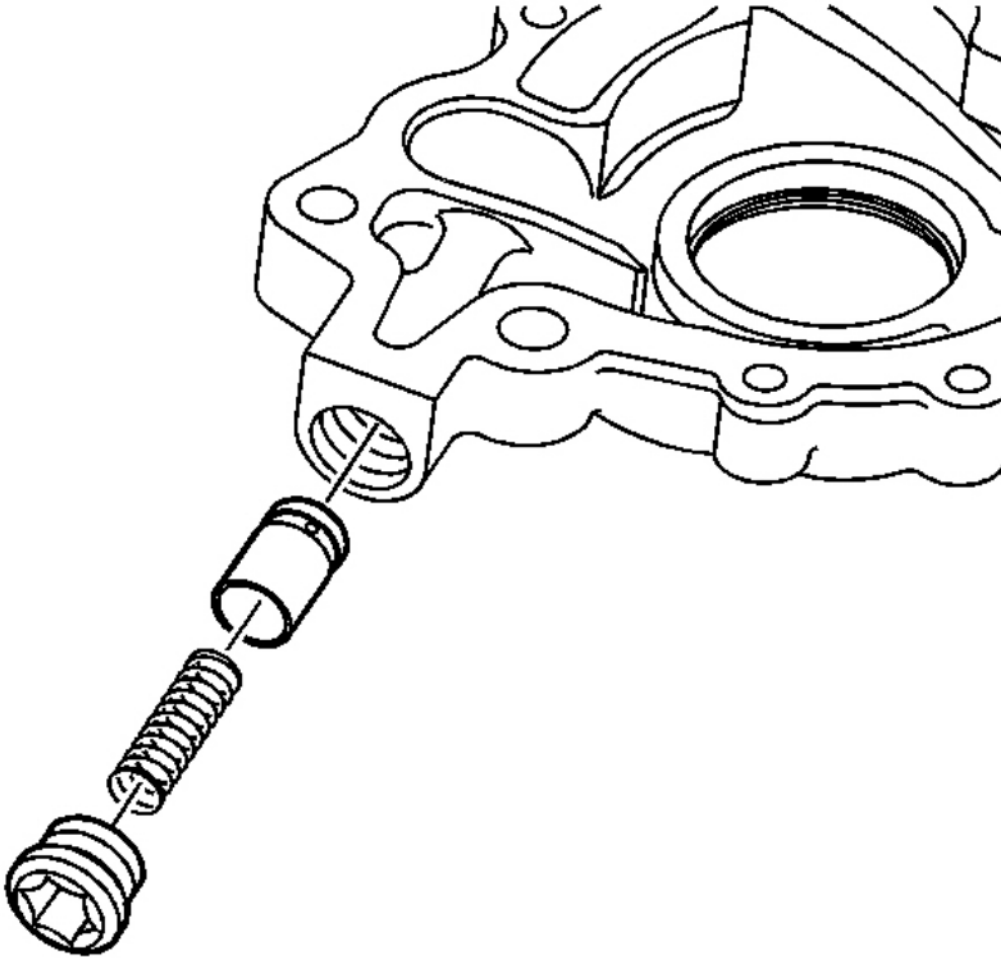


Fig. 165: View Of Oil Pump Drive Relief Valve Plug, Spring & Plunger
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the oil pump drive relief valve plunger, relief valve spring and relief valve plug.

Tighten: Tighten the oil pump relief valve plug to 12 N.m (106 lb in).

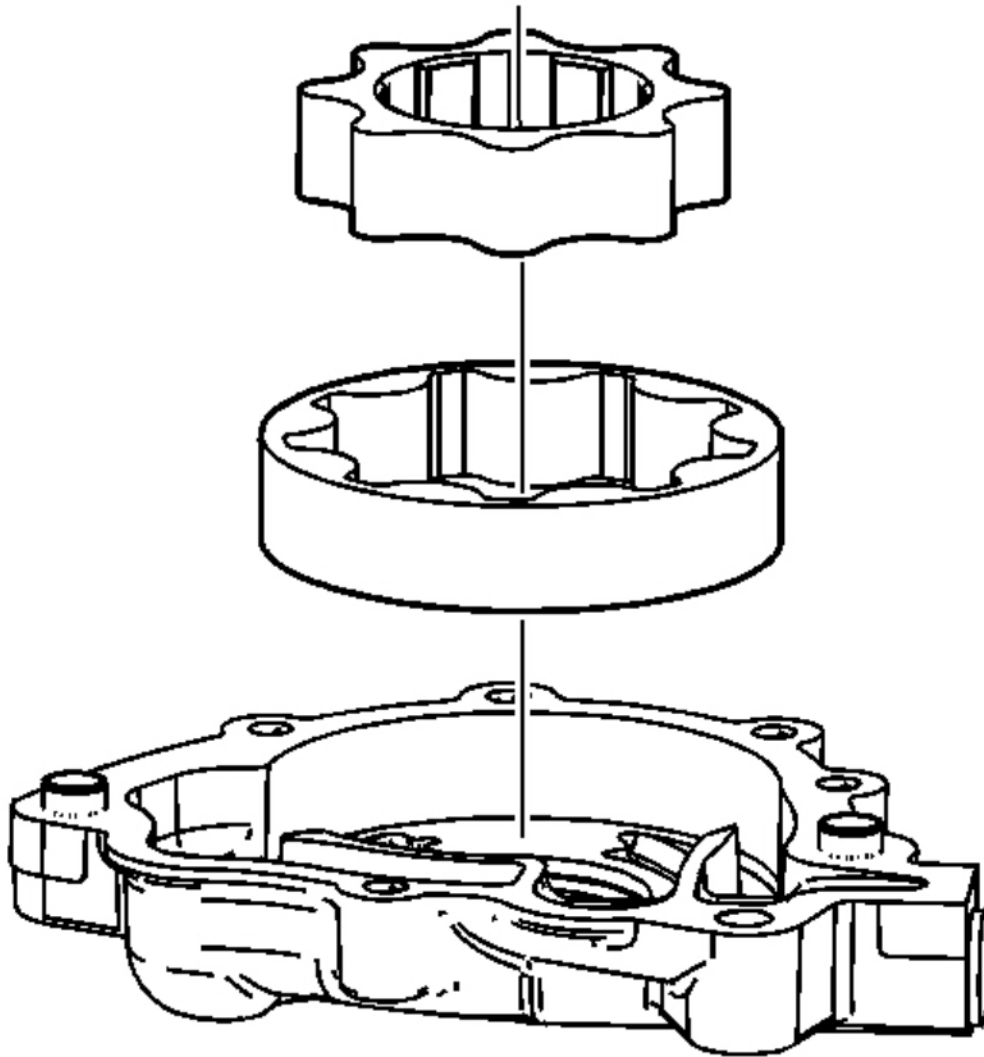


Fig. 166: View Of Oil Pump Drive & Driven Gears
Courtesy of GENERAL MOTORS CORP.

3. Install the oil pump driven and drive gears. The outer driven gear has one chamfered edge. The chamfered edge of the driven gear must face-down into the oil pump body.
4. Pack the pump body housing with clean white petroleum jelly to ensure pump priming.

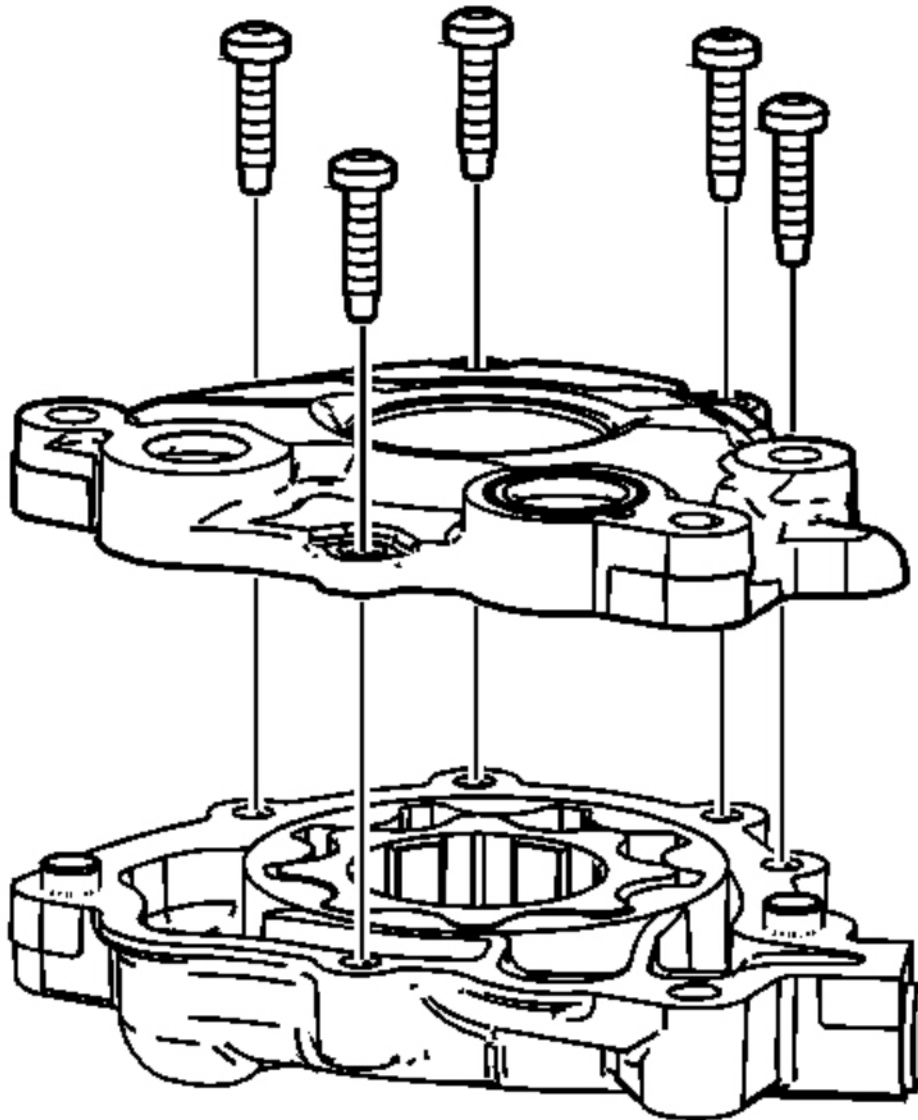


Fig. 167: View Of Oil Pump Body Cover
Courtesy of GENERAL MOTORS CORP.

5. Install the oil pump body cover.
6. Install the oil pump body bolts.

Tighten: Tighten the oil pump body bolts to 12 N.m (106 lb in).

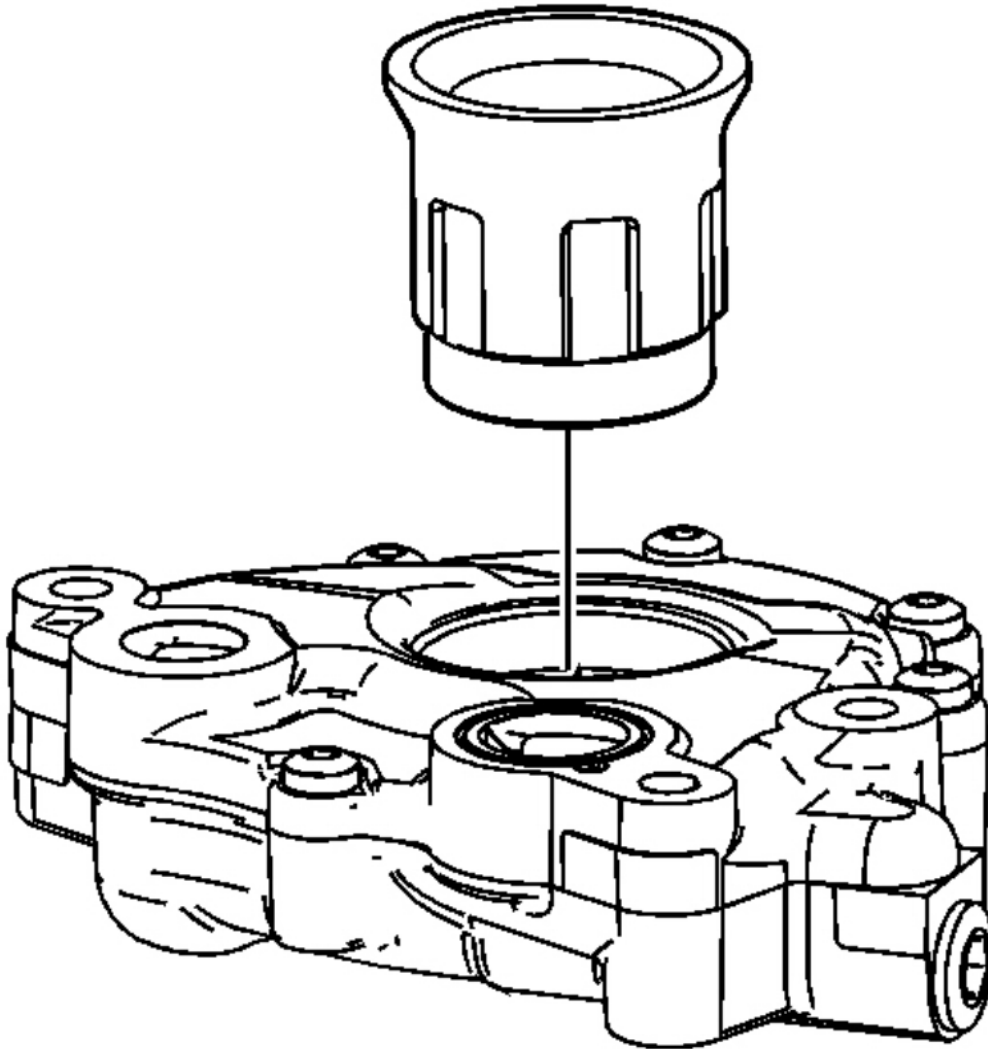


Fig. 168: View Of Oil Pump Drive Spacer
Courtesy of GENERAL MOTORS CORP.

7. Install the oil pump drive spacer.

2004 Cadillac SRX

2004 ENGINE Engine Mechanical - 4.6L (LH2) (Repair Instructions, 3 Of 5) - SRX

Cleaning Procedure

1. Clean the oil pump outlet with solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Dry the oil pump outlet tube with compressed air.

Inspection Procedure

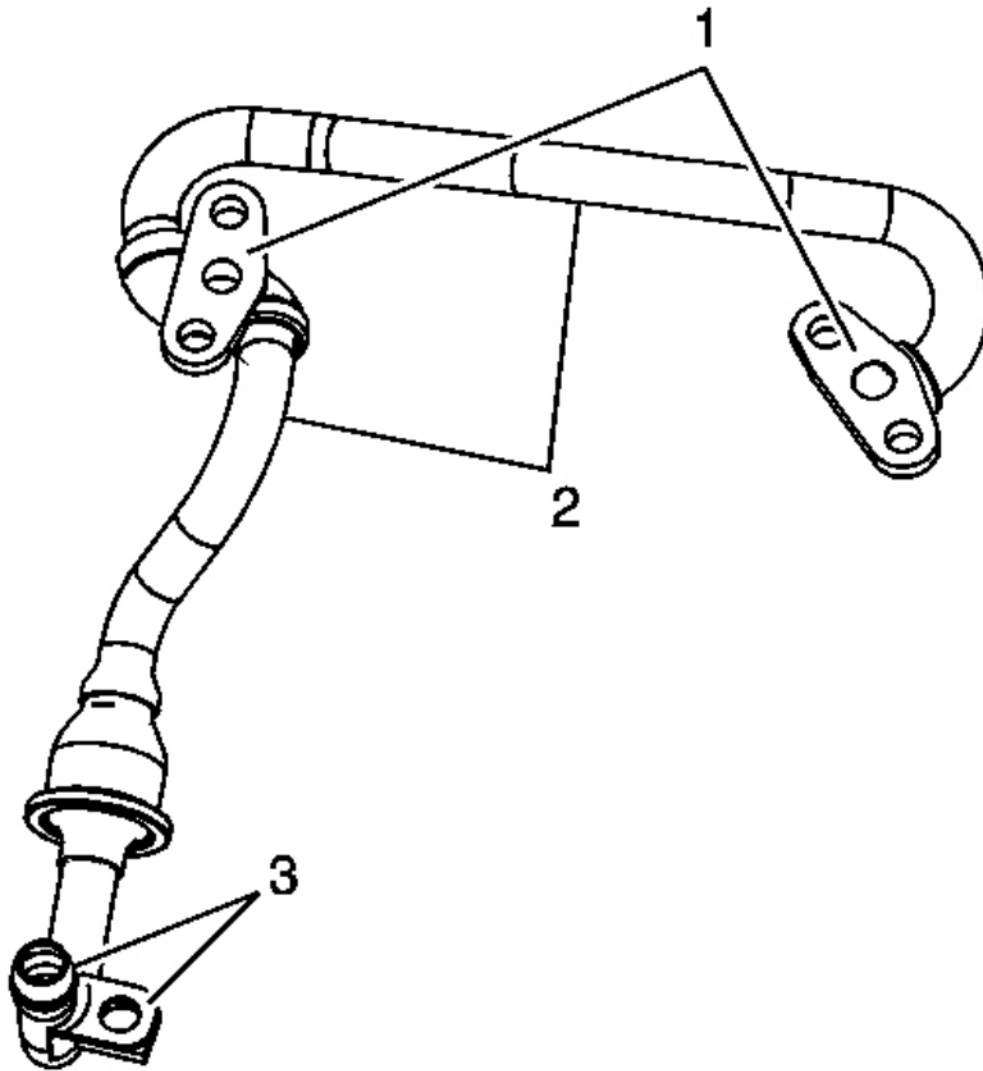


Fig. 169: Inspecting Oil Pump Outlet Tube
Courtesy of GENERAL MOTORS CORP.

1. Inspect the mounting surfaces (1) for possible leakage paths.
2. Inspect the oil pump outlet tube pipe (2) for cracks, imperfections and/or damage.
3. Inspect the oil pump outlet tube for distortion or damage to the pipe (3) and the bracket at the oil pump outlet end.

4. Repair or replace the oil pump outlet tube as necessary.

OIL FILTER ADAPTER DISASSEMBLE (WITHOUT OIL COOLER)

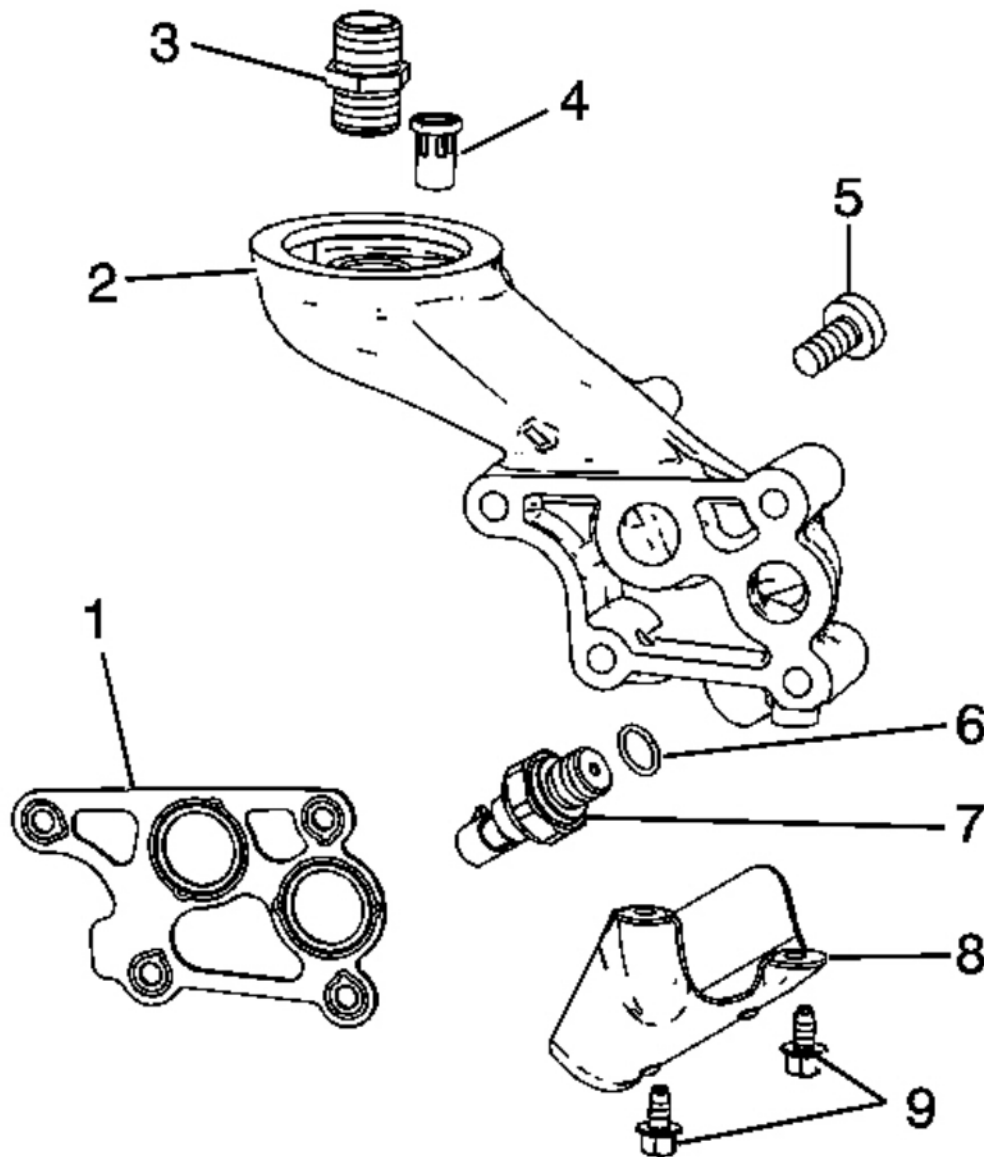


Fig. 170: Exploded View Of Oil Filter Adapter Assembly - w/o Oil Cooler
Courtesy of GENERAL MOTORS CORP.

1. Remove and discard the oil filter adapter gasket (1).
2. Remove and inspect the heat shield bolts (9).
3. Remove and inspect the heat shield (8).
4. Remove and inspect the oil pressure switch (7).
5. Remove and discard the oil pressure switch O-ring (6).
6. Remove and inspect the bypass hole plug (5).
7. Remove and inspect the oil filter fitting (3).
8. If necessary, remove and inspect the oil filter bypass valve (4).

OIL FILTER ADAPTER DISASSEMBLE (WITH OIL COOLER)

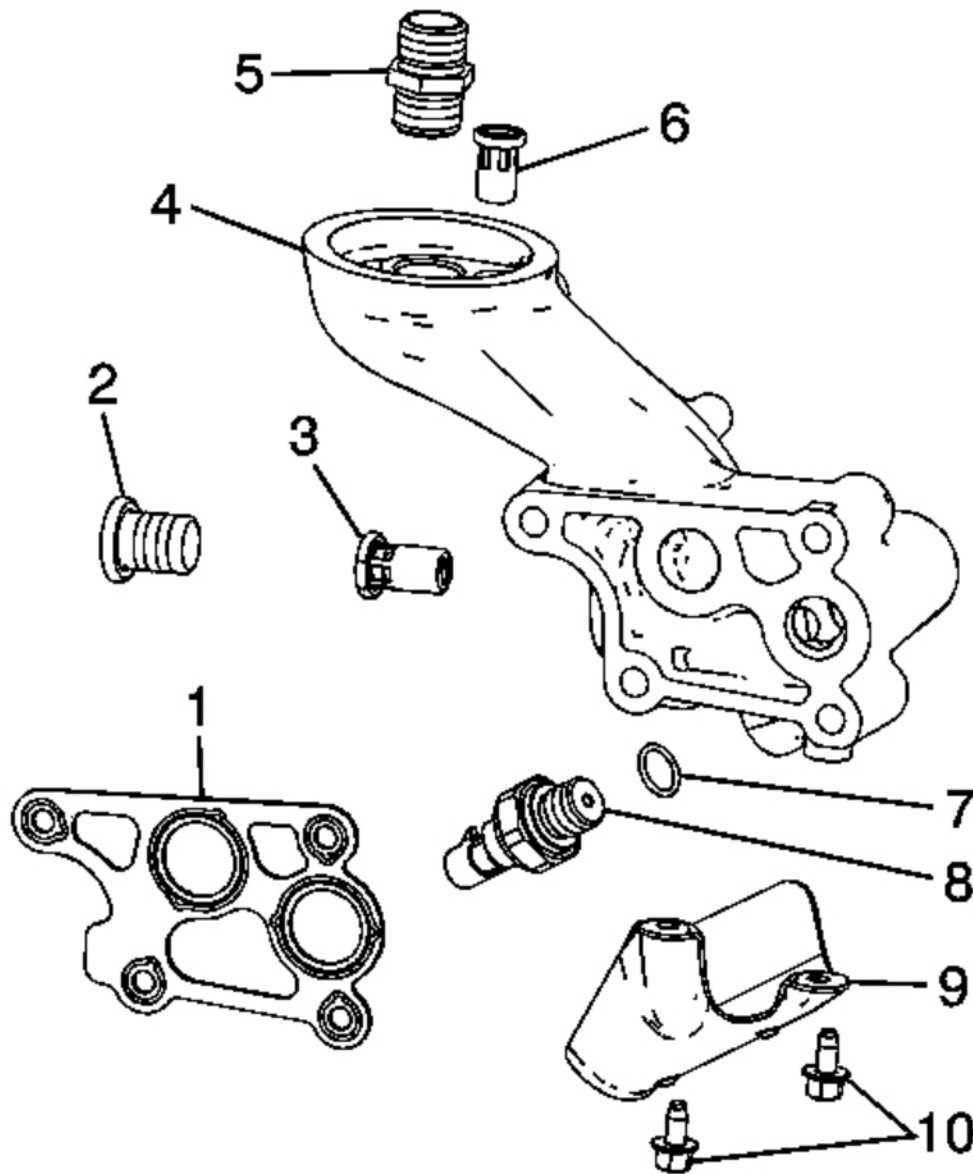


Fig. 171: Exploded View Of Oil Filter Adapter Assembly - w/Oil Cooler
Courtesy of GENERAL MOTORS CORP.

1. Remove and discard the oil filter adapter gasket (1).
2. Remove and inspect the heat shield bolts (10).

3. Remove and inspect the heat shield (9).
4. Remove and inspect the oil pressure switch (8).
5. Remove and discard the oil pressure switch O-ring (7).
6. Remove and inspect the oil cooler bypass valve hole plug (2).
7. Remove and inspect the oil cooler bypass valve (3).
8. Remove and inspect the oil filter fitting (5).
9. If necessary, remove and inspect the oil filter bypass valve (6).

OIL FILTER ADAPTER CLEANING AND INSPECTION (WITHOUT OIL COOLER)

Cleaning Procedure

1. Clean the oil filter adapter in solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Dry the oil filter adapter with compressed air.

Inspection Procedure

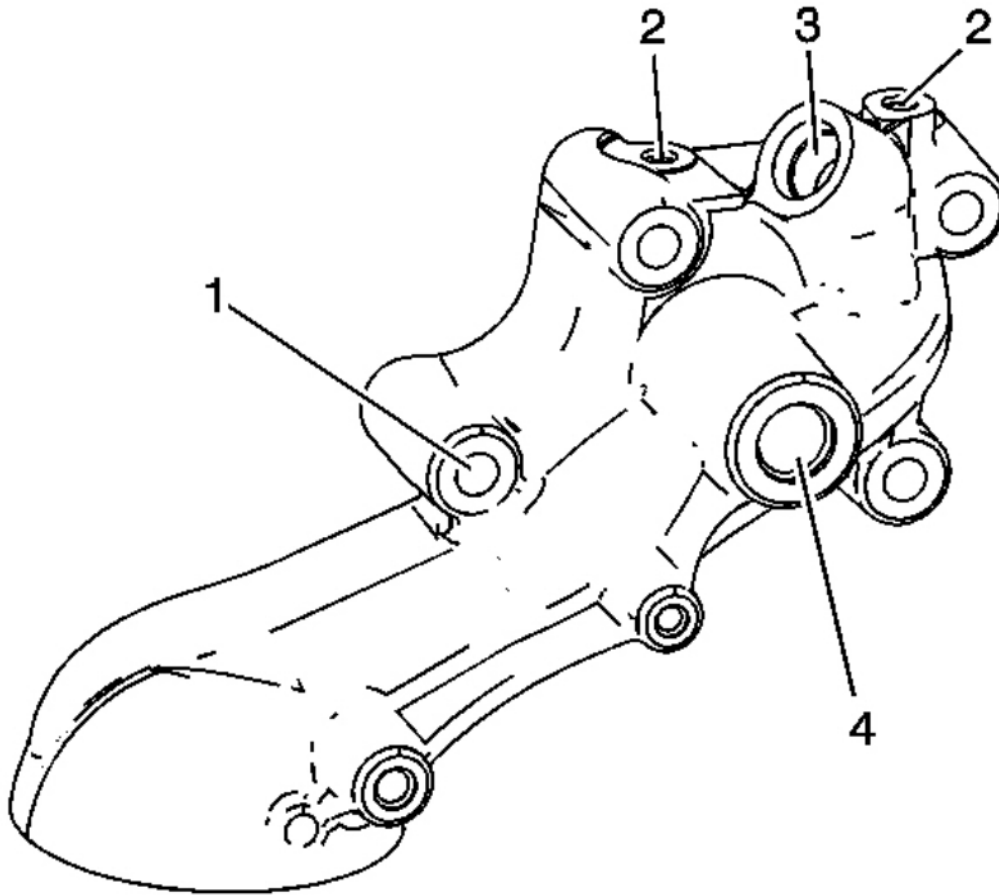


Fig. 172: Inspecting Exterior Of Oil Filter Adapter - w/o Oil Cooler
Courtesy of GENERAL MOTORS CORP.

1. Inspect the exterior of the oil filter adapter for the following:
 - Damage to the mounting holes (1)
 - Damage to the heat shield bolt hole threads (2)
 - Damage to the oil pressure switch hole threads (3)
 - Damage to the bypass plug hole threads (4)

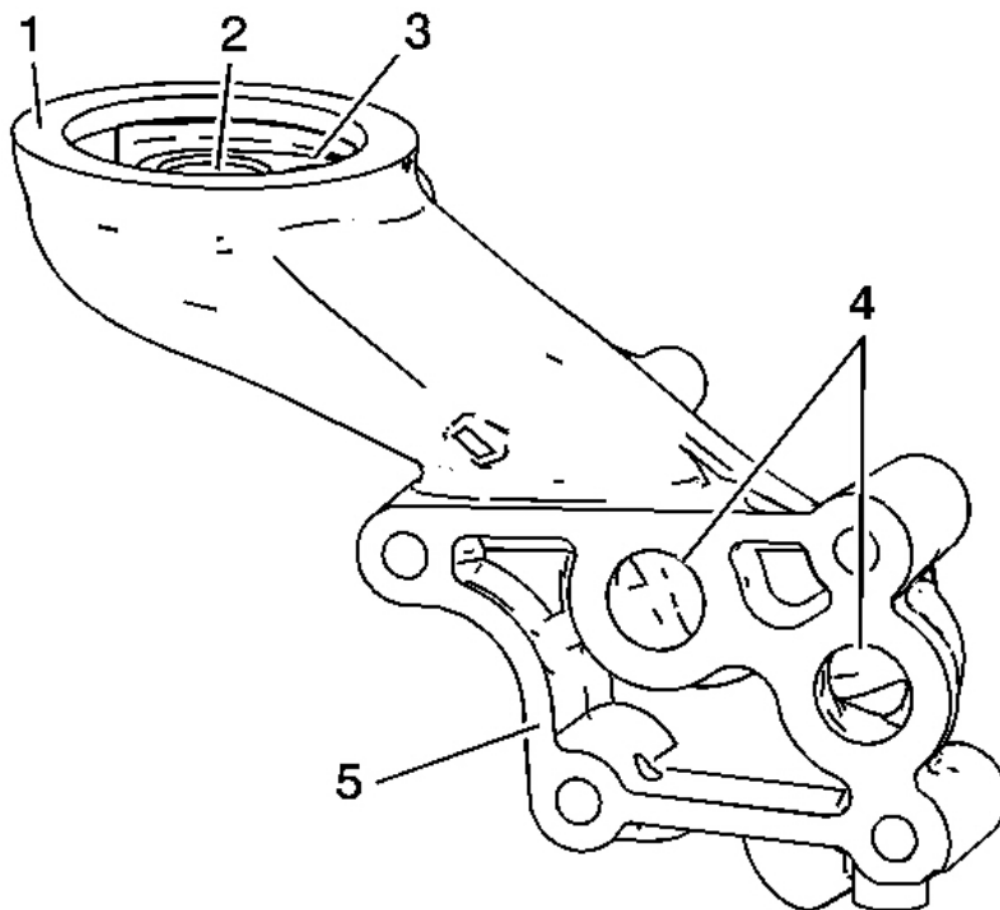


Fig. 173: Inspecting Interior Of Oil Filter Adapter - w/o Oil Cooler
Courtesy of GENERAL MOTORS CORP.

2. Inspect the interior of the oil filter adapter for the following:
 - Damage to the oil filter sealing surface (1)
 - Damage to the oil filter fitting hole threads (2)
 - Blockage in the oil filter fitting hole (2)
 - Damage or blockage to the oil filter bypass hole (3)
 - Blockage to the inlet and outlet passages (4)
 - Damage to the mounting surface (5)
3. Repair or replace the oil filter adapter as necessary.

OIL FILTER ADAPTER CLEANING AND INSPECTION (WITH OIL COOLER)

Cleaning Procedure

1. Clean the oil filter adapter in solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Dry the oil filter adapter with compressed air.

Inspection Procedure

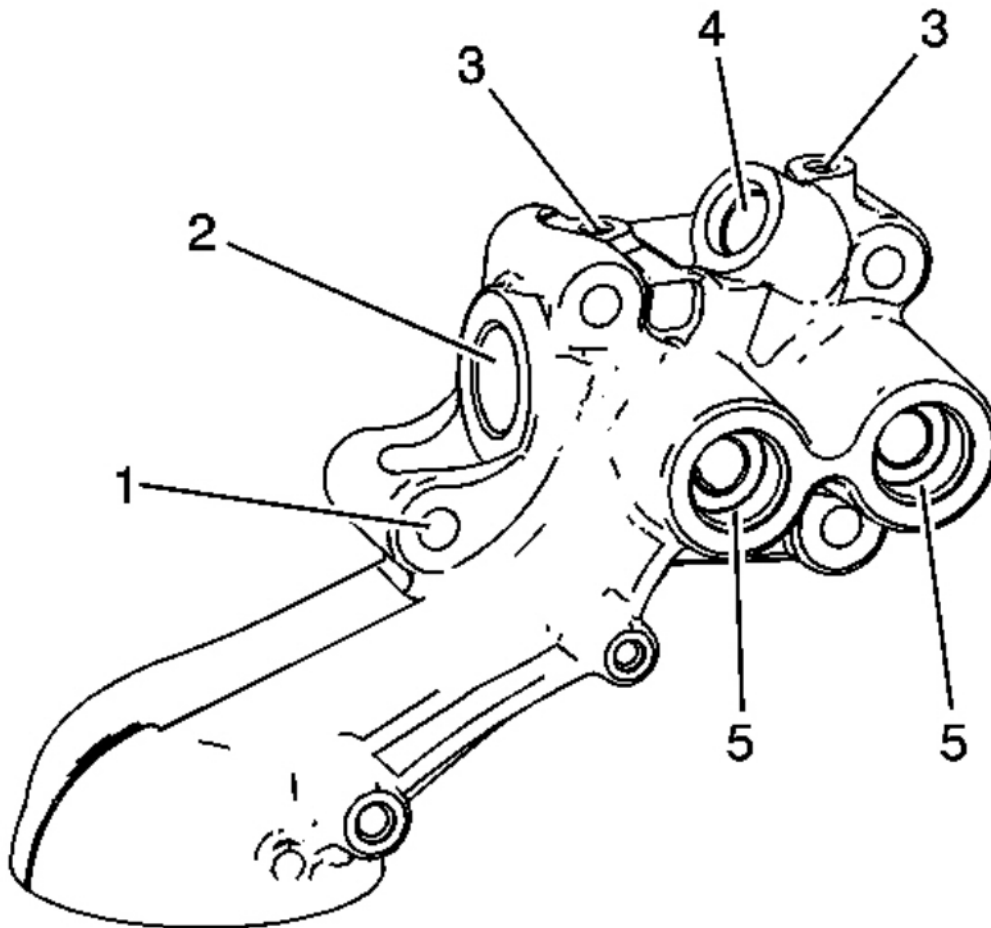


Fig. 174: Inspecting Exterior Of Oil Filter Adapter - w/Oil Cooler
Courtesy of GENERAL MOTORS CORP.

1. Inspect the exterior of the oil filter adapter for the following:
 - Damage to the mounting holes (1)
 - Damage to the oil cooler bypass valve plug hole threads (2)
 - Blockage in the oil cooler bypass valve passage (2)
 - Damage to the heat shield bolt hole threads (3)
 - Damage to the oil pressure switch hole threads (4)
 - Damage to the oil cooler line fitting hole threads (5)
 - Blockage in the oil cooler line passages (5)

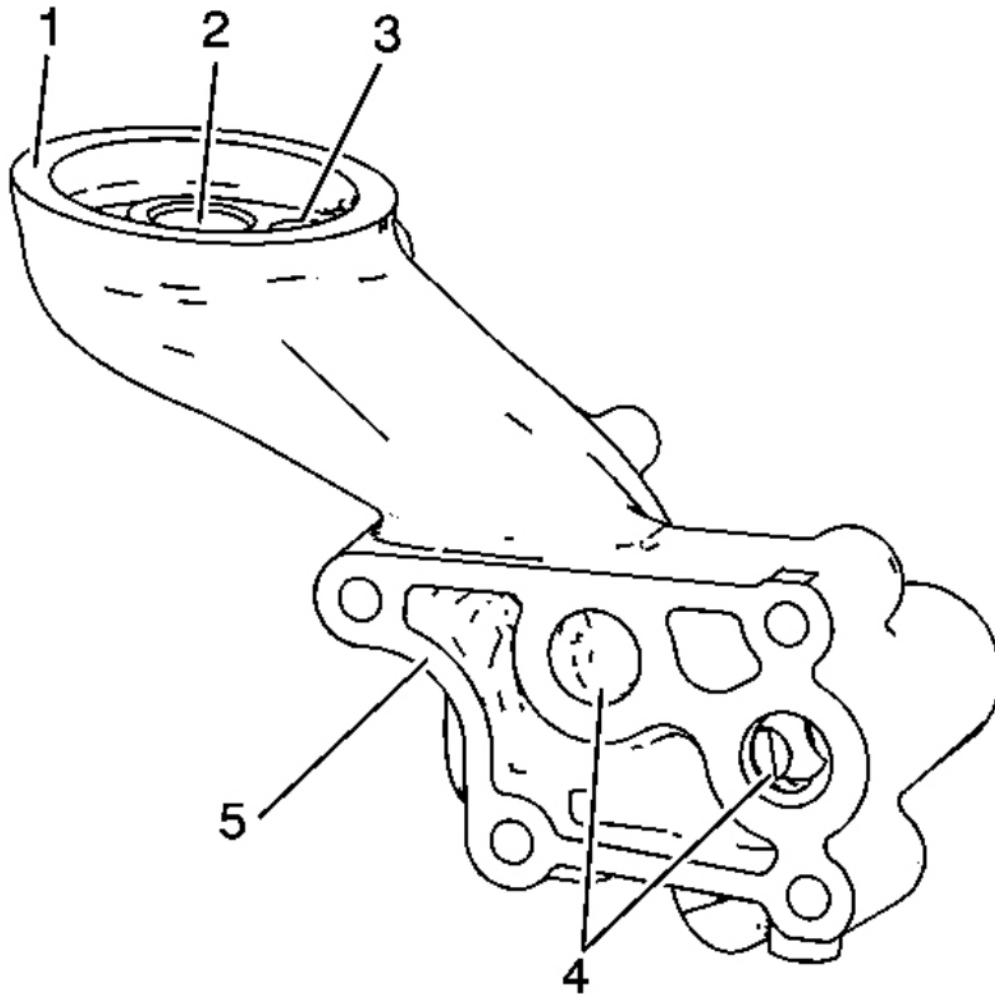


Fig. 175: Inspecting Interior Of Oil Filter Adapter - w/Oil Cooler
Courtesy of GENERAL MOTORS CORP.

2. Inspect the interior of the oil filter adapter for the following:
 - Damage to the oil filter sealing surface (1)
 - Damage to the oil filter fitting hole threads (2)
 - Blockage in the oil filter fitting hole (2)
 - Damage or blockage to the oil filter bypass hole (3)
 - Blockage to the inlet and outlet passages (4)

- Damage to the mounting surface (5)
3. Repair or replace the oil filter adapter as necessary.

OIL FILTER ADAPTER ASSEMBLY (WITHOUT OIL COOLER)

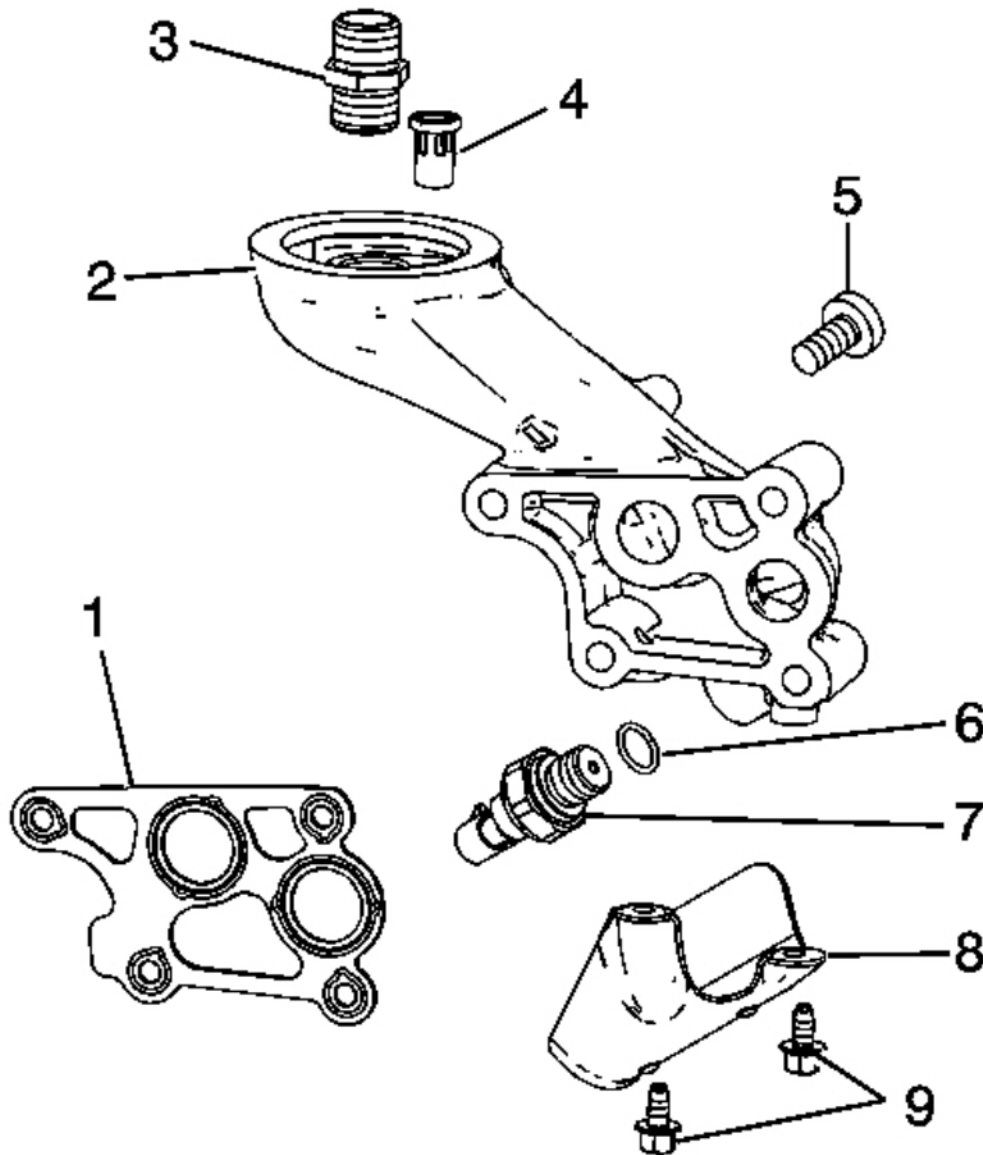


Fig. 176: Exploded View Of Oil Filter Adapter Assembly - w/o Oil Cooler
Courtesy of GENERAL MOTORS CORP.

1. If removed, install the oil filter bypass valve (4).

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the oil filter fitting (3).

Tighten: Tighten the oil filter fitting to 29 N.m (21 lb ft).

3. Install the bypass hole plug (5).

Tighten: Tighten the bypass hole plug to 20 N.m (15 lb ft).

4. Install a NEW O-ring (6) on the oil pressure switch (7).
5. Install the oil pressure switch (7).

Tighten: Tighten the oil pressure switch to 16 N.m (12 lb ft).

6. Install the heat shield (8).
7. Install the heat shield bolts (9).

Tighten: Tighten the heat shield bolts to 10 N.m (89 lb in).

8. Install the NEW oil filter adapter gasket (1).

OIL FILTER ADAPTER ASSEMBLE (WITH OIL COOLER)

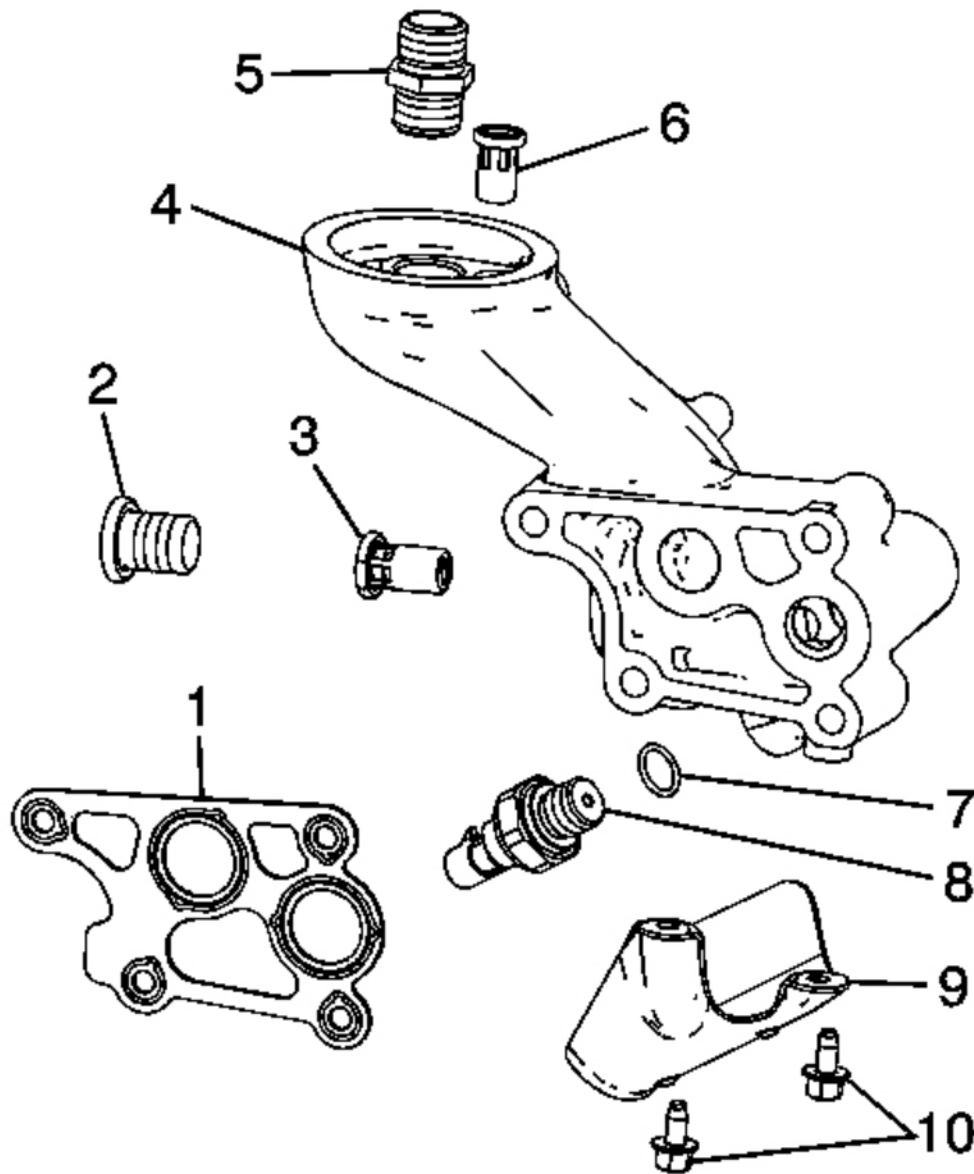


Fig. 177: Exploded View Of Oil Filter Adapter Assembly - w/Oil Cooler
Courtesy of GENERAL MOTORS CORP.

1. If removed, install the oil filter bypass valve (6).

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the oil filter fitting (5).

Tighten: Tighten the oil filter fitting to 29 N.m (21 lb ft).

3. Install the oil cooler bypass valve (3).
4. Install the oil cooler bypass valve hole plug (2).

Tighten: Tighten the oil cooler bypass valve hole plug to 20 N.m (15 lb ft).

5. Install a NEW O-ring (7) on the oil pressure switch (8).
6. Install the oil pressure switch (8).

Tighten: Tighten the oil pressure switch to 16 N.m (12 lb ft).

7. Install the heat shield (9).
8. Install the heat shield bolts (10).

Tighten: Tighten the heat shield bolts to 10 N.m (89 lb in).

9. Install the NEW oil filter adapter gasket (1).

OIL PAN DISASSEMBLE

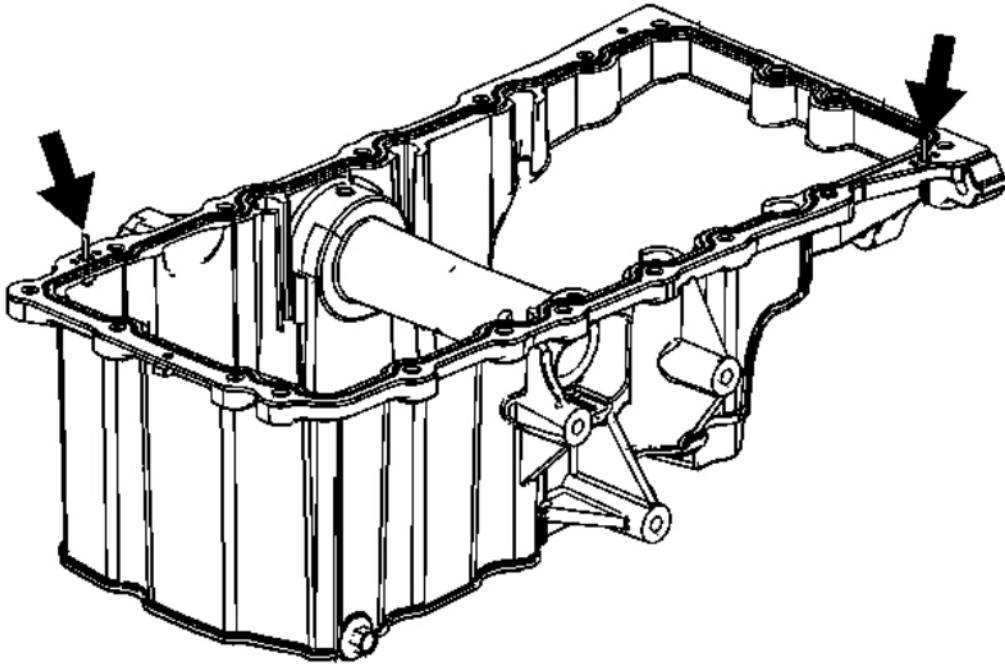


Fig. 178: Locating Oil Pan Gasket Rivets
Courtesy of GENERAL MOTORS CORP.

1. Drill out the oil pan gasket rivets.

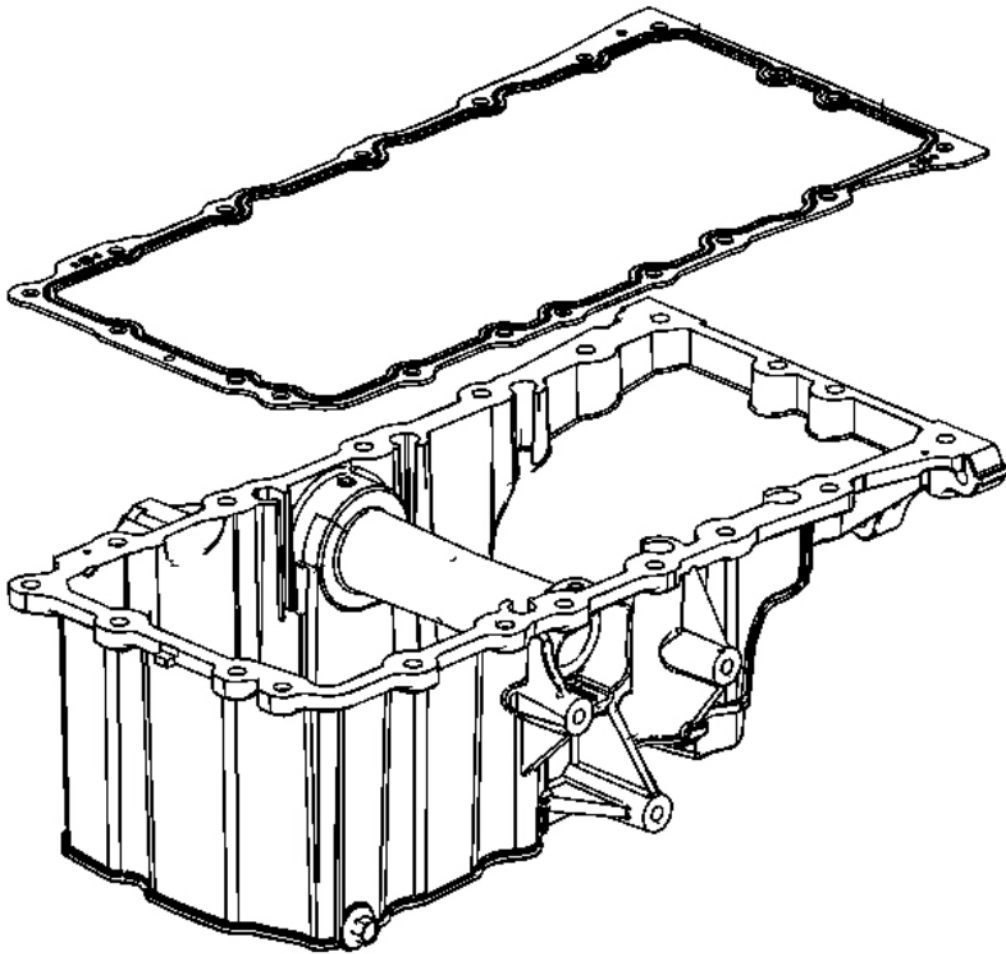


Fig. 179: View Of Oil Pan Gasket
Courtesy of GENERAL MOTORS CORP.

2. Remove and discard the oil pan gasket.

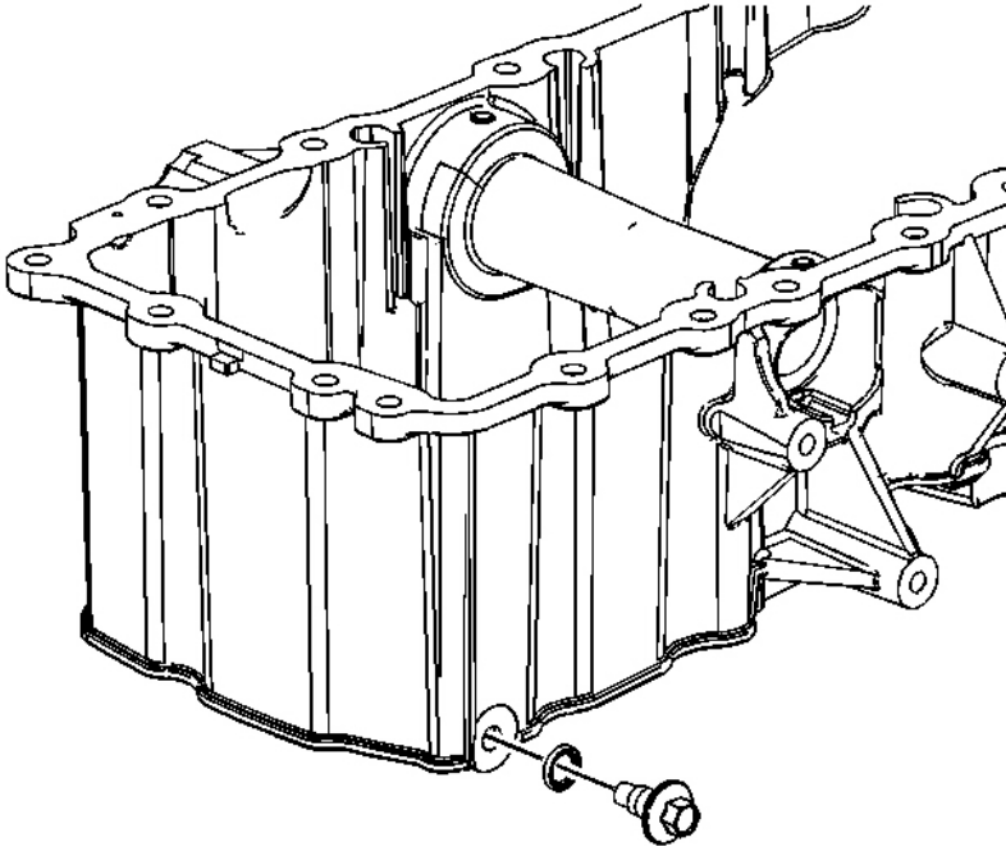


Fig. 180: View Of Oil Pan Drain Plug
Courtesy of GENERAL MOTORS CORP.

3. Remove the oil pan drain plug.
4. Remove and discard the oil pan drain plug O-ring.

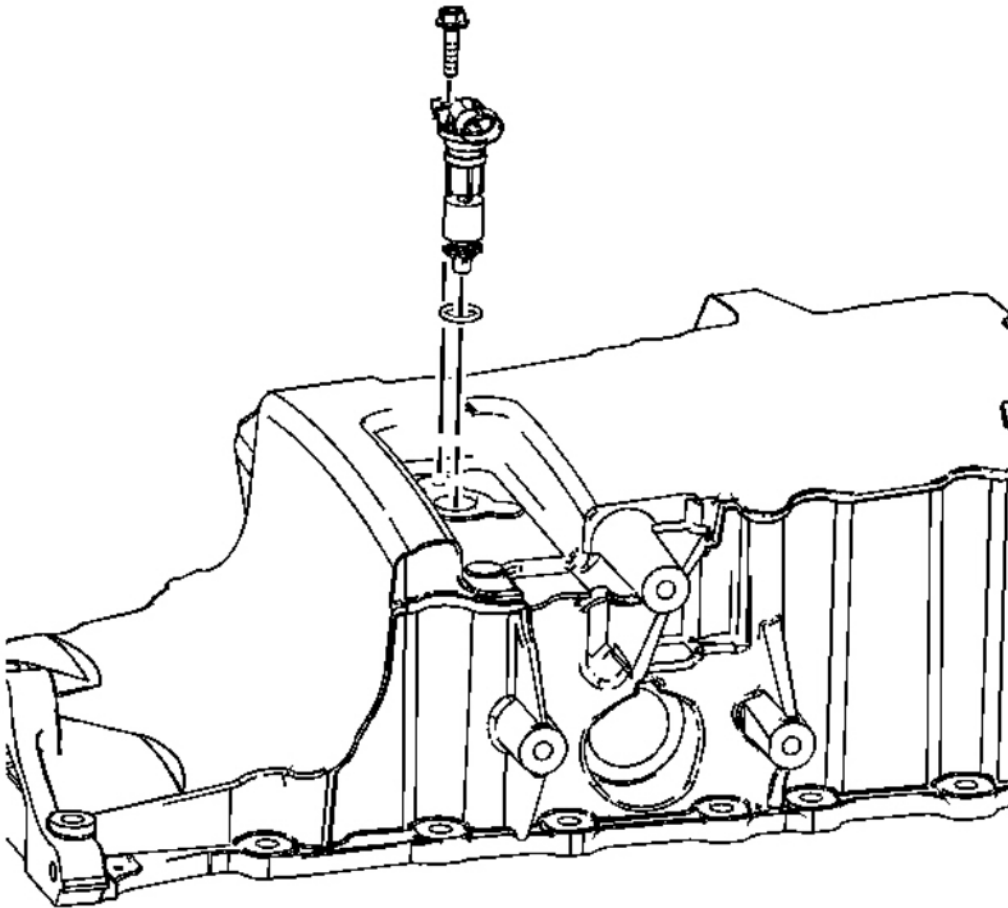


Fig. 181: View Of Oil Level Sensor
Courtesy of GENERAL MOTORS CORP.

5. Remove the oil level sensor bolt.
6. Remove the oil level sensor.
7. Remove and discard the oil level sensor O-ring.

OIL PAN CLEANING AND INSPECTION

Cleaning Procedure

1. Clean the oil pan components with solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Dry the oil pan components with compressed air.

Inspection Procedure

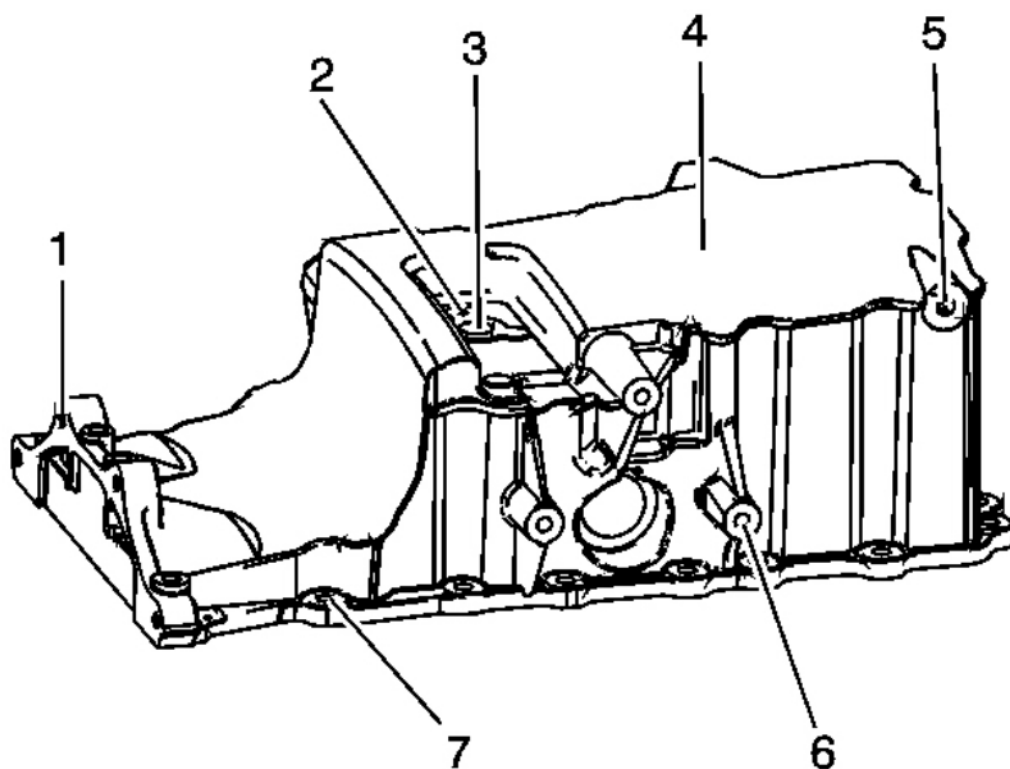


Fig. 182: Inspecting Exterior Of Oil Pan
Courtesy of GENERAL MOTORS CORP.

1. Inspect the exterior of the oil pan for the following:
 - Damage to the transmission mounting hole threads (1)
 - Damage to the oil level sensor bolt hole threads (2)
 - Damage to the oil level sensor hole (3)
 - Damage to the exterior of the oil pan (4)
 - Damage to the oil pan drain plug hole threads (5)

- Damage to the mounting hole threads (6) for the front differential
- Damage to the oil pan bolt holes (7)

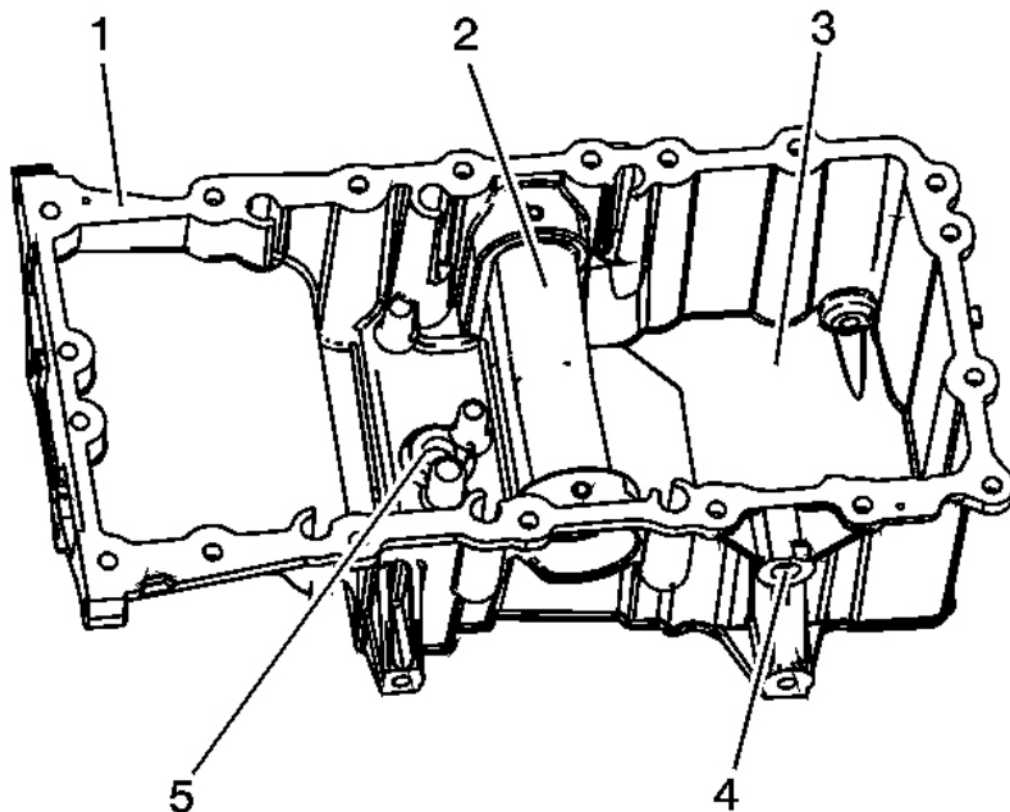


Fig. 183: Inspecting Interior Of Oil Pan
Courtesy of GENERAL MOTORS CORP.

2. Inspect the interior of the oil pan for the following:
 - Damage to the oil pan gasket sealing surface (1)
 - Damage to the oil pan-axle pass through (2)
 - Damage or blockage to the oil pan interior (3)
 - Damage to the mounting hole threads (4) for the front differential
 - Damage to the oil level sensor mounting bore (5)
3. Repair or replace the oil pan as necessary.

OIL PAN ASSEMBLE

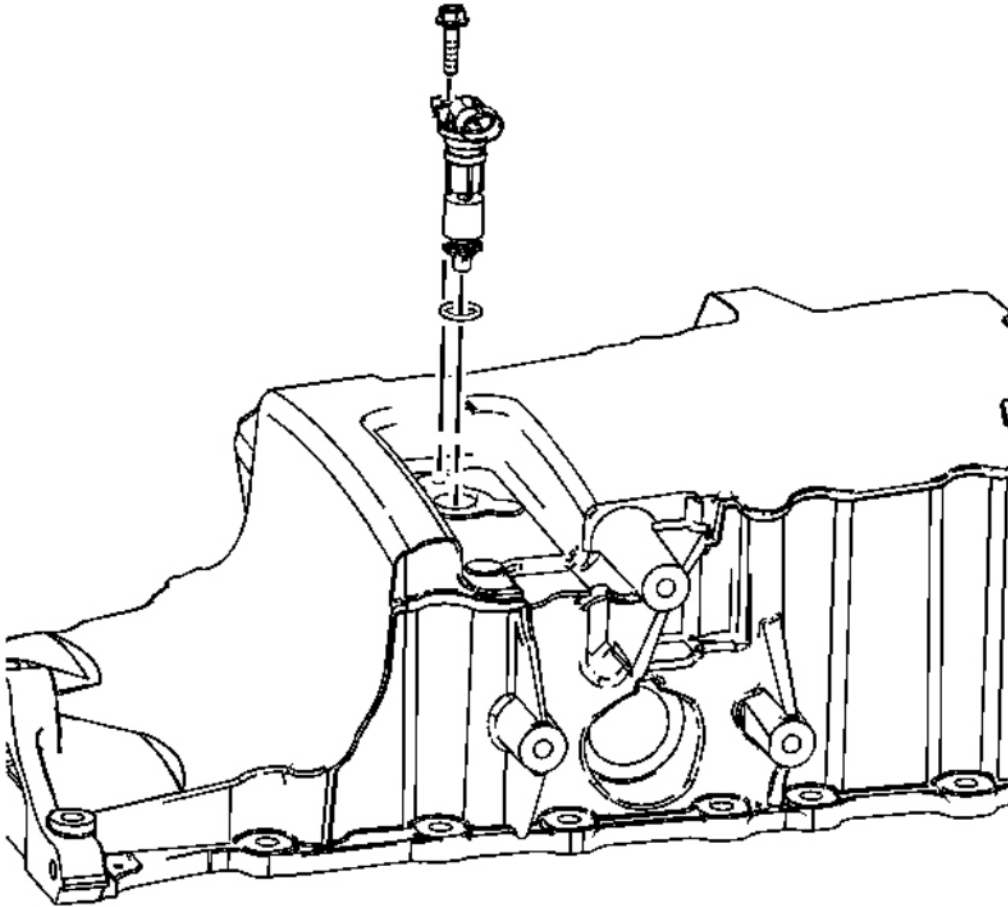


Fig. 184: View Of Oil Level Sensor
Courtesy of GENERAL MOTORS CORP.

1. Install a NEW O-ring on the oil level sensor.
2. Install the oil level sensor.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the oil level sensor bolt.

Tighten: Tighten the oil level sensor bolt to 10 N.m (89 lb in).

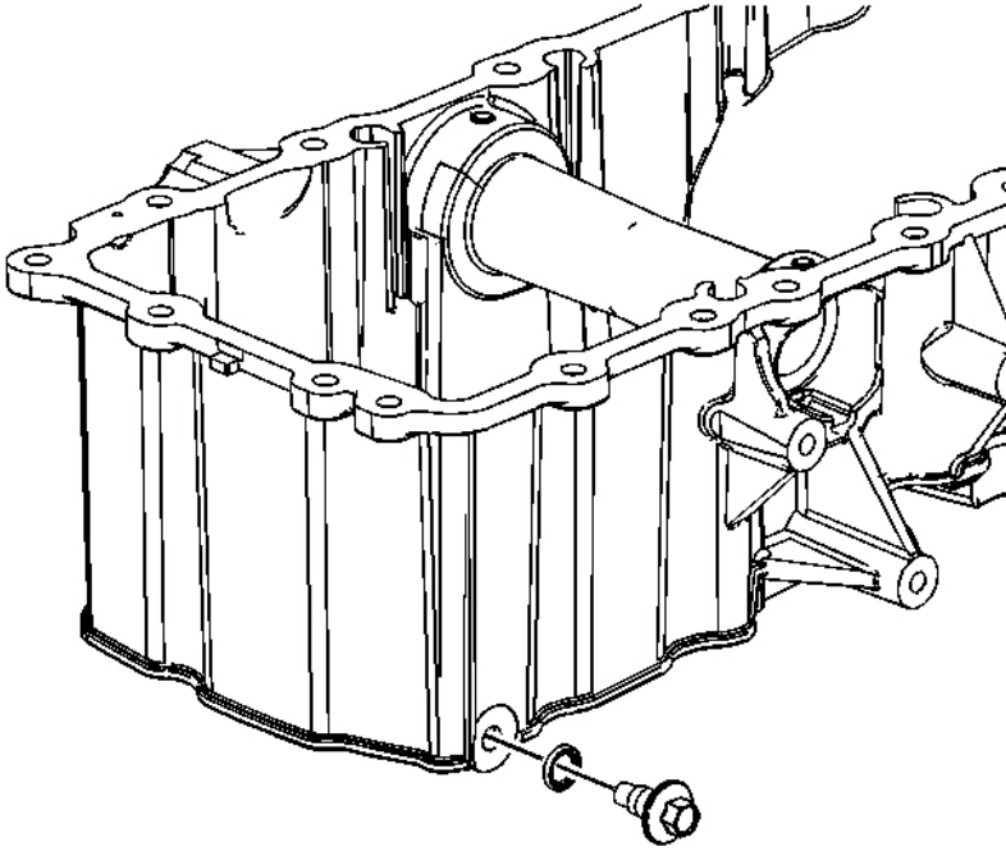


Fig. 185: View Of Oil Pan Drain Plug
Courtesy of GENERAL MOTORS CORP.

4. Install a NEW O-ring on the oil pan drain plug.
5. Install the oil pan drain plug.

Tighten: Tighten the oil pan drain plug to 25 N.m (18 lb ft).

OIL PUMP PIPE AND SCREEN CLEANING AND INSPECTION

Cleaning Procedure

1. Clean the oil pump pipe and screen with solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

2. Dry the oil pump pipe and screen with compressed air.

Inspection Procedure

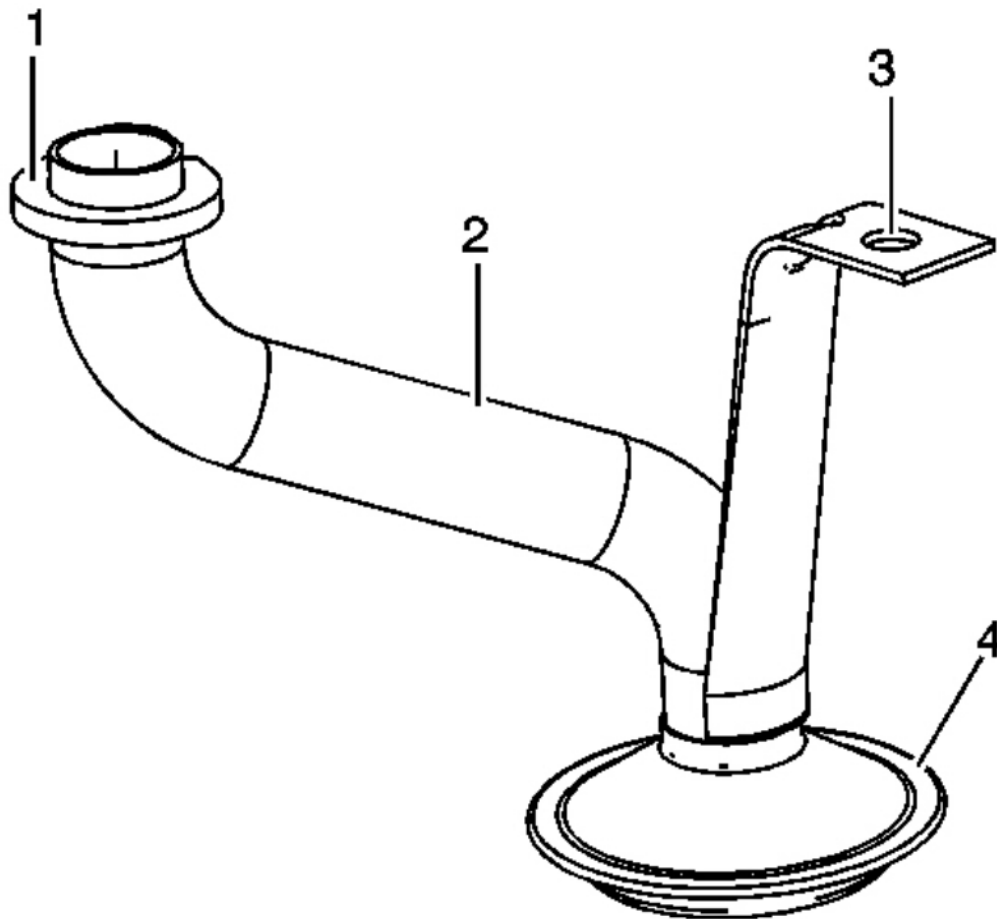


Fig. 186: Inspecting Oil Pump Pipe
Courtesy of GENERAL MOTORS CORP.

1. Inspect the gasket sealing surface (1) for damage.
2. Inspect the oil pump pipe tube (2) for cracks, imperfections and/or damage.
3. Inspect the mounting bracket (3) for distortion or damage.

4. Inspect the oil pump screen (4) for blockage, foreign material, tears, cracks and/or damage.
5. Replace the oil pump pipe and screen as necessary.

ENGINE FRONT COVER DISASSEMBLE

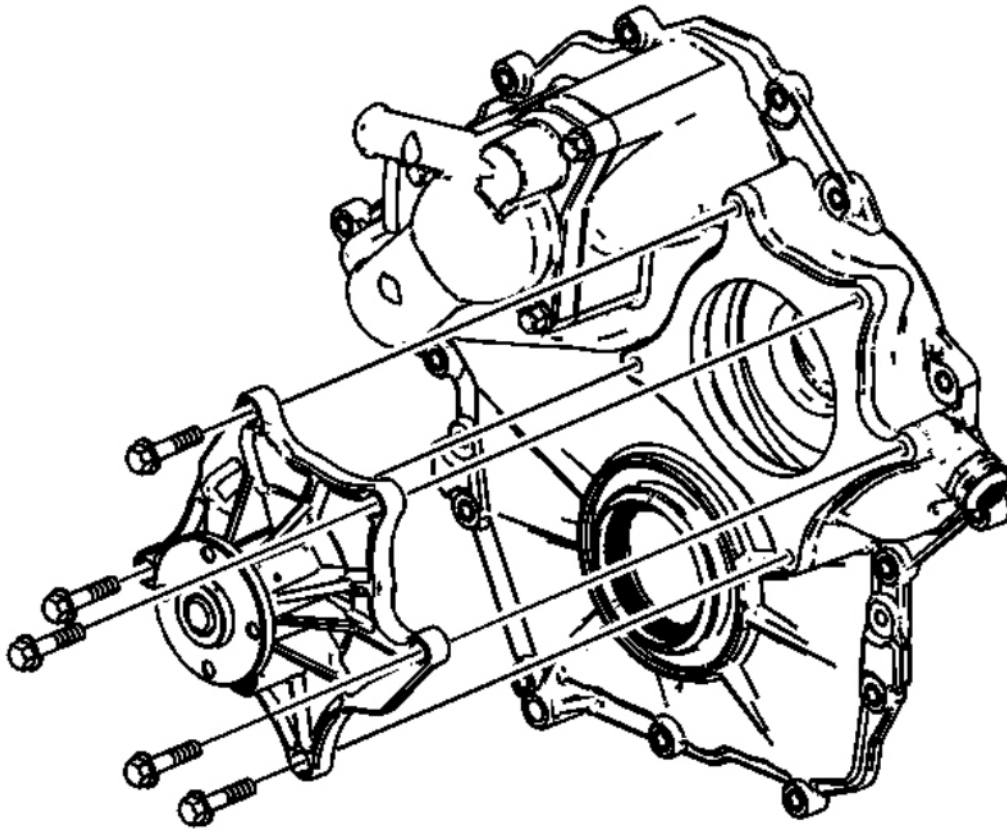


Fig. 187: View Of Water Pump
Courtesy of GENERAL MOTORS CORP.

1. Remove the water pump bolts.
2. Remove the water pump.

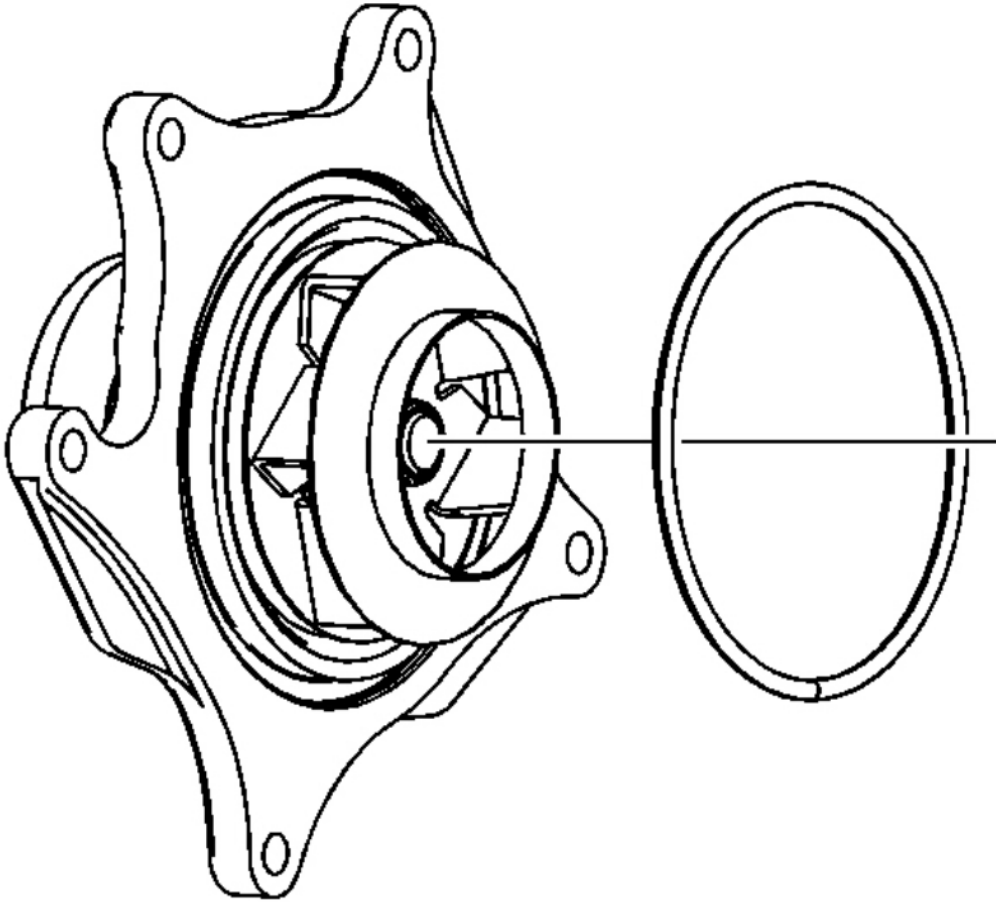


Fig. 188: View Of Water Pump O-Ring
Courtesy of GENERAL MOTORS CORP.

3. Remove and discard the water pump O-ring.

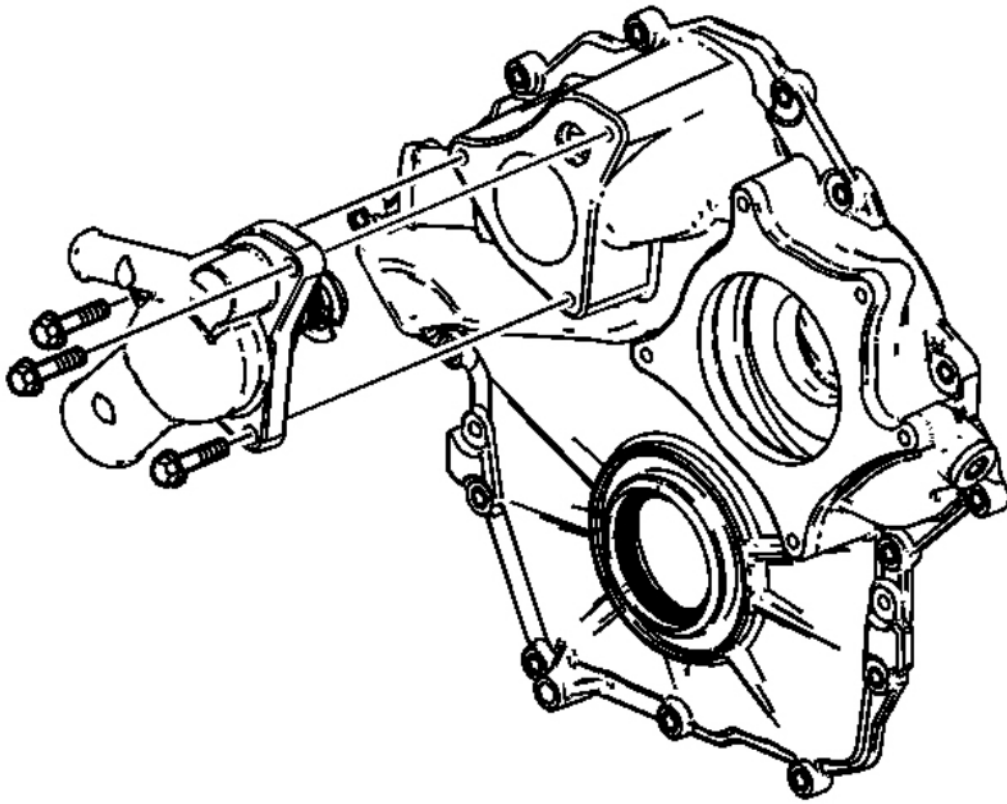


Fig. 189: View Of Thermostat Housing
Courtesy of GENERAL MOTORS CORP.

4. Remove the thermostat housing bolts.
5. Remove the thermostat housing.

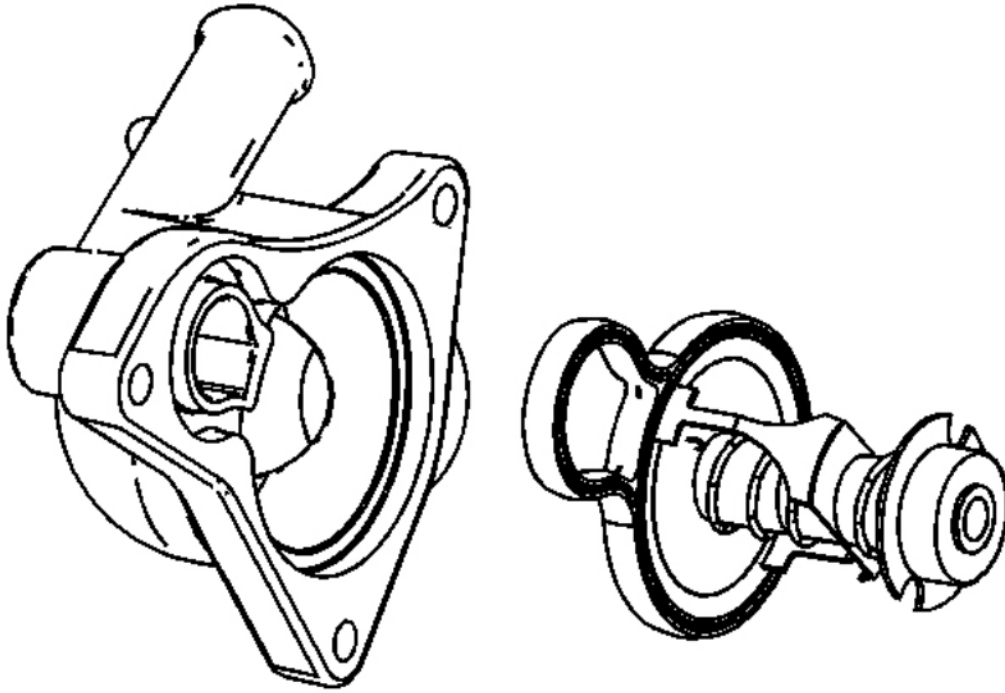


Fig. 190: View Of Thermostat
Courtesy of GENERAL MOTORS CORP.

6. Remove the thermostat and gasket from the thermostat housing.

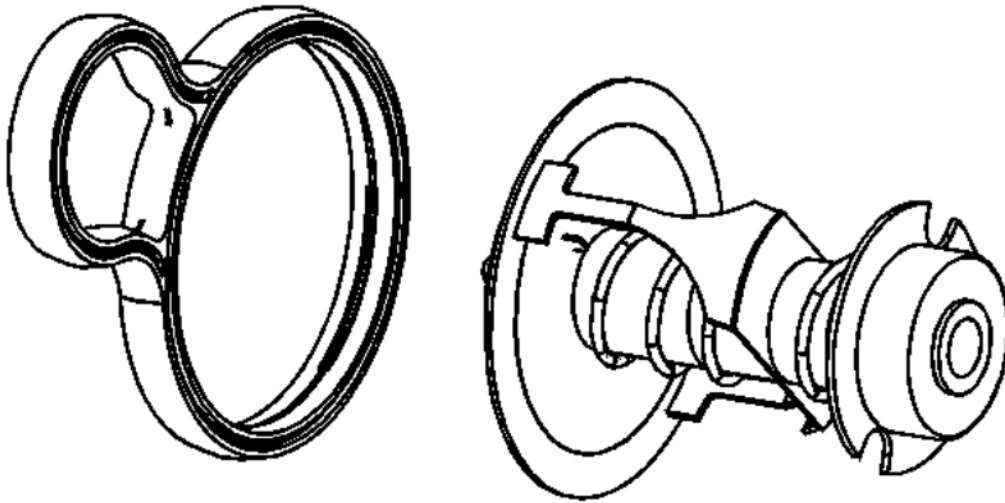


Fig. 191: View Of Thermostat Gasket
Courtesy of GENERAL MOTORS CORP.

7. Remove the thermostat gasket from the thermostat and discard the thermostat gasket.

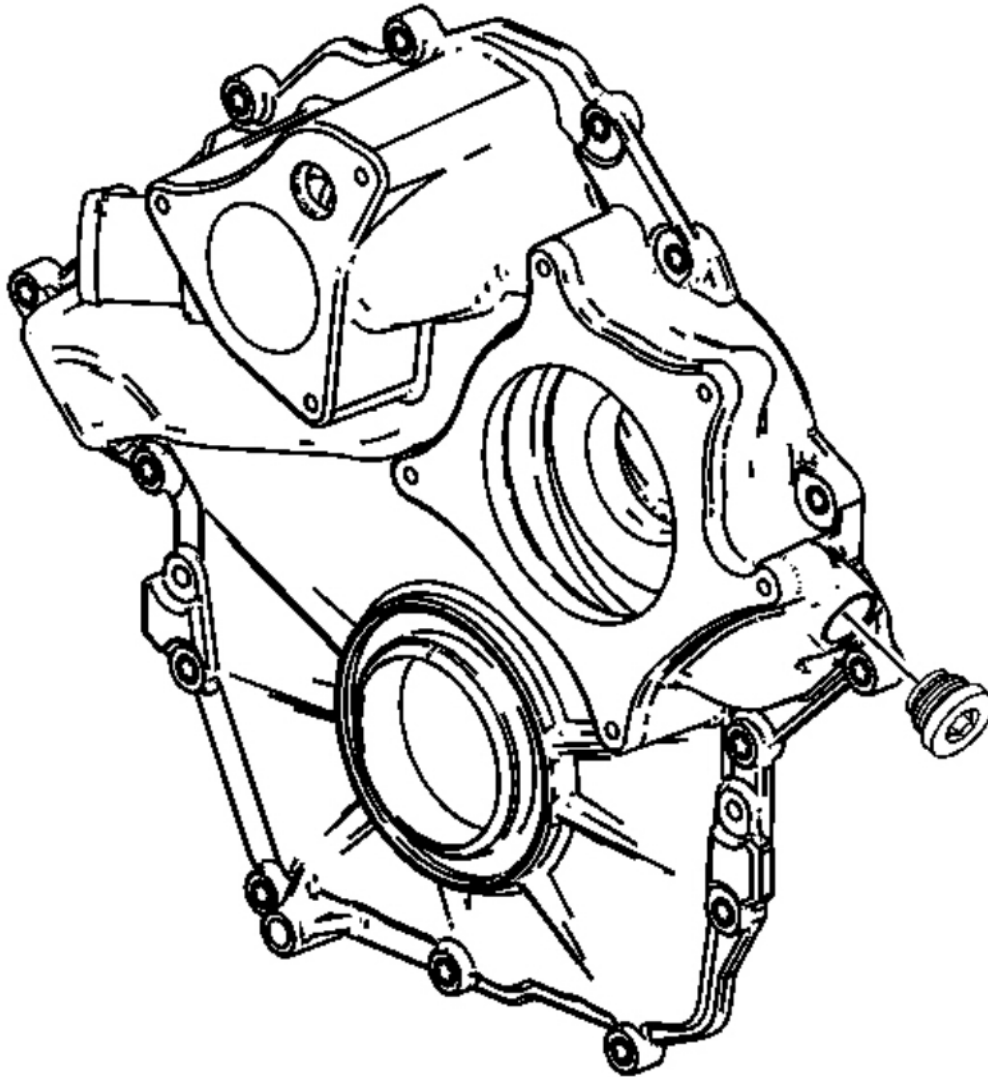


Fig. 192: View Of Engine Front Cover Fitting
Courtesy of GENERAL MOTORS CORP.

8. Remove the engine front cover fitting.

ENGINE FRONT COVER CLEANING AND INSPECTION

Cleaning Procedure

2004 Cadillac SRX

2004 ENGINE Engine Mechanical - 4.6L (LH2) (Repair Instructions, 3 Of 5) - SRX

1. Clean the engine front cover with solvent without the solvent contacting the crankshaft front oil seal.
2. Except for the water pump, clean the other engine front cover components with solvent.

CAUTION: Refer to Safety Glasses Caution in Cautions and Notices.

3. Dry the engine front cover components with compressed air.

Inspection Procedure

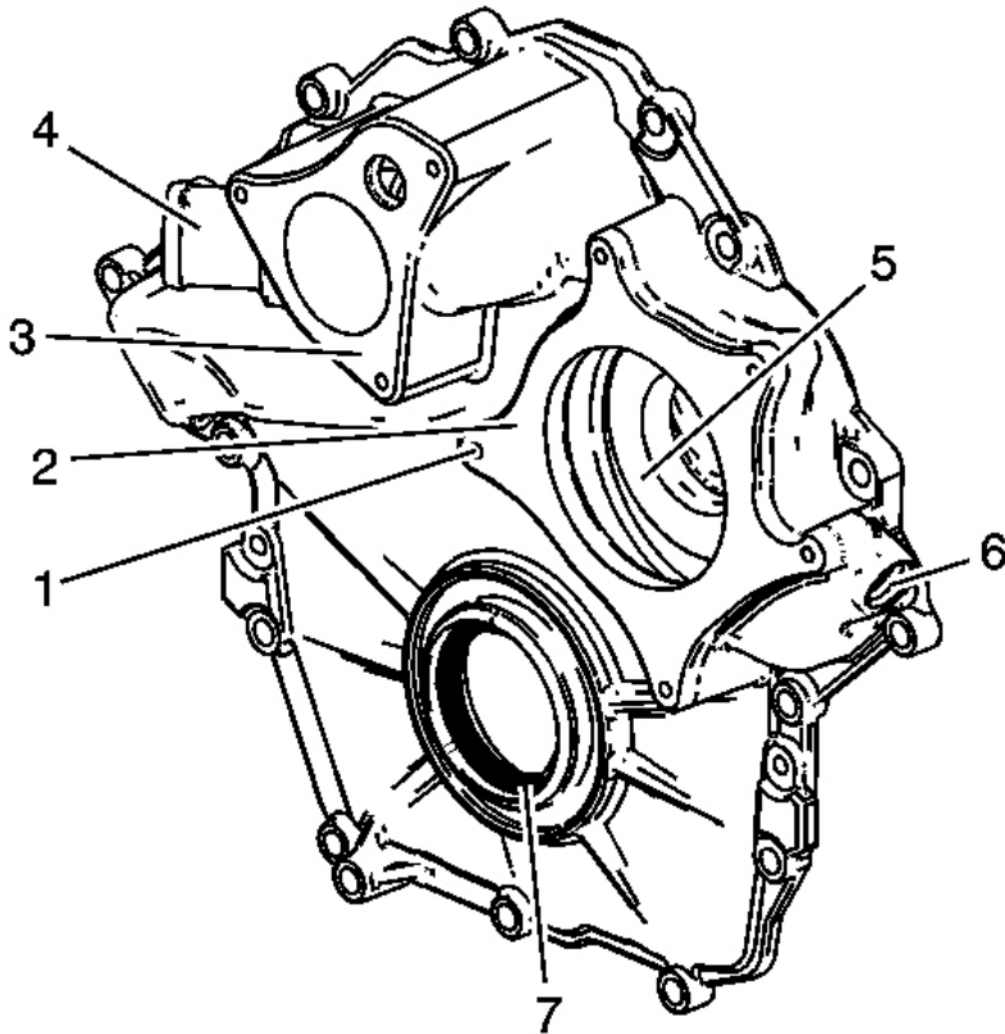


Fig. 193: Inspecting Exterior Of Engine Front Cover
Courtesy of GENERAL MOTORS CORP.

1. Inspect the exterior of the engine front cover for the following conditions:
 - The engine front cover for damaged threads (1)
 - The water pump gasket sealing surface (2) for damage
 - The thermostat gasket sealing surface (3) for damage
 - The crankshaft front oil seal (7) for damage

- Damage to the coolant passages (5)
- The water bypass hose connection (4) for damage
- The fitting threads (6) for damage

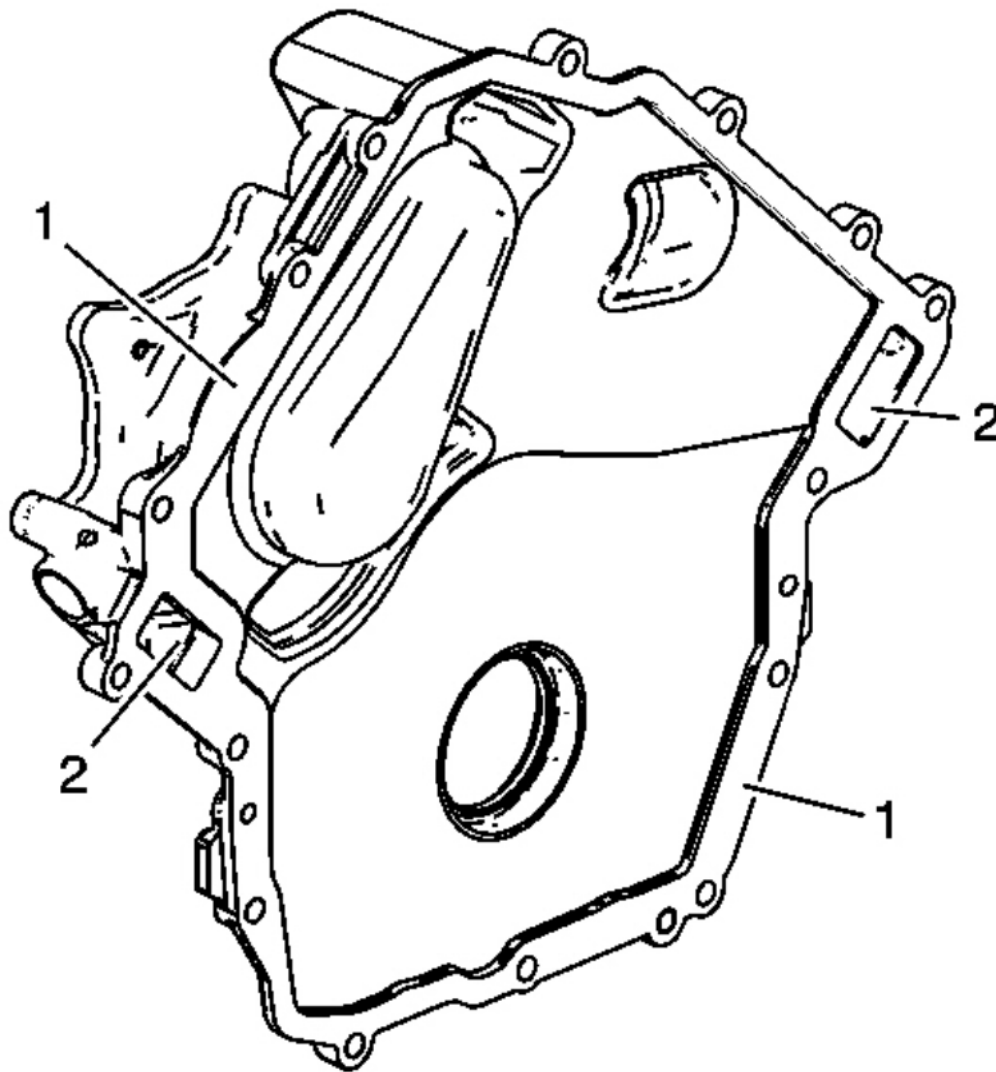


Fig. 194: Inspecting Interior Of Engine Front Cover
Courtesy of GENERAL MOTORS CORP.

2004 Cadillac SRX

2004 ENGINE Engine Mechanical - 4.6L (LH2) (Repair Instructions, 3 Of 5) - SRX

2. Inspect the interior of the engine front cover for the following conditions:
 - Gouges or damage to the engine front cover sealing surface (1)
 - Damage to the coolant passages (2)
3. Repair or replace the engine front cover and/or components as necessary.