

2000 Chevrolet Cab & Chassis C2500

2000-01 ENGINE Engine Mechanical - 5.0L & 5.7L

2000-01 ENGINE**Engine Mechanical - 5.0L & 5.7L****SPECIFICATIONS****FASTENER TIGHTENING SPECIFICATIONS****FASTENER TIGHTENING SPECIFICATIONS**

Application	Specification	
	Metric	English
Accelerator Control Cable Bracket Bolt and Nut	12 N.m	106 lb in
Belt Idler Pulley Bolt	50 N.m	37 lb ft
Camshaft Retainer Bolt	12 N.m	106 lb in
Camshaft Sprocket Bolt	25 N.m	18 lb ft
Connecting Rod Nut		
First Pass	27 N.m	20 lb ft
Final Pass	55 degrees	
Crankshaft Balancer Bolt	95 N.m	70 lb ft
Crankshaft Bearing Cap Bolt and Stud -Preferred Method		
First Pass-Two Bolt Type Bearing Cap	20 N.m	15 lb ft
Final Pass-Two Bolt Type Bearing Cap	73 degrees	
First Pass-Four Bolt Type Bearing Cap	20 N.m	15 lb ft
Final Pass Outboard Bolt-Four Bolt Type Bearing Cap	43 degrees	
Final Pass Inboard Bolt and Stud-Four Bolt Type Bearing Cap	73 degrees	
Crankshaft Bearing Cap Bolt and Stud-Optional Strategy		
Two Bolt Type Bearing Cap	105 N.m	77 lb ft
Inboard Bolt and Stud-Four Bolt Type Bearing Cap	105 N.m	77 lb ft
Outboard Bolt-Four Bolt Type Bearing Cap	90 N.m	66 lb ft
Crankshaft Oil Deflector Nut	40 N.m	30 lb ft
Crankshaft Position Sensor Bolt	9 N.m	80 lb in
Crankshaft Pulley Bolt	58 N.m	43 lb ft
Crankshaft Rear Oil Seal Housing Nut and Bolt	12 N.m	106 lb in
Crankshaft Rear Oil Seal Housing Retainer Stud	6 N.m	53 lb in
Cylinder Head Core Hole Plug	20 N.m	15 lb ft
Cylinder Head Bolt-Optional On-Vehicle Strategy		
First Pass in Sequence	35 N.m	26 lb ft
Second Pass in Sequence	60 N.m	44 lb ft
Final Pass in Sequence	90 N.m	66 lb ft

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Cylinder Head Bolt-Preferred Method

All Bolts First Pass in Sequence	30 N.m	22 lb ft
Long Bolt Final Pass in Sequence	75 degrees	
Medium Bolt Final Pass in Sequence	65 degrees	
Short Bolt Final Pass in Sequence	55 degrees	
Distributor Cap Bolt	2.4 N.m	21 lb in
Distributor Clamp Bolt	25 N.m	18 lb ft
Drive Belt Tensioner Bolt	50 N.m	37 lb ft
EGR Valve Bolt		
First Pass	10 N.m	89 lb in
Final Pass	30 N.m	22 lb ft
EGR Valve Pipe Clamp Bracket Bolt	25 N.m	18 lb ft
EGR Valve Pipe Nut at Exhaust Manifold	30 N.m	22 lb ft
EGR Valve Pipe Nut at Intake Manifold	25 N.m	18 lb ft
Engine Block Coolant Drain Hole Plug	20 N.m	15 lb ft
Engine Block Oil Gallery Plug	20 N.m	15 lb ft
Engine Coolant Temperature (ECT) Gage Sensor	20 N.m	15 lb ft
Engine Flywheel Bolt	100 N.m	74 lb ft
Engine Front Cover Bolt	12 N.m	106 lb in
Engine Lift Bracket Bolt-Special Tool J 41427	15 N.m	11 lb ft
Engine Lift Front Bracket Stud	35 N.m	26 lb ft
Engine Mount Bolt-Through-bolt-to Engine Mount Bracket	95 N.m	70 lb ft
Engine Mount Bolt to Engine Mount Frame Bracket	58 N.m	43 lb ft
Engine Mount Bracket Bolt to Engine	54 N.m	40 lb ft
Engine Mount Bracket Bolt to Frame	45 N.m	33 lb ft
Engine Mount Heat Shield to Engine Mount Bracket	6 N.m	53 lb in
Engine Mount Nut-Through-bolt	68 N.m	50 lb ft
Engine Oil Pressure Gage Sensor	30 N.m	22 lb ft
Engine Oil Pressure Gage Sensor Fitting-Plus Required Angle	15 N.m	11 lb ft
Engine Wiring Harness Bracket Nut	12 N.m	106 lb in
Evaporative Emission (EVAP) Canister Purge Solenoid Valve Stud	10 N.m	89 lb in
Exhaust Manifold Bolt		
First Pass	15 N.m	11 lb ft
Final Pass	30 N.m	22 lb ft
Fan and Water Pump Pulley Bolt	25 N.m	18 lb ft
Fuel Pipe Bracket Bolt	6 N.m	53 lb in
Fuel Pipe Retainer Nut	3 N.m	27 lb in

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Generator and Drive Belt Tensioner Bracket Bolt and Nut to Engine	41 N.m	30 lb ft
Generator and Drive Belt Tensioner Bracket Stud to Engine	20 N.m	15 lb ft
Ignition Coil Stud	12 N.m	106 lb in
Knock Sensor	20 N.m	15 lb ft
Lower Intake Manifold Bolt		
First Pass in Sequence	3 N.m	27 lb in
Second Pass in Sequence	12 N.m	106 lb in
Final Pass in Sequence	15 N.m	11 lb ft
Oil Filter Adapter Bolt	25 N.m	18 lb ft
Oil Filter Fitting	35 N.m	26 lb ft
Oil Level Indicator Tube Bolt	25 N.m	18 lb ft
Oil Pan Bolt or Stud	12 N.m	106 lb in
Oil Pan Drain Plug	25 N.m	18 lb ft
Oil Pan Stud-Front	6 N.m	53 lb in
Oil Pan Stud Nut	25 N.m	18 lb ft
Oil Pump Bolt to Rear Crankshaft Bearing Cap		
First Pass	20 N.m	15 lb ft
Final Pass	65 degrees	
Oil Pump Cover Bolt	12 N.m	106 lb in
Power Steering Pump Bolt	50 N.m	37 lb ft
Power Steering Pump Bracket Bolt to Engine	41 N.m	30 lb ft
Power Steering Pump Bracket Stud Nut	41 N.m	30 lb ft
Power Steering Pump Bracket Stud to Engine	20 N.m	15 lb ft
Power Steering Pump Nut to Engine	41 N.m	30 lb ft
Power Steering Pump Rear Bracket Nut	50 N.m	37 lb ft
Spark Plug		
Initial Installation-NEW Cylinder Head	30 N.m	22 lb ft
All Subsequent Installations	15 N.m	11 lb ft
Spark Plug Wire Support Bolt	12 N.m	106 lb in
Square Socket Plug-Engine Block Oil Gallery	20 N.m	15 lb ft
Throttle Body Stud	9 N.m	80 lb in
Transmission Cover Bolt	12 N.m	106 lb in
Upper Intake Manifold Stud		
First Pass	5 N.m	44 lb in
Final Pass	10 N.m	89 lb in
Valve Lifter Guide Retainer Bolt	25 N.m	18 lb ft
Valve Rocker Arm Cover Bolt	12 N.m	106 lb in
Water Outlet Stud	25 N.m	18 lb ft
Water Pump Bolt	45 N.m	33 lb ft

SEALERS, ADHESIVES & LUBRICANTS

Application	Type of Material	GM Part Number
Camshaft Retainer Bolt	Threadlock	12345382
Crankshaft Balancer Keyway	Adhesive	12346141
Cylinder Head Bolt	Sealant	12346004
Engine Block Core Hole Plug	Threadlock	12345382
Engine Block Coolant Drain Hole Plug	Sealant	12346004
Engine Block to the Crankshaft Rear Oil Seal Housing Junction at the Oil Pan Sealing Surfaces	Adhesive	12346141
Engine Block to the Engine Front Cover Junction at the Oil Pan Sealing Surfaces	Adhesive	12346141
Engine Block at the Lower Intake Manifold Sealing Surfaces	Adhesive	12346141
Engine Block Oil Gallery Plug	Sealant	12346004
Engine Coolant Sensor	Sealant	12346004
Engine Coolant Temperature (ECT) Gage Sensor	Sealant	12346004
Engine Oil	SAE 5W-30 Oil	12345610
Engine Oil Pressure Gage Sensor	Sealant	12346004
Engine Oil Pressure Gage Sensor Fitting	Sealant	12346004
Engine Oil Supplement	Lubricant	1052367
Evaporative Emission (EVAP) Canister Purge Solenoid Valve Stud	Threadlock	12345382
Exhaust Manifold Bolt	Threadlock	12345493
Expansion Cup Plug—Camshaft Rear Bearing Hole	Sealant	12346004
Expansion Cup Plug—Engine Block Core Hole	Sealant	12346004
Fuel Meter Body Bracket Bolt	Threadlock	12345382
Fuel Pipe Bolt	Threadlock	12345382
Knock Sensor	Sealant	12346004
Lower Intake Manifold Bolt	Threadlock	12345382
Oil Level Indicator Tube	Sealant	12346004
Oil Pump Screen Tube	Sealant	12346004
Throttle Body Stud	Threadlock	12345382
Upper Intake Manifold Stud	Threadlock	12345382
Valve Rocker Arm Ball Stud	Lubricant	1052271
Valve Train Component Prelube	Lubricant	12345501
Water Pump Bolt	Sealant	12346004

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Fig. 1: Sealers, Adhesives & Lubricants
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DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - ENGINE MECHANICAL

Begin the system diagnosis by reviewing the **DISASSEMBLED VIEWS**, **ENGINE COMPONENT DESCRIPTION**, **LUBRICATION DESCRIPTION**, **NEW PRODUCT INFORMATION** and **Drive Belt System Description**. Reviewing the description and operation information will help you determine the correct symptom diagnostic procedure when a malfunction exists. Reviewing the description and operation information will also help you determine if the condition described by the customer is normal operation. Refer to **Symptoms - Engine Mechanical** in order to identify the correct procedure for diagnosing the system and where the procedure is located.

SYMPTOMS - ENGINE MECHANICAL

Strategy Based Diagnostics

1. Perform DIAGNOSTIC SYSTEM CHECK before using the symptom tables, if applicable.
2. Review the system operations in order to familiarize yourself with the system functions. Refer to **DISASSEMBLED VIEWS** , **ENGINE COMPONENT DESCRIPTION** , **LUBRICATION DESCRIPTION** , **NEW PRODUCT INFORMATION** and **Drive Belt System Description**.

All diagnosis on a vehicle should follow a logical process. Strategy based diagnostics is a uniform approach for repairing all systems. The diagnostic flow may always be used in order to resolve a system problem. The diagnostic flow is the place to start when repairs are necessary.

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the Engine.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Check for the correct oil level, proper oil viscosity, and correct filter application.
- Verify the exact operating conditions under which the concern exists. Note factors such as engine RPM, ambient temperature, engine temperature, amount of engine warm-up time, and other specifics.
- Compare the engine sounds, if applicable, to a known good engine and make sure you are not trying to correct a normal condition.

Intermittent

Test the vehicle under the same conditions that the customer reported in order to verify the system is operating properly.

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **Base Engine Misfire Without Internal Engine Noises**
- **Base Engine Misfire With Abnormal Internal Lower Engine Noises**
- **Base Engine Misfire With Abnormal Valve Train Noise**
- **Base Engine Misfire With Coolant Consumption**
- **Base Engine Misfire With Excessive Oil Consumption**
- **Engine Compression Test**
- **Engine Noise On Start-Up, But Only Lasting A Few Seconds**
- **Upper Engine Noise, Regardless Of Engine Speed**
- **Lower Engine Noise, Regardless Of Engine Speed**
- **Engine Noise Under Load**
- **Engine Will Not Crank - Crankshaft Will Not Rotate**

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- Oil Consumption Diagnosis
- Oil Pressure Diagnosis And Testing
- Oil Leak Diagnosis

BASE ENGINE MISFIRE WITHOUT INTERNAL ENGINE NOISES

Cause	Correction
High oil pressure	• Verify oil pressure. Refer to <i>Oil Pressure Diagnosis and Testing</i>. • Repair or replace damaged components as required.
Worn, damaged, or improperly installed accessory drive belt – severe cracking, bumps or missing segments A misfire DTC may be present without an actual misfire condition.	• Inspect the accessory drive system components. • Repair or replace damaged components as required. Refer to <i>Drive Belt Replacement</i>.

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Fig. 2: Base Engine Misfire Without Internal Engine Noises (1 Of 3)
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Cause	Correction
Worn, damaged, or improperly installed accessory drive system components A misfire DTC may be present without an actual misfire condition.	- Inspect the accessory drive system components. - Repair or replace damaged components as required.
Damaged, loose or improperly installed crankshaft balancer A misfire DTC may be present without an actual misfire condition.	- Inspect the crankshaft balancer. - Repair or replace damaged components as required. Refer to <i>Crankshaft Balancer Replacement</i>.
Worn, damaged, or improperly installed crankshaft reluctor wheel A worn or damaged crankshaft reluctor wheel can result in different symptoms depending on the severity and location of the wear or damage. - Systems with electronic communications, such as DIS or coil per cylinder, and severe reluctor ring damage may exhibit periodic loss of crankshaft position, stop delivering a signal, and then re-sync the crankshaft position. - Systems with electronic communication, such as DIS or coil per cylinder, and slight reluctor ring damage may exhibit no loss of crankshaft position and no misfire may occur. However, a DTC P0300 may be set. - Systems with mechanical communications, such as high voltage switch, and severe reluctor ring damage may cause additional pulses and effect fuel and spark delivery. A DTC P0300 or P0336 may be set.	- Inspect the crankshaft position sensor. - Inspect the crankshaft reluctor wheel. - Inspect the crankshaft. - Repair or replace damaged components as required.
Damaged, loose or improperly installed engine flywheel A misfire DTC may be present without an actual misfire condition.	- Inspect the flywheel. - Repair or replace damaged components as required. Refer to <i>Engine Flywheel Replacement</i>.
Damaged, improperly installed or restricted exhaust system, collapsed or dented pipes, plugged mufflers or malfunctioning catalytic converters A DTC may be present without an actual fault condition.	- Inspect the exhaust system components. - Repair or replace damaged components as required.
Worn, damaged or improperly installed vacuum hoses	- Inspect the vacuum system components. - Repair or replace damaged components as required.
Damaged or improperly installed MAP sensor – sealing grommet nicked, torn or missing	- Inspect the MAP sensor. - Repair or replace damaged components as required.
Damaged or improperly installed throttle body	- Inspect the throttle body. - Repair or replace damaged components as required.
Damaged or improperly installed intake manifold	- Inspect the intake manifold. - Repair or replace damaged components as required.
Damaged or improperly installed cylinder head Oil consumption may or may not cause the engine to misfire.	- Inspect the spark plugs. - Verify engine compression. Refer to <i>Engine Compression Test</i>. - Inspect the cylinder heads. - Inspect the engine block. - Repair or replace damaged components as required.
Worn, damaged or loose valve rocker arm	- Inspect the valve rocker arms. - Repair or replace damaged components as required.
Worn, damaged or loose valve rotator	- Inspect the valve rotators. - Repair or replace damaged components as required.
Worn, damaged, loose or broken valve spring	- Inspect the valve springs. - Repair or replace damaged components as required.
Worn, damaged or stuck valve – carbon on the valve stem or valve seal	- Inspect the valves. - Inspect the valve guides. - Repair or replace damaged components as required.

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Fig. 3: Base Engine Misfire Without Internal Engine Noises (2 Of 3)
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Cause	Correction
Worn or damaged valve guide	• Inspect the valve guides. • Inspect the valves. • Repair or replace damaged components as required.
Worn, damaged, loose or bent valve push rod	• Inspect the valve push rods. • Repair or replace damaged components as required.
Worn, damaged or dirty valve lifter	• Inspect the valve lifters. • Inspect the camshaft. • Repair or replace damaged components as required.
Worn or damaged camshaft lobe	• Inspect the camshaft. • Inspect the valve lifters. • Repair or replace damaged components as required.
Worn, damaged or loose timing chain and sprockets	• Inspect the timing chain and sprockets. • Repair or replace damaged components as required.
Worn, damaged or improperly installed piston Pistons must be installed with the mark, or dimple, on the top of the piston, facing the front of the engine; piston pins must be centered in the connecting rod pin bore. Oil consumption may or may not cause the engine to misfire.	• Inspect the spark plugs. • Verify engine compression. Refer to <i>Engine Compression Test</i>. • Inspect the cylinder bores. • Inspect the pistons. • Inspect the piston pins. • Inspect the connecting rods. • Repair or replace damaged components as required.

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Fig. 4: Base Engine Misfire Without Internal Engine Noises (3 Of 3)
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BASE ENGINE MISFIRE WITH ABNORMAL INTERNAL LOWER ENGINE NOISES

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Cause	Correction
Worn, damaged, or improperly installed accessory drive belt – severe cracking, bumps or missing segments A misfire DTC may be present without an actual misfire condition.	- Inspect the accessory drive system components. - Repair or replace damaged components as required. Refer to <i>Drive Belt Replacement</i>.
Worn, damaged, or improperly installed accessory drive system components A misfire DTC may be present without an actual misfire condition.	- Inspect the accessory drive system components. - Repair or replace damaged components as required.
Worn, damaged, improperly installed or loose crankshaft balancer A misfire code may be present without an actual misfire condition.	- Inspect the crankshaft balancer. - Repair or replace damaged components as required. Refer to <i>Crankshaft Balancer Replacement</i>.
Worn, damaged, improperly installed or loose engine flywheel A misfire code may be present without an actual misfire condition.	- Inspect the engine flywheel. - Repair or replace damaged components as required. Refer to <i>Engine Flywheel Replacement</i>.
Worn, damaged or improperly installed piston Pistons must be installed with the mark, or dimple, on the top of the piston, facing the front of the engine; piston pins must be centered in the connecting rod pin bore Oil consumption may or may not cause the engine to misfire.	- Inspect the spark plugs. - Verify engine compression. Refer to <i>Engine Compression Test</i>. - Inspect the cylinder bores. - Inspect the pistons. - Inspect the piston pins. - Inspect the connecting rods. - Repair or replace damaged components as required.
Worn, damaged or improperly installed crankshaft thrust bearing A misfire code may be present without an actual misfire condition.	- Inspect the crankshaft. - Inspect the crankshaft thrust bearing. - Repair or replace damaged components as required.

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Fig. 5: Base Engine Misfire With Abnormal Internal Lower Engine Noises
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BASE ENGINE MISFIRE WITH ABNORMAL VALVE TRAIN NOISE

Cause	Correction
Worn, damaged or loose rocker arm	- Inspect the valve rocker arms. - Repair or replace damaged components as required.
Worn, damaged, loose or bent valve push rod	- Inspect the valve push rods. - Repair or replace damaged components as required.
Worn, damaged or stuck valve -- carbon on the valve stem or valve seat	- Inspect the valves. - Inspect the valve guides. - Repair or replace damaged components as required.
Worn, damaged or dirty valve lifter	- Inspect the valve lifters. - Inspect the camshaft. - Repair or replace damaged components as required.
Worn or damaged camshaft lobe	- Inspect the camshaft. - Inspect the valve lifters. - Repair or replace damaged components as required.
Worn, damaged or loose timing chain and sprockets	- Inspect the timing chain and sprockets. - Repair or replace damaged components as required.

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Fig. 6: Base Engine Misfire With Abnormal Valve Train Noise
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BASE ENGINE MISFIRE WITH COOLANT CONSUMPTION

Cause	Correction
Damaged or improperly installed cylinder head Coolant consumption may or may not cause the engine to misfire.	• Inspect the spark plugs. • Verify engine compression. Refer to <i>Engine Compression Test</i>. • Inspect the cylinder heads. • Inspect the engine block. • Repair or replace damaged components as required.

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Fig. 7: Base Engine Misfire With Coolant Consumption
Courtesy of GENERAL MOTORS CORP.

BASE ENGINE MISFIRE WITH EXCESSIVE OIL CONSUMPTION

Cause	Correction
Worn or damaged valve	• Inspect the valves. • Inspect the valve guides. • Repair or replace damaged components as required.
Worn, damaged or improperly installed piston rings Piston rings must be installed with the mark, or dimple, on the top of the piston ring, facing up.	• Inspect the spark plugs. • Verify engine compression. Refer to <i>Engine Compression Test</i>. • Inspect the cylinder bores. • Inspect the pistons. • Inspect the piston pins. • Inspect the connecting rods. • Repair or replace damaged components as required

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Fig. 8: Base Engine Misfire with Excessive Oil Consumption
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ENGINE NOISE ON START-UP, BUT ONLY LASTING A FEW SECONDS

Cause	Correction
Important: A cold piston knock which disappears in 1.5 minutes should be considered acceptable. A cold engine knock usually disappears when the specific cylinder's secondary ignition circuit is grounded out during diagnosis. A light rattle/tapping noise may indicate a valve train, upper engine concern, or a low rumble/knocking may indicate a crankshaft or piston, lower engine concern.	
Incorrect engine oil – viscosity	Install the correct engine oil and oil filter. Refer to <i>Engine Oil and Oil Filter Replacement</i> .
Incorrect oil filter – without anti-drainback feature	Install the correct engine oil and oil filter. Refer to <i>Engine Oil and Oil Filter Replacement</i> .

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Fig. 9: Engine Noise On Start-Up, But Only Lasting A Few Seconds
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Cause	Correction
Worn, damaged or improperly installed oil filter by-pass valve	• Inspect the oil filter by-pass valve. • Repair or replace damaged components as required.
High valve lifter leak down rate	• Inspect the valve lifters. • Repair or replace damaged components as required.
Worn, damaged or improperly installed crankshaft thrust bearing	• Inspect the crankshaft. • Inspect the crankshaft thrust bearing. • Repair or replace damaged components as required.

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Fig. 10: Engine Noise On Start-Up, But Only Lasting A Few Seconds
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UPPER ENGINE NOISE, REGARDLESS OF ENGINE SPEED

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Cause	Correction
Important: A cold piston knock which disappears in 1.5 minutes should be considered acceptable. A cold engine knock usually disappears when the specific cylinder's secondary ignition circuit is grounded out during diagnosis. A light rattle/tapping noise may indicate a valve train, upper engine concern.	
Low oil pressure	• Verify oil pressure. Refer to <i>Oil Pressure Diagnosis and Testing</i>. • Repair or replace damaged components as required.
Improper lubrication of the valve train components	• Verify oil pressure. Refer to <i>Oil Pressure Diagnosis and Testing</i>. • Inspect the valve rocker arms. • Inspect the valve push rods. • Inspect the valve lifters. • Inspect the oil filter bypass valve. • Inspect the oil pump and pump screen. • Inspect the engine block oil galleries. • Repair or replace damaged components as required.
Worn, damaged or improperly installed valve rocker arm	• Inspect the valve rocker arms. • Repair or replace damaged components as required.
Worn or damaged valve rotator	• Inspect the valve rotators. • Repair or replace damaged components as required.
Broken valve spring	• Inspect the valve springs. • Repair or replace damaged components as required.
Worn, damaged or stuck valves – carbon on the valve stem or valve seat	• Inspect the valves. • Inspect the valve guides. • Repair or replace damaged components as required.
Worn or damaged valve guide	• Inspect the valve guides. • Inspect the valves. • Repair or replace damaged components as required.
Worn, damaged or bent valve push rod	• Inspect the valve rocker arms. • Inspect the valve push rods. • Inspect the valve lifters. • Repair or replace damaged components as required.
Worn, damaged or dirty valve lifter	• Inspect the valve lifters. • Repair or replace damaged components as required.
Worn or damaged camshaft lobes	• Inspect the engine camshaft lobes. • Repair or replace damaged components as required.
Worn, damaged, improperly installed or loose timing chain and sprockets	• Inspect the timing chain and sprockets. • Repair or replace damaged components as required.
Worn, damaged or improperly installed timing chain tensioner, if equipped	• Inspect the timing chain tensioner. • Repair or replace damaged components as required.

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Fig. 11: Upper Engine Noise, Regardless Of Engine Speed
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LOWER ENGINE NOISE, REGARDLESS OF ENGINE SPEED

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Cause	Correction
Important: A cold piston knock which disappears in 1.5 minutes should be considered acceptable. A cold engine knock usually disappears when the specific cylinder's secondary ignition circuit is grounded out during diagnosis. A low rumble/knocking may indicate a crankshaft or piston, lower engine concern.	
Low oil pressure	• Verify oil pressure. Refer to <i>Oil Pressure Diagnosis and Testing</i>. • Repair or replace damaged components as required.
Detonation or spark knock	• Verify the operation of the ignition controls system. Refer to <i>Diagnostic System Check - Engine Controls</i>. • Repair or replace damaged components as required.
Worn, damaged or improperly installed accessory drive belt – severe cracking, bumps or missing segments in the accessory drive belt	• Inspect the accessory drive system components. • Repair or replace damaged components as required.
Worn, damaged or improperly installed accessory drive system components	• Inspect the accessory drive system components. • Repair or replace damaged components as required.
Worn, damaged or improperly installed crankshaft balancer	• Inspect the crankshaft balancer. • Inspect the crankshaft. • Repair or replace damaged components as required.
Worn, damaged or improperly installed engine flywheel	• Inspect the engine flywheel. • Inspect the engine flywheel bolts. • Inspect the torque converter. • Inspect the torque converter bolts. • Inspect the crankshaft. • Repair or replace damaged components as required.
Worn, damaged or improperly installed torque converter	• Inspect the torque converter. • Inspect the torque converter bolts. • Inspect the engine flywheel. • Repair or replace damaged components as required.
Damaged oil pan, contacting the oil pump screen An oil pan that has been damaged may loosen, improperly position or restrict oil flow at the oil pump screen, preventing proper oil flow to the oil pump.	• Inspect the oil pan. • Inspect the oil pump screen. • Repair or replace damaged components as required.
Worn, damaged, improperly installed or restricted oil pump screen An oil pan that has been damaged may loosen, improperly position or restrict oil flow at the oil pump screen, preventing proper oil flow to the oil pump.	• Inspect the oil pan. • Inspect the oil pump screen. • Repair or replace damaged components as required.
Worn, damaged or improperly installed piston Pistons must be installed with the mark, or dimple, on the top of the piston, facing the front of the engine; piston pins must be centered in the connecting rod pin bore.	• Inspect the spark plugs. • Verify engine compression. Refer to <i>Engine Compression Test</i>. • Inspect the cylinder bores. • Inspect the pistons. • Inspect the piston pins. • Inspect the connecting rods. • Repair or replace damaged components as required.
Worn, damaged or improperly installed connecting rod bearing	• Inspect the connecting rods. • Inspect the connecting rod bearings. • Inspect the crankshaft connecting rod journals. • Repair or replace damaged components as required.
Worn, damaged or improperly installed crankshaft bearing	• Inspect the crankshaft bearings. • Inspect the crankshaft journals. • Repair or replace damaged components as required.

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Fig. 12: Lower Engine Noise, Regardless Of Engine Speed
 Courtesy of GENERAL MOTORS CORP.

ENGINE NOISE UNDER LOAD

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Cause	Correction
Important: A cold piston knock which disappears in 1.5 minutes should be considered acceptable. A cold engine knock usually disappears when the specific cylinder's secondary ignition circuit is grounded out during diagnosis. A low rumble/knocking may indicate a crankshaft or piston, lower engine concern.	
Low oil pressure	• Perform an oil pressure test. Refer to <i>Oil Pressure Diagnosis and Testing</i>. • Repair or replace as required.
Detonation or spark knock	• Verify the correct operation of the ignition controls. Refer to <i>Diagnostic System Check - Engine Controls</i>. • Repair or replace damaged components as required.
Worn, damaged or improperly installed engine flywheel	• Inspect the engine flywheel. • Inspect the engine flywheel bolts. • Inspect the torque converter. • Inspect the torque converter bolts. • Inspect the crankshaft. • Repair or replace damaged components as required.
Worn, damaged or improperly installed torque converter	• Inspect the torque converter. • Inspect the torque converter bolts. • Inspect the engine flywheel. • Repair or replace damaged components as required.
Worn, damaged or improperly installed pistons Pistons must be installed with the mark, or dimple, on the top of the piston, facing the front of the engine; piston pins must be centered in the connecting rod pin bore.	• Inspect the cylinder bores. • Inspect the pistons. • Inspect the piston pins. • Inspect the connecting rods. • Repair or replace damaged components as required.
Worn, damaged or improperly installed connecting rod bearing	• Inspect the connecting rods. • Inspect the connecting rod bearings. • Inspect the crankshaft connecting rod journals. • Repair or replace damaged components as required.
Worn, damaged or improperly installed crankshaft bearing	• Inspect the crankshaft bearings. • Inspect the crankshaft journals. • Repair or replace damaged components as required.

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Fig. 13: Engine Noise Under Load
Courtesy of GENERAL MOTORS CORP.

ENGINE WILL NOT CRANK - CRANKSHAFT WILL NOT ROTATE

2000 Chevrolet Cab & Chassis C2500

2000-01 ENGINE Engine Mechanical - 5.0L & 5.7L

Cause	Correction
Seized accessory drive system component	1. Remove the accessory drive belts. 2. Rotate the crankshaft by hand at the balancer or flywheel location.
Hydraulically locked cylinder • Coolant/antifreeze in cylinder • Oil in cylinder • Fuel in cylinder	1. Remove the spark plugs and check for fluid. 2. Inspect for broken head gasket. 3. Inspect for cracked engine block or cylinder head. 4. Inspect for a sticking fuel injector.
Seized automatic transmission torque converter	1. Remove the torque converter bolts. 2. Rotate crankshaft by hand at the balancer or flywheel location.
Seized manual transmission	1. Disengage the clutch. 2. Rotate crankshaft by hand at the balancer or flywheel location. Refer to Unit Repair Manual - Manual Transmission.

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Fig. 14: Engine Will Not Crank - Crankshaft Will Not Rotate (1 Of 2)
Courtesy of GENERAL MOTORS CORP.

Cause	Correction
Broken timing chain and/or gears	• Inspect timing chain and gears. • Repair as required.
Material in cylinder • Broken valve • Piston material • Foreign material	• Inspect cylinder for damaged components and/or foreign materials. • Repair or replace as required.
Seized crankshaft or connecting rod bearings	• Inspect crankshaft and connecting rod bearings. • Repair as required.
Bent or broken connecting rod	• Inspect connecting rods. • Repair as required.
Broken crankshaft	• Inspect crankshaft. • Repair as required.

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Fig. 15: Engine Will Not Crank - Crankshaft Will Not Rotate (2 Of 2)
Courtesy of GENERAL MOTORS CORP.

ENGINE COMPRESSION TEST

1. Ensure that the vehicle batteries are in good condition, and fully charged.
2. Operate the vehicle until the engine is at normal operating temperature.
3. Disconnect the positive ignition coil wire plug from the ignition coil.
4. Disconnect the fuel injector electrical connector.
5. Remove all of the spark plugs.

NOTE: Do not insert objects into the throttle plate opening. Damage to the throttle body can result, requiring replacement of the throttle body assembly.

6. Block the throttle linkage wide-open.
7. Install the engine cylinder compression gage to the cylinder being tested.
8. Using the vehicle starter motor, rotate, or crank the engine for 4 compression strokes, or puffs, for the cylinder being tested. If the engine rotates for more than 4 compression strokes, test the cylinder again.
9. Record the compression reading.
10. Remove the engine cylinder compression gage from the cylinder being tested.
11. Repeat steps 8-11 for each additional cylinder. All cylinders must be tested to obtain valid test results.
12. Check the compression readings. Refer to **SPECIFICATIONS**.

- Normal

The compression builds up quickly and evenly to the specified compression.

- Leaking

The compression is low on the first compression stroke. The compression builds up with the following strokes, but does not reach the specified compression.

13. If any cylinders have low compression, inject approximately 15 ml (1 oz) of engine oil into the cylinder through the spark plug hole.
14. Repeat steps 8-11 for all low compression cylinders.
15. Check the compression readings. Refer to **SPECIFICATIONS**

- Piston rings leaking

Compression is low on the first compression stroke. The compression builds up on the following strokes, but does not reach normal. Compression improves considerably when you add oil.

- Valves leaking

Compression is low on the first compression stroke. The compression does not build up on the following strokes, and does not reach normal. Compression does not improve much, if at all, when you add oil.

- Head gasket leaking

Compression is low on the first stroke. The compression does not build up on the following strokes, and does not reach normal. Compression does not improve much, if at all, when you add oil. Adjacent cylinders have the same, or similar, low compression readings.

16. If one or more cylinders fails to meet the minimum specified compression, repair or replace all damaged or worn components and test the engine again.

OIL CONSUMPTION DIAGNOSIS

Excessive oil consumption, not due to leaks, is the use of 1 liter (1 quart) of engine oil within 3 200 kilometers (2,000 miles). However, during initial engine break-in periods 4 828-6 437 kilometers (3,000-4,000 miles), oil

consumption may exceed 1 liter (1 quart) or more. The causes of excessive oil consumption include the following conditions:

- External oil leaks

Tighten the bolts and/or replace gaskets and oil seals as necessary.

- Incorrect oil level or improper reading of oil level indicator

With the vehicle on a level surface, allow adequate drain down time and check for the correct oil level.

- Improper oil viscosity

Use recommended SAE viscosity for the prevailing temperatures.

- Continuous high speed driving and/or severe usage
- Crankcase ventilation system restrictions or malfunctioning components
- Valve guides and/or valve stem oil seals worn, damaged, or the seal omitted

Ream the valve guides and install oversize service valves and/or new valve stem oil seals.

- Piston rings broken, improperly installed, worn, or not seated properly

Allow adequate time for the piston rings to seat. Replace broken or worn piston rings as necessary.

- Piston improperly installed or miss-fitted

OIL PRESSURE DIAGNOSIS AND TESTING

1. With the vehicle on a level surface, allow adequate drain down time, 2-3 minutes, and measure for a low engine oil level.

Add the recommended grade engine oil, and fill the crankcase until the oil level measures FULL on the oil level indicator.

2. Operate the engine and verify low or no oil pressure on the vehicle oil pressure gage or the oil indicator light.

Listen for a noisy valve train or a knocking noise.

3. Inspect for the following:

- Engine oil diluted by moisture or unburned fuel mixtures
- Improper engine oil viscosity for the expected temperature
- Incorrect or faulty oil pressure gage sensor
- Incorrect or faulty oil pressure gage

- Plugged oil filter
 - Malfunctioning oil filter bypass valve
4. Remove the oil pressure gage sensor or another engine block oil gallery plug.
 5. Install an oil pressure gage.
 6. Start the engine and then allow the engine to reach normal operation temperature.
 7. Measure the engine oil pressure at the following RPM:

Specification

- 7.1. 42 kPa (6 psig, minimum, at 1,000 RPM)
 - 7.2. 125 kPa (18 psig, minimum, at 2,000 RPM)
 - 7.3. 166 kPa (24 psig, minimum, at 4,000 RPM)
8. If the engine oil pressure is below minimum specifications, inspect the engine for one or more of the following:
 - Oil pump worn or dirty
 - Malfunctioning oil pump pressure relief valve
 - Oil pump screen loose, plugged, or damaged
 - Excessive bearing clearance
 - Cracked, porous or restricted oil galleries
 - Engine block oil gallery plugs missing or incorrectly installed
 - Broken valve lifters

OIL LEAK DIAGNOSIS

2000 Chevrolet Cab & Chassis C2500

2000-01 ENGINE Engine Mechanical - 5.0L & 5.7L

Step	Action	Yes	No
Important: You can repair most fluid leaks by first visually locating the leak, repairing or replacing the component, or by resealing the gasket surface. Once the leak is identified, determine the cause of the leak. Repair the cause of the leak as well as the leak itself.			
1	1. Operate the vehicle until it reaches normal operating temperature. 2. Park the vehicle on a level surface, over a large sheet of paper or other clean surface. 3. Wait 15 minutes. 4. Check for drippings. Are drippings present?	Go to <i>Step 2</i>	System OK
2	Can you identify the type of fluid and the approximate location of the leak?	Go to <i>Step 10</i>	Go to <i>Step 3</i>
3	1. Visually inspect the suspected area. Use a small mirror to assist in looking at hard to see areas. 2. Check for leaks at the following locations: • Sealing surfaces • Fittings • Cracked or damaged components Can you identify the type of fluid and the approximate location of the leak?	Go to <i>Step 10</i>	Go to <i>Step 4</i>
4	1. Completely clean the entire engine and surrounding components. 2. Operate the vehicle for several kilometers – miles at normal operating temperature and at varying speeds. 3. Park the vehicle on a level surface, over a large sheet of paper or other clean surface. 4. Wait 15 minutes. 5. Identify the type of fluid, and the approximate location of the leak. Can you identify the type of fluid and the approximate location of the leak?	Go to <i>Step 10</i>	Go to <i>Step 5</i>
5	1. Visually inspect the suspected area. Use a small mirror to assist in looking at hard to see areas. 2. Check for leaks at the following locations: • Sealing surfaces • Fittings • Cracked or damaged components Can you identify the type of fluid and the approximate location of the leak?	Go to <i>Step 10</i>	Go to <i>Step 6</i>
6	1. Completely clean the entire engine and surrounding components. 2. Apply an aerosol-type powder, baby powder, foot powder, etc., to the suspected area. 3. Operate the vehicle for several kilometers (miles) at normal operating temperature and at varying speeds. 4. Identify the type of fluid, and the approximate location of the leak, from the discolorations in the powder surface. Can you identify the type of fluid and the approximate location of the leak?	Go to <i>Step 10</i>	Go to <i>Step 7</i>

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Fig. 16: Oil Leak Diagnosis (1 Of 2)

Courtesy of GENERAL MOTORS CORP.

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Step	Action	Yes	No
7	1. Visually inspect the suspected area. Use a small mirror to assist in looking at hard to see areas. 2. Check for leaks at the following locations: • Sealing surfaces • Fittings • Cracked or damaged components Can you identify the type of fluid and the approximate location of the leak?	Go to Step 10	Go to Step 8
8	Use J 28428-E High Intensity Black Light Kit in order to identify the type of fluid, and the approximate location of the leak. Refer to the manufacturer's instructions when using the tool. Can you identify the type of fluid and the approximate location of the leak?	Go to Step 10	Go to Step 9
9	1. Visually inspect the suspected area. Use a small mirror to assist in looking at hard to see areas. 2. Check for leaks at the following locations: • Sealing surfaces • Fittings • Cracked or damaged components Can you identify the type of fluid and the approximate location of the leak?	Go to Step 10	System OK
10	1. Inspect the engine for mechanical damage. Special attention should be shown to the following areas: • Higher than recommended fluid levels • Higher than recommended fluid pressures • Plugged or malfunctioning fluid filters or pressure bypass valves • Plugged or malfunctioning engine ventilation system • Improperly tightened or damaged fasteners • Cracked or porous components • Improper sealants or gaskets where required • Improper sealant or gasket installation • Damaged or worn gaskets or seals • Damaged or worn sealing surfaces 2. Inspect the engine for customer modifications. Is there mechanical damage, or customer modifications to the engine?	Go to Step 11	System OK
11	Repair or replace all damaged or modified components. Does the engine still leak oil?	Go to Step 1	System OK

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Fig. 17: Oil Leak Diagnosis (2 Of 2)

Courtesy of GENERAL MOTORS CORP.

DRIVE BELT CHIRPING DIAGNOSIS**Diagnostic Aids**

The symptom may be intermittent due to moisture on the drive belt or the pulleys. It may be necessary to spray a small amount of water on the drive belt in order to duplicate the customers concern. If spraying water on the drive belt duplicates the symptom, cleaning the belt pulleys may be the probable solution.

A loose or improper installation of a body component, a suspension component, or other items of the vehicle may cause the chirping noise.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. The noise may not be engine related. This step is to verify that the engine is making the noise. If the engine is not making the noise do not proceed further with this table.
3. The noise may be an internal engine noise. Removing the drive belt and operating the engine for a brief period will verify the noise is related to the drive belt. When removing the drive belt the water pump may not be operating and the engine may overheat. Also DTCs may set when the engine is operating with the drive belt removed.
4. Inspect all drive belt pulleys for pilling. Pilling is the small balls or pills or it may be strings in the drive belt grooves from the accumulation of rubber dust.
6. Misalignment of the pulleys may be caused from improper mounting of the accessory drive component, incorrect installation of the accessory drive component pulley, or the pulley bent inward or outward from a previous repair. Test for a misalign pulley using a straight edge in the pulley grooves across 2 or 3 pulleys. If a misalign pulley is found refer to that accessory drive component for the proper installation procedure for that pulley.
10. Inspecting of the fasteners can eliminate the possibility that a wrong bolt, nut, spacer, or washer was installed.
12. Inspecting the pulleys for being bent should include inspecting for a dent or other damage to the pulleys that would prevent the drive belt from not seating properly in all of the pulley grooves or on the smooth surface of a pulley when the back side of the belt is used to drive the pulley.
14. Replacing the drive belt when it is not damaged or there is not excessive pilling will only be a temporary repair.

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Step	Action	Yes	No
Notice: Refer to <i>Belt Dressing Notice</i> in Cautions and Notices. DEFINITION: The following items are indications of chirping: • A high pitched noise that is heard once per revolution of the drive belt or a pulley. • Chirping usually occurs on cold damp mornings and will subside once vehicle reaches normal operating temperature.			
1	Did you review the Drive Belt Symptom operation and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Engine Mechanical
2	Verify that there is a chirping noise. Does the engine make the chirping noise?	Go to Step 3	Go to Diagnostic Aids
3	1. Remove the drive belt. 2. Operate the engine for no longer than 30 to 40 seconds. Does the chirping noise still exist?	Go to Symptoms - Engine Mechanical	Go to Step 4
4	Inspect for severe pilling exceeding 1/3 of the belt groove depth. Does the belt grooves have pilling?	Go to Step 5	Go to Step 6
5	Clean the drive belt pulleys with a suitable wire brush. Did you complete the repair?	Go to Step 15	Go to Step 6
6	Inspect for misalignment of the pulleys. Are any of the pulleys misaligned?	Go to Step 7	Go to Step 8
7	Replace or repair any misaligned pulleys. Did you complete the repair?	Go to Step 15	Go to Step 8
8	Inspect for bent or cracked brackets. Did you find any bent or cracked brackets?	Go to Step 9	Go to Step 10
9	Replace any bent or cracked brackets. Did you complete the repair?	Go to Step 15	Go to Step 10
10	Inspect for improper, loose or missing fasteners. Did you find the condition?	Go to Step 11	Go to Step 12
11	Tighten any loose fasteners. Replace any improper or missing fasteners. Refer to <i>Fastener Tightening Specifications</i> . Did you complete the repair?	Go to Step 15	Go to Step 12
12	Inspect for a bent pulley. Did you find the condition?	Go to Step 13	Go to Step 14
13	Replace the bent pulley. Did you complete the repair?	Go to Step 15	Go to Step 14
14	Replace the drive belt. Refer to <i>Drive Belt Replacement</i> . Did you complete the repair?	Go to Step 15	Go to Diagnostic Aids
15	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

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Fig. 18: Drive Belt Chirping Diagnosis
 Courtesy of GENERAL MOTORS CORP.

DRIVE BELT SQUEAL DIAGNOSIS

Diagnostic Aids

A loose or improper installation of a body component, a suspension component, or other items of the vehicle may cause the squeal noise.

If the noise is intermittent, verify the accessory drive components by varying their loads making sure they are operated to their maximum capacity. An overcharged A/C system, power steering system with a pinched hose or wrong fluid, or a generator failing are suggested items to inspect.

Test Description

The number(s) below refer to the step number(s) on the diagnostic table.

2. The noise may not be engine related. This step is to verify that the engine is making the noise. If the engine is not making the noise do not proceed further with this table.
3. The noise may be an internal engine noise. Removing the drive belt and operating the engine for a brief period will verify the squeal noise is the drive belt(s) or an accessory drive component. When removing the drive belt the water pump may not be operating and the engine may overheat. Also DTCs may set when the engine is operating with the drive belt removed.
4. This test is to verify that an accessory drive component does not have a seized bearing. With the belt remove test the bearings in the accessory drive components for turning smoothly. Also test the accessory drive components with the engine operating by varying the load on the components to verify that the components operate properly.
5. This test is to verify that the drive belt tensioner operates properly. If the drive belt tensioner is not operating properly, proper belt tension may not be achieved to keep the drive belt from slipping which could cause a squeal noise.
6. This test is to verify that the drive belt(s) is not too long, which would prevent the drive belt tensioner from working properly. Also if an incorrect length drive belt was installed, it may not be routed properly and may be turning an accessory drive component in the wrong direction.
7. Misalignment of the pulleys may be caused from improper mounting of the accessory drive component, incorrect installation of the accessory drive component pulley, or the pulley bent inward or outward from a previous repair. Test for a misalign pulley using a straight edge in the pulley grooves across two or three pulleys. If a misalign pulley is found refer to that accessory drive component for the proper installation procedure for that pulley.
8. This test is to verify that the pulleys are the correct diameter or width. Using a known good vehicle compare the pulley sizes.

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Step	Action	Yes	No
Notice: Refer to <i>Belt Dressing Notice</i> in Cautions and Notices. DEFINITION: The following items are indications of drive belt squeal: • A loud screeching noise that is caused by a slipping drive belt (this is unusual for a drive belt with multiple ribs) • The noise occurs when a heavy load is applied to the drive belt, such as an air conditioning compressor engagement snapping the throttle, or slipping on a seized pulley or a faulty accessory drive component.			
1	Did you review the Drive Belt Symptom operation and perform the necessary inspections?	Go to <i>Step 2</i>	Go to <i>Symptoms - Engine Mechanical</i>
2	Verify that there is a squeal noise. Does the engine make the squeal noise?	Go to <i>Step 3</i>	Go to Diagnostic Aids
3	1. Remove the drive belt(s). 2. Operate the engine for no longer than 30 to 40 seconds. Does the noise still exist?	Go to <i>Symptoms - Engine Mechanical</i>	Go to <i>Step 4</i>
4	Inspect for an accessory drive component seized bearing or a faulty accessory drive component. Did you find and correct the condition?	Go to <i>Step 9</i>	Go to <i>Step 5</i>
5	Test the drive belt tensioner for proper operation. Refer to <i>Drive Belt Tensioner Diagnosis</i> . Did you find and correct the condition?	Go to <i>Step 9</i>	Go to <i>Step 6</i>
6	Inspect for the correct drive belt length. Refer to <i>Drive Belt Replacement</i> . Did you find and correct the condition?	Go to <i>Step 9</i>	Go to <i>Step 7</i>
7	Inspect for misalignment of a pulley. Did you find and correct the condition?	Go to <i>Step 9</i>	Go to <i>Step 8</i>
8	Inspect for the correct pulley size. Did you find and correct the condition?	Go to <i>Step 9</i>	Go to Diagnostic Aids
9	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to <i>Step 3</i>

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Fig. 19: Drive Belt Squeal Diagnosis
Courtesy of GENERAL MOTORS CORP.

DRIVE BELT WHINE DIAGNOSIS

Diagnostic Aids

The drive belt(s) will not cause the whine noise.

If the whine noise is intermittent, verify the accessory drive components by varying their loads making sure they are operated to their maximum capacity. Such items but not limited to may be an A/C system overcharged, the power steering system restricted or the wrong fluid, or the generator failing.

Test Description

The number(s) below refer to the step number(s) on the diagnostic table.

3. This test is to verify that the noise is being caused by the drive belt(s) or the accessory drive components. When removing the drive belt the water pump may not be operating and the engine may overheat. Also DTCs may set when the engine is operating with the drive belt removed.

4. The inspection should include checking the drive belt tensioner and the drive belt idler pulley bearings. The drive belt(s) may have to be installed and the accessory drive components operated separately by varying their loads. Refer to the suspected accessory drive component for the proper inspection and

replacement procedure.

Step	Action	Yes	No
Notice: Refer to <i>Belt Dressing Notice</i> in Cautions and Notices. DEFINITION: A high pitched continuous noise that may be caused by an accessory drive component failed bearing.			
1	Did you review the Drive Belt Symptom operation and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Engine Mechanical
2	Verify that there is a whine noise. Does the engine make the whine noise?	Go to Step 3	Go to Diagnostic Aids
3	1. Remove the drive belt(s). 2. Operate the engine for no longer than 30 to 40 seconds. Does the whine noise still exist?	Go to Symptoms - Engine Mechanical	Go to Step 4
4	Inspect for a failed accessory drive component bearing. Did you find and repair the condition?	Go to Step 5	Go to Diagnostic Aids
5	Operate the system in order to verify the repair. Did you correct the condition?	System OK	—

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Fig. 20: Drive Belt Whine Diagnosis
 Courtesy of GENERAL MOTORS CORP.

DRIVE BELT RUMBLING DIAGNOSIS

Diagnostic Aids

Vibration from the engine operating may cause a body component or another part of the vehicle to make rumbling noise.

The drive belt(s) may have a condition that can not be seen or felt. Sometimes replacing the drive belt may be the only repair for the symptom.

If replacing the drive belt(s), completing the diagnostic table, and the noise is only heard when the drive belt(s) is installed, there might be an accessory drive component with a failure. Varying the load on the different accessory drive components may aid in identifying which component is causing the rumbling noise.

Test Description

The number(s) below refer to the step number(s) on the diagnostic table.

- This test is to verify that the symptom is present during diagnosing. Other vehicle components may cause a similar symptom.
- This test is to verify that the drive belt(s) is causing the rumbling noise. Rumbling noise may be confused with an internal engine noise due to the similarity in the description. Remove only one drive belt at a time if the vehicle has multiple drive belts. When removing the drive belt the water pump may not be operating and the engine may overheat. Also DTCs may set when the engine is operating with the drive belt removed.
- Inspecting the drive belt(s) is to ensure that it is not causing a the noise. Small cracks across the ribs of the drive belt will not cause the noise. Belt separation is identified by the plys of the belt separating and may be seen at the edge of the belt our felt as a lump in the belt.

5. Small amounts of pilling is normal condition and acceptable. When the pilling is severe the drive belt does not have a smooth surface for proper operation.

Step	Action	Yes	No
Notice: Refer to <i>Belt Dressing Notice</i> in Cautions and Notices. DEFINITION: • A low pitch tapping, knocking, or thumping noise heard at or just above idle. • Heard once per revolution of the drive belt or a pulley. • Rumbling may be caused from: – Pilling, the accumulation of rubber dust that forms small balls (pills) or strings in the drive belt pulley groove – The separation of the drive belt – A damaged drive belt			
1	Did you review the Drive Belt Symptom operation and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Engine Mechanical
2	Verify that there is a rumbling noise. Does the engine make the rumbling noise?	Go to Step 3	Go to Diagnostic Aids
3	1. Remove the drive belt(s). 2. Operate the engine for no longer than 30 to 40 seconds. Does the rumbling noise still exist?	Go to Symptoms - Engine Mechanical	Go to Step 4
4	Inspect the drive belt(s) for damage, separation, or sections of missing ribs. Did you find any of these conditions?	Go to Step 7	Go to Step 5
5	Inspect for severe pilling of more than 1/3 of the drive belt pulley grooves. Did you find severe pilling?	Go to Step 6	Go to Step 7
6	1. Clean the drive belt pulleys using a suitable wire brush. 2. Reinstall the drive belt. Refer to <i>Drive Belt Replacement</i> . Did you complete the repair?	Go to Step 8	Go to Step 7
7	Install a new drive belt. Refer to <i>Drive Belt Replacement</i> . Did you complete the replacement?	Go to Step 8	—
8	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Diagnostic Aids

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Fig. 21: Drive Belt Rumbling Diagnosis
Courtesy of GENERAL MOTORS CORP.

DRIVE BELT VIBRATION DIAGNOSIS

Diagnostic Aids

The accessory drive components can have an affect on engine vibration. Such as but not limited to the A/C system over charged, the power steering system restricted or the incorrect fluid, or an extra load on the generator. To help identify an intermittent or an improper condition, vary the loads on the accessory drive components.

Test Description

The number(s) below refer to the step number(s) on the diagnostic table.

2. This test is to verify that the symptom is present during diagnosing. Other vehicle components may cause a similar symptom such as the exhaust system, or the drivetrain.

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3. This test is to verify that the drive belt(s) or accessory drive components may be causing the vibration. When removing the drive belt the water pump may not be operating and the engine may overheat. Also DTCs may set when the engine is operating with the drive belt removed.
4. The drive belt(s) may cause a vibration. While the drive belt(s) is removed this is the best time to inspect the condition of the belt.
6. Inspecting of the fasteners can eliminate the possibility that a wrong bolt, nut, spacer, or washer was installed.
8. This step should only be performed if the fan is driven by the drive belt. Inspect the engine cooling fan for bent, twisted, loose, or cracked blades. Inspect the fan clutch for smoothness, ease of turning. Inspect for a bent fan shaft or bent mounting flange.
9. This step should only be performed if the water pump is driven by the drive belt. Inspect the water pump shaft for being bent. Also inspect the water pump bearings for smoothness and excessive play. Compare the water pump with a known good water pump.
10. Accessory drive component brackets that are bent, cracked, or loose may put extra strain on that accessory component causing it to vibrate.

Step	Action	Yes	No
Notice: Refer to <i>Belt Dressing Notice</i> in Cautions and Notices. DEFINITION: The following items are indications of drive belt vibration: • The vibration is engine-speed related. • The vibration may be sensitive to accessory load.			
1	Did you review the Drive Belt Symptom operation and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Engine Mechanical
2	Verify that the vibration is engine related. Does the engine make the vibration?	Go to Step 3	Go to Diagnostic Aids
3	1. Remove the drive belt. 2. Operate the engine for no longer than 30 to 40 seconds. Does the engine still make the vibration?	Go to in Vibration Analysis in Vibration Diagnosis and Correction	Go to Step 4
4	Inspect the drive belt for wear, damage, debris build-up and missing drive belt ribs. Did you find any of these conditions?	Go to Step 5	Go to Step 6
5	Install a new drive belt. Refer to <i>Drive Belt Replacement</i> . Did you complete the replacement?	Go to Step 11	—
6	Inspect for improper, loose or missing fasteners. Did you find any of these conditions?	Go to Step 7	Go to Step 8
7	Tighten any loose fasteners. Replace improper or missing fasteners. Refer to <i>Fastener Tightening Specifications</i> . Did you complete the repair?	Go to Step 11	—
8	Inspect for damaged fan blades or bent fan clutch shaft, if the fan is belt driven. Refer to <i>Fan Clutch Replacement</i> . Did you find and correct the condition?	Go to Step 11	Go to Step 9
9	Inspect for a bent water pump shaft, if the water pump is belt driven. Refer to <i>Water Pump Replacement (4.3L, 5.0L, and 5.7L)</i> or <i>Water Pump Replacement (6.5L)</i> or <i>Water Pump Replacement (8.1L)</i> . Did you find and correct the condition?	Go to Step 11	Go to Step 10
10	Inspect for bent or cracked brackets. Did you find and correct the condition?	Go to Step 11	Go to Diagnostic Aids
11	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

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Fig. 22: Drive Belt Vibration Diagnosis
Courtesy of GENERAL MOTORS CORP.

DRIVE BELT FALLS OFF DIAGNOSIS

Diagnostic Aids

If the drive belt repeatedly falls off the drive belt pulleys, this is because of pulley misalignment.

An extra load that is quickly applied on released by an accessory drive component may cause the drive belt to fall off the pulleys. Verify the accessory drive components operate properly.

If the drive belt is the incorrect length, the drive belt tensioner may not keep the proper tension on the drive belt.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This inspection is to verify the condition of the drive belt. Damage may of occurred to the drive belt when the drive belt fell off. The drive belt may of been damaged, which caused the drive belt to fall off. Inspect the belt for cuts, tears, sections of ribs missing, or damaged belt plys.
4. Misalignment of the pulleys may be caused from improper mounting of the accessory drive component, incorrect installation of the accessory drive component pulley, or the pulley bent inward or outward from a previous repair. Test for a misalign pulley using a straight edge in the pulley grooves across 2 or 3 pulleys. If a misalign pulley is found refer to that accessory drive component for the proper installation procedure of that pulley.
5. Inspecting the pulleys for being bent should include inspecting for a dent or other damage to the pulleys that would prevent the drive belt from not seating properly in all of the pulley grooves or on the smooth surface of a pulley when the back side of the belt is used to drive the pulley.
6. Accessory drive component brackets that are bent or cracked will let the drive belt fall off.
7. Inspecting of the fasteners can eliminate the possibility that a wrong bolt, nut, spacer, or washer was installed. Missing loose, or the wrong fasteners may cause pulley misalignment from the bracket moving under load. Over tightening of the fasteners may cause misalignment of the accessory component bracket.

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Step	Action	Yes	No
Notice: Refer to <i>Belt Dressing Notice</i> in Cautions and Notices. DEFINITION: The drive belt falls off the pulleys or may not ride correctly on the pulleys.			
1	Did you review the Drive Belt Symptom operation and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Engine Mechanical
2	Inspect for a damaged drive belt. Did you find the condition?	Go to Step 3	Go to Step 4
3	Install a new drive belt. Refer to <i>Drive Belt Replacement</i> . Does the drive belt continue to fall off?	Go to Step 4	System OK
4	Inspect for misalignment of the pulleys. Did you find and repair the condition?	Go to Step 12	Go to Step 5
5	Inspect for a bent or dented pulley. Did you find and repair the condition?	Go to Step 12	Go to Step 6
6	Inspect for a bent or a cracked bracket. Did you find and repair the condition?	Go to Step 12	Go to Step 7
7	Inspect for improper, loose or missing fasteners. Did you find loose or missing fasteners?	Go to Step 8	Go to Step 9
8	Tighten any loose fasteners. Replace improper or missing fasteners. Refer to <i>Fastener Tightening Specifications</i> . Does the drive belt continue to fall off?	Go to Step 9	System OK
9	Test the drive belt tensioner for operating correctly. Refer to <i>Drive Belt Tensioner Diagnosis</i> . Does the drive belt tensioner operate correctly?	Go to Step 11	Go to Step 10
10	Replace the drive belt tensioner. Refer to <i>Drive Belt Tensioner Replacement</i> . Does the drive belt continue to fall off?	Go to Step 11	System OK
11	Inspect for failed drive belt idler and drive belt tensioner pulley bearings. Did you find and repair the condition?	Go to Step 12	Go to Diagnostic Aids
12	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 2

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Fig. 23: Drive Belt Falls Off Diagnosis
Courtesy of GENERAL MOTORS CORP.

DRIVE BELT EXCESSIVE WEAR DIAGNOSIS**Diagnostic Aids**

Excessive wear on a drive belt(s) is usually caused by an incorrect installation or the wrong drive belt for the application.

Minor misalignment of the drive belt pulleys will not cause excessive wear, but will probably cause the drive belt(s) to make a noise or to fall off.

Excessive misalignment of the drive belt pulleys will cause excessive wear but may also make the drive belt(s) fall off.

Test Description

The number(s) below refer to the step number(s) on the diagnostic table.

2. The inspection is to verify the drive belt(s) is correctly installed on all of the drive belt pulleys. Wear on the drive belt(s) may be caused by mis-positioning the drive belt(s) by one groove on a pulley.
3. The installation of a drive belt that is two wide or two narrow will cause wear on the drive belt. The drive belt ribs should match all of the grooves on all of the pulleys.
4. This inspection is to verify the drive belt(s) is not contacting any parts of the engine or body while the engine is operating. There should be sufficient clearance when the drive belt accessory drive components load varies. The drive belt(s) should not come in contact with an engine or a body component when snapping the throttle.

Step	Action	Yes	No
Notice: Refer to <i>Belt Dressing Notice</i> in Cautions and Notices. DEFINITION: Wear at the outside ribs of the drive belt due to an incorrectly installed drive belt.			
1	Did you review the Drive Belt Symptom operation and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Engine Mechanical
2	Inspect the drive belt(s) for the proper installation. Refer to <i>Drive Belt Replacement</i> . Did you find this condition?	Go to Step 5	Go to Step 3
3	Inspect for the proper drive belt. Did you find this condition?	Go to Step 5	Go to Step 4
4	Inspect for the drive belt rubbing against a bracket, hose, or wiring harness. Did you find and repair the condition?	Go to Step 6	Go to Diagnostic Aids
5	Replace the drive belt. Refer to <i>Drive Belt Replacement</i> . Did you complete the replacement?	Go to Step 6	—
6	Operate the system in order to verify the repair. Did you correct the condition?	System OK	—

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Fig. 24: Drive Belt Excessive Wear Diagnosis
Courtesy of GENERAL MOTORS CORP.

DRIVE BELT TENSIONER DIAGNOSIS

Inspection Procedure

NOTE: Allowing the drive belt tensioner to snap into the free position may result in damage to the tensioner.

1. Remove the drive belt. Refer to [Drive Belt Replacement](#).
2. Position a hex-head socket on the drive belt tensioner pulley bolt head.
3. Move the drive belt tensioner through the full travel.
 - The movement should feel smooth
 - There should be no binding
 - The drive belt tensioner should return freely
4. If any binding is observed, replace the drive belt tensioner. Refer to [Drive Belt Tensioner Replacement](#).

Important: Movement of the drive belt tensioner while the engine is operating is a normal operating

condition. Do not replace the drive belt tensioner for this normal condition.

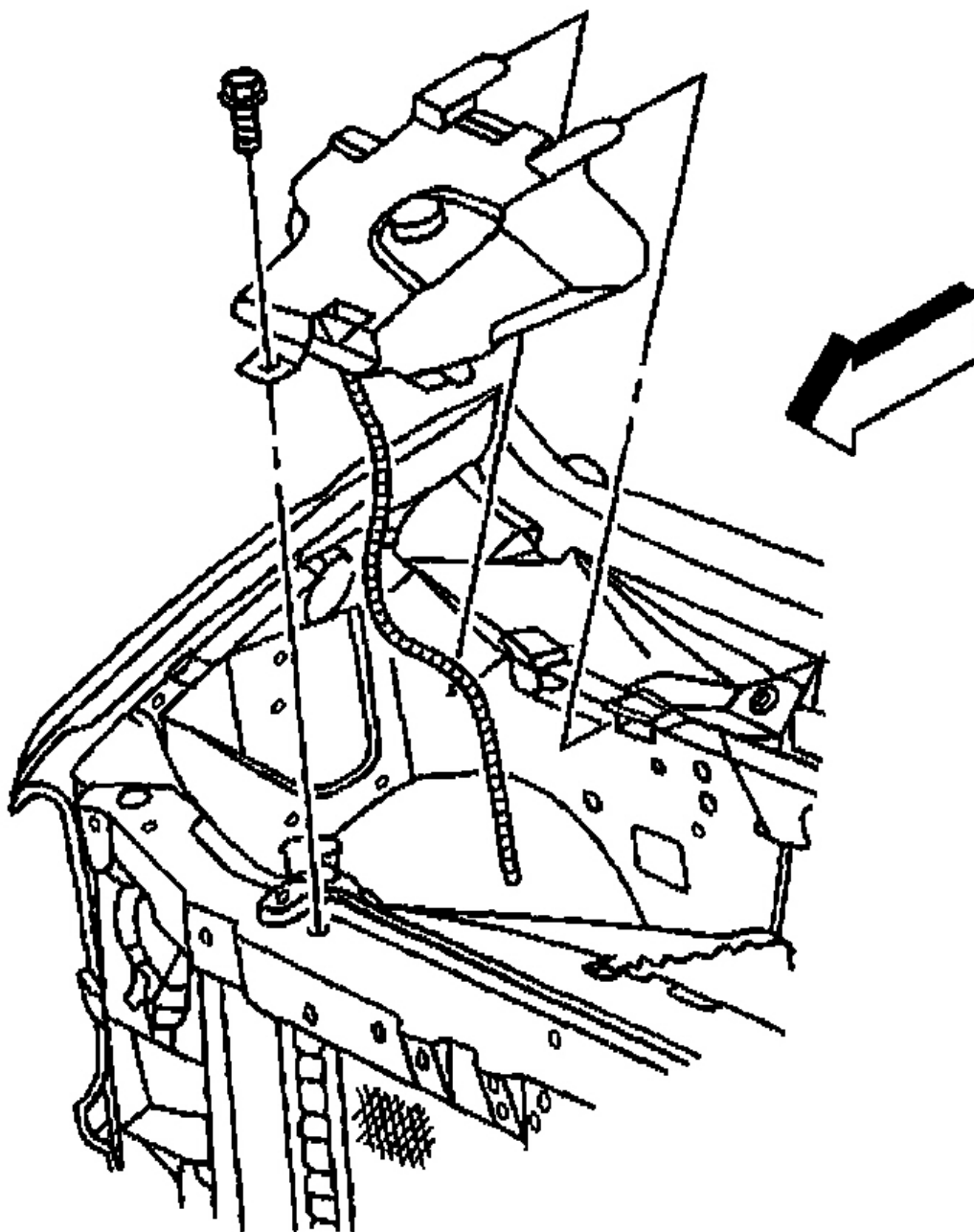
5. Install the drive belt. Refer to **Drive Belt Replacement**.

REPAIR INSTRUCTIONS

DRIVE BELT REPLACEMENT

Removal Procedure

1. In order to gain access to the drive belt, remove the engine coolant reservoir.
2. Remove the air cleaner intake duct.



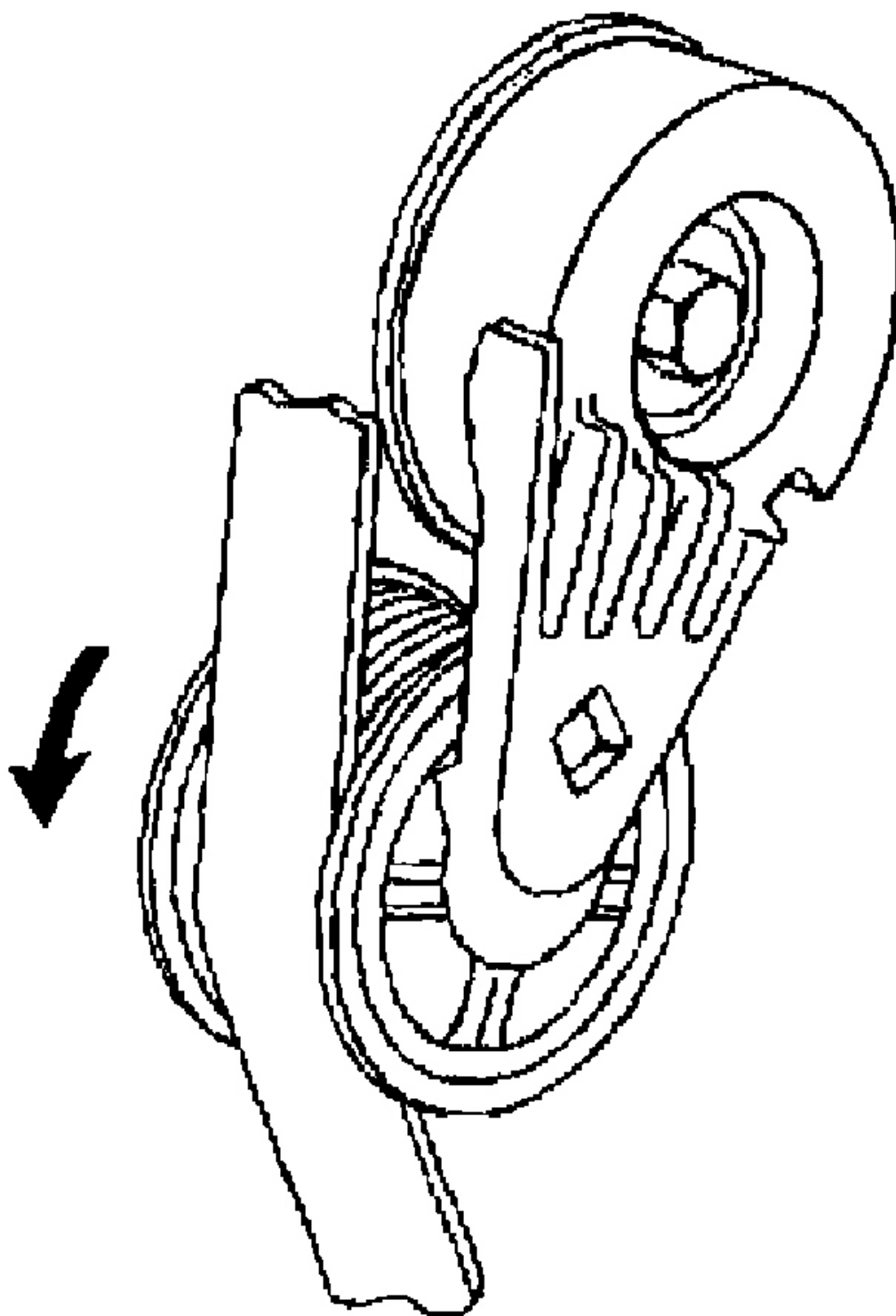
G01688402

Fig. 25: Removing Engine Coolant Reservoir
Courtesy of GENERAL MOTORS CORP.

3. Install a 3/8 inch drive wrench on the drive belt tensioner arm and rotate the drive belt tensioner arm

counterclockwise.

4. Remove the drive belt.
5. Slowly release the tension on the drive belt tensioner arm.



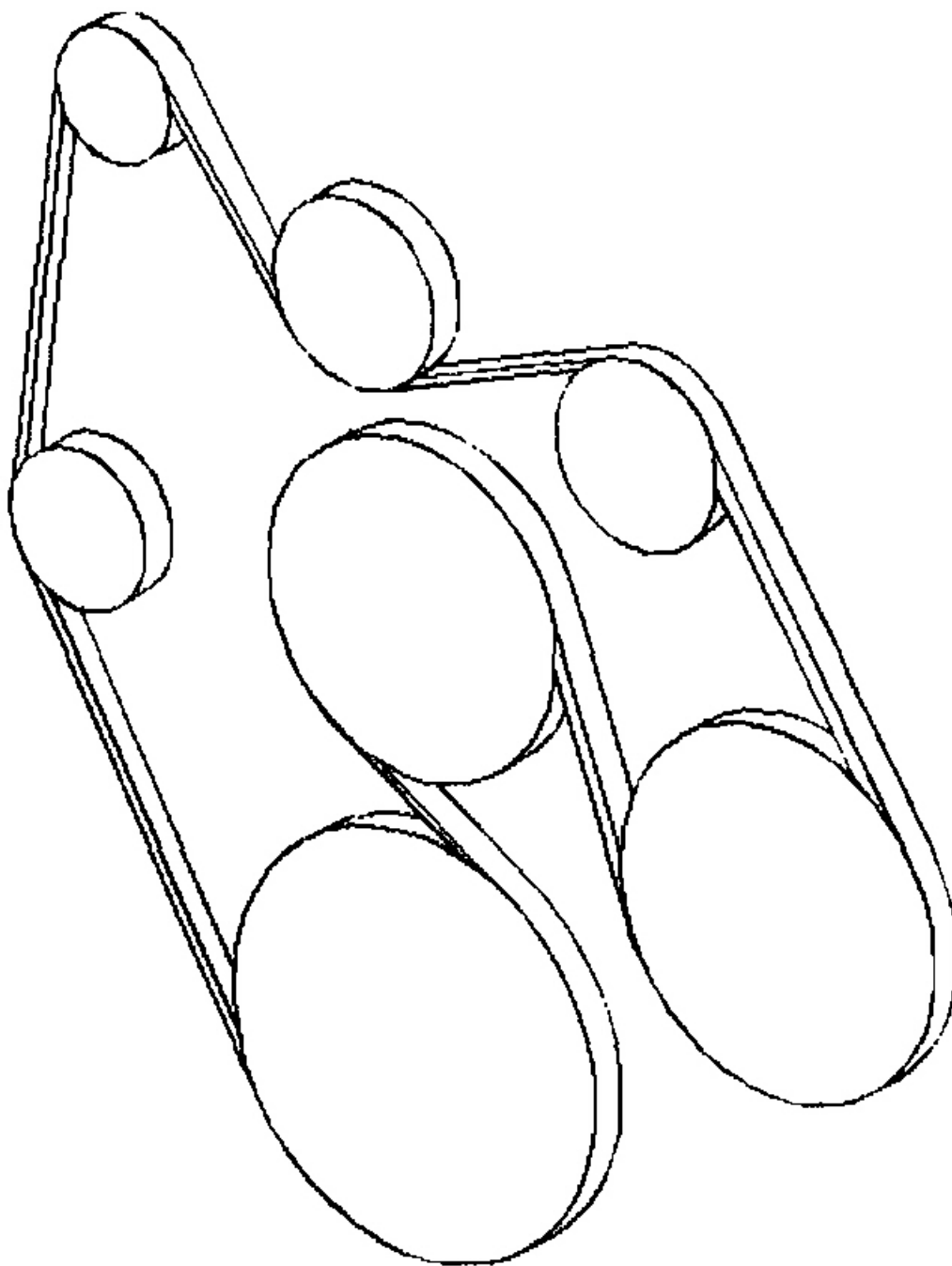
G01688403

Fig. 26: Removing Drive Belt

Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Route the drive belt over all the pulleys except the drive belt tensioner arm.

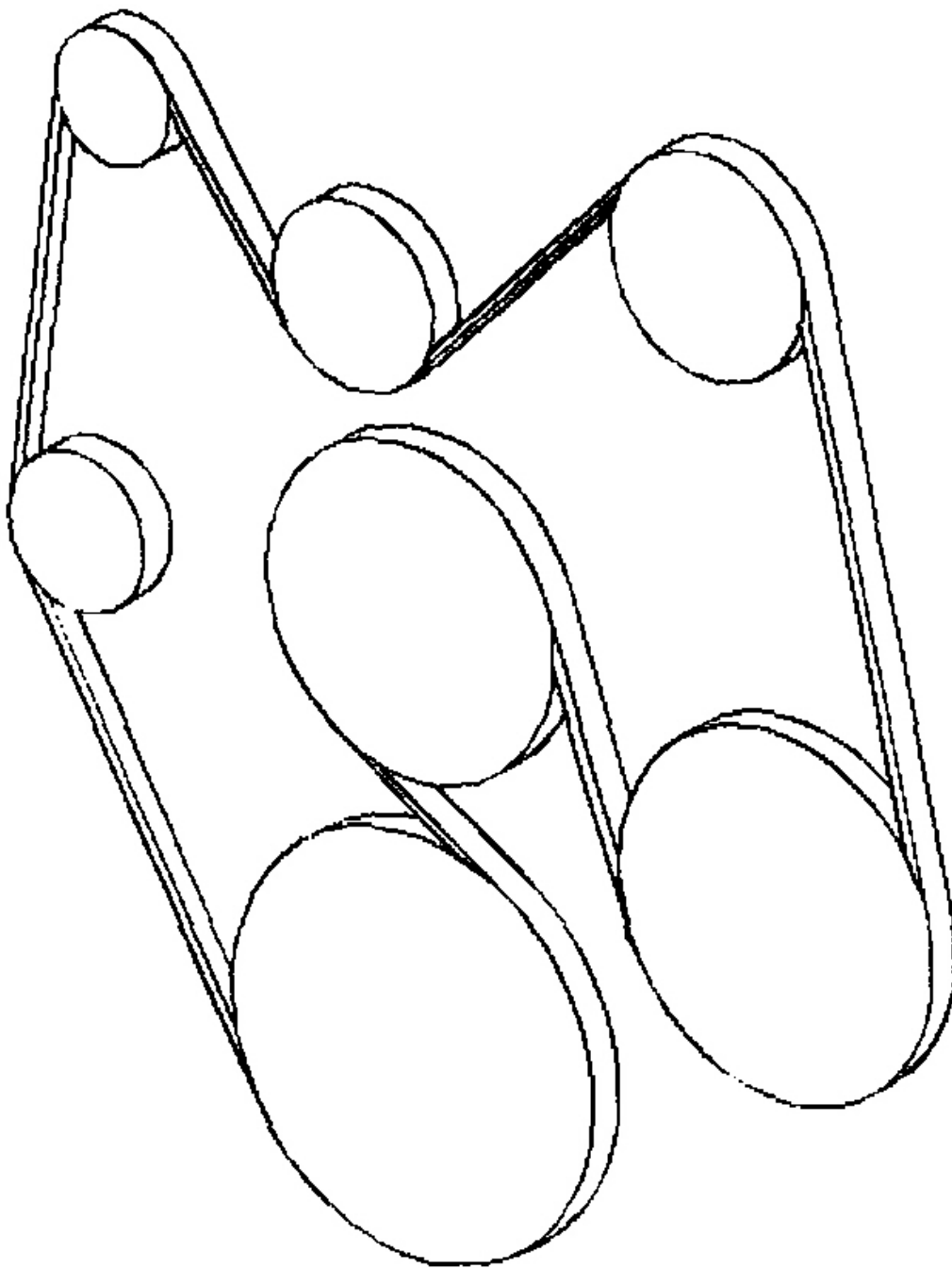


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Fig. 27: View Of Drive Belt (Without A/C)
Courtesy of GENERAL MOTORS CORP.

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2. Observe drive belt routing for vehicles with air conditioning.

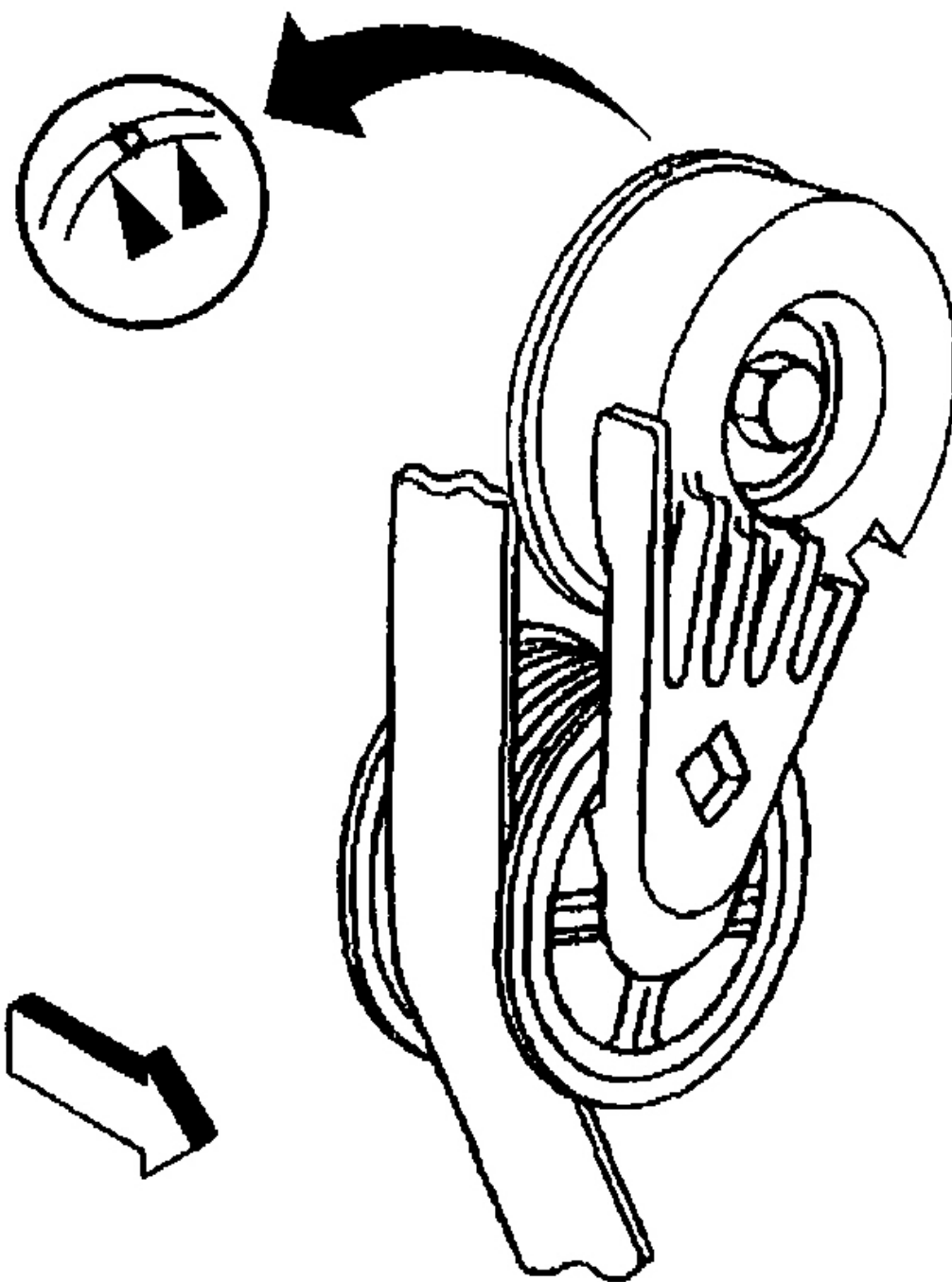


G01688405

Fig. 28: View Of Drive Belt (With A/C)

Courtesy of GENERAL MOTORS CORP.

3. Install a 3/8 inch drive wrench on the drive belt tensioner arm and rotate the drive belt tensioner arm counterclockwise.
4. Install the drive belt over the drive belt tensioner arm pulley.
5. Slowly release the tension on the drive belt tensioner arm.
6. Confirm that the drive belt is properly routed.
7. Install the air cleaner intake duct.
8. Install the engine coolant reservoir.



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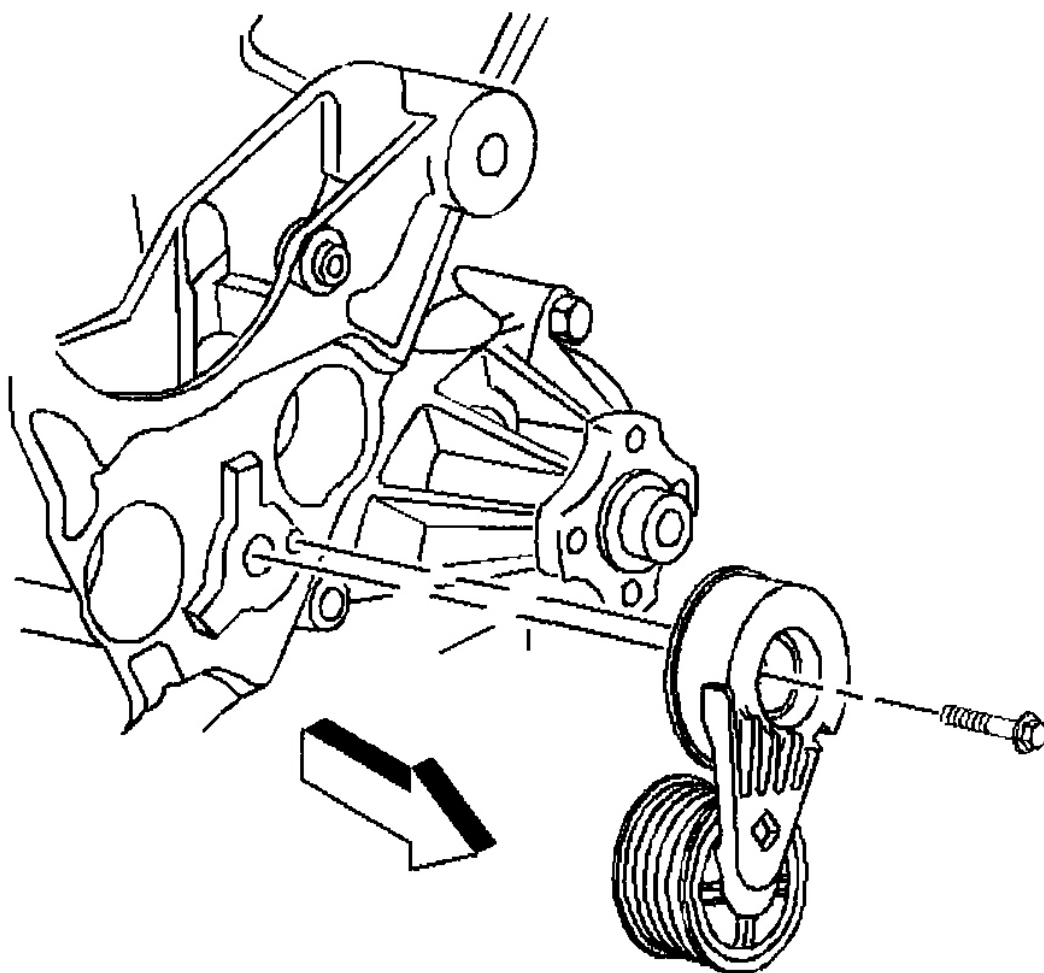
Fig. 29: Installing Drive Belt

Courtesy of GENERAL MOTORS CORP.

DRIVE BELT TENSIONER REPLACEMENT

Removal Procedure

1. Remove the drive belt. Refer to Drive Belt Replacement.
2. Remove the bolt.
3. Remove the drive belt tensioner.



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Fig. 30: Removing Drive Belt Tensioner & Bolt
Courtesy of GENERAL MOTORS CORP.

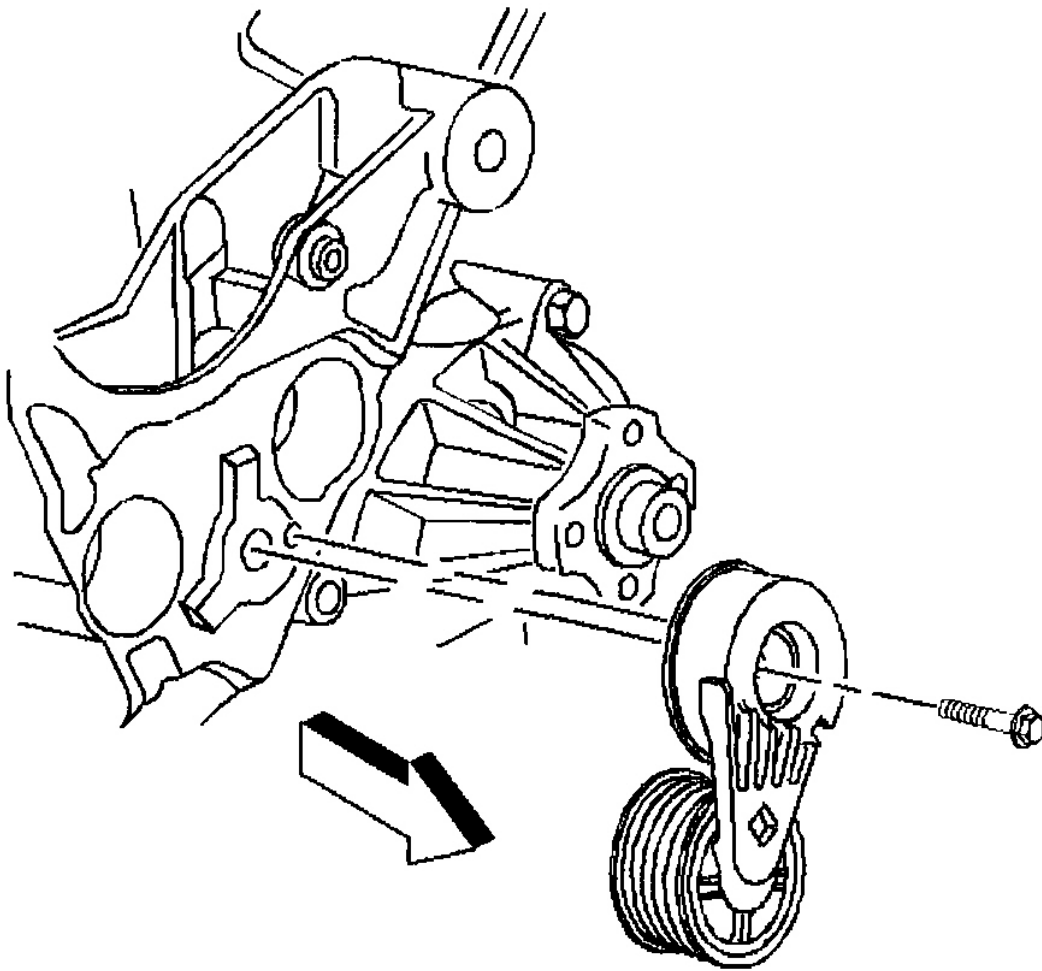
Installation Procedure

1. Install the drive belt tensioner assembly.
2. Install the attaching bolt.

Tighten

Tighten the drive belt tensioner assembly bolt to 50 N.m (37 lb ft).

3. Install the drive belt. Refer to **Drive Belt Replacement**.



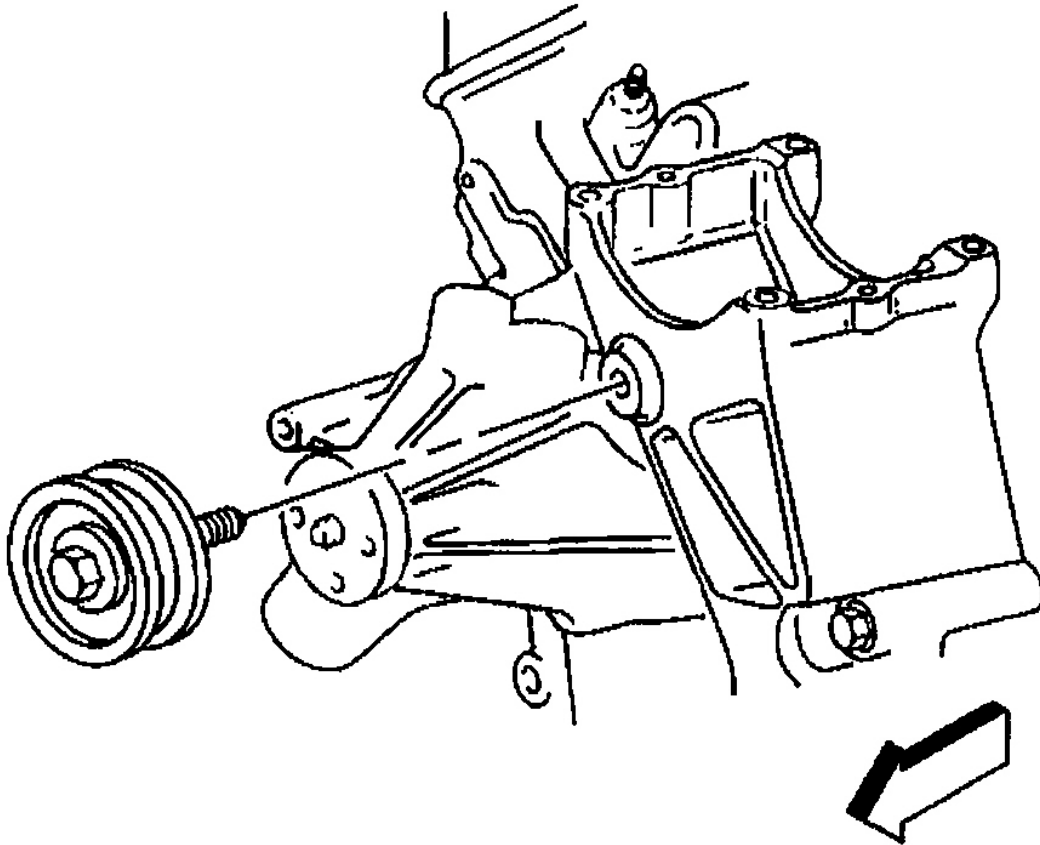
G01688408

Fig. 31: Installing Drive Belt Tensioner & Bolt
Courtesy of GENERAL MOTORS CORP.

DRIVE BELT IDLER PULLEY REPLACEMENT - ACCESSORY

Removal Procedure

1. Remove the drive belt. Refer to **Drive Belt Replacement**.
2. Remove the belt idler pulley bolt.
3. Remove the belt idler pulley.



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Fig. 32: Removing Drive Belt Idler Pulley & Bolt
Courtesy of GENERAL MOTORS CORP.

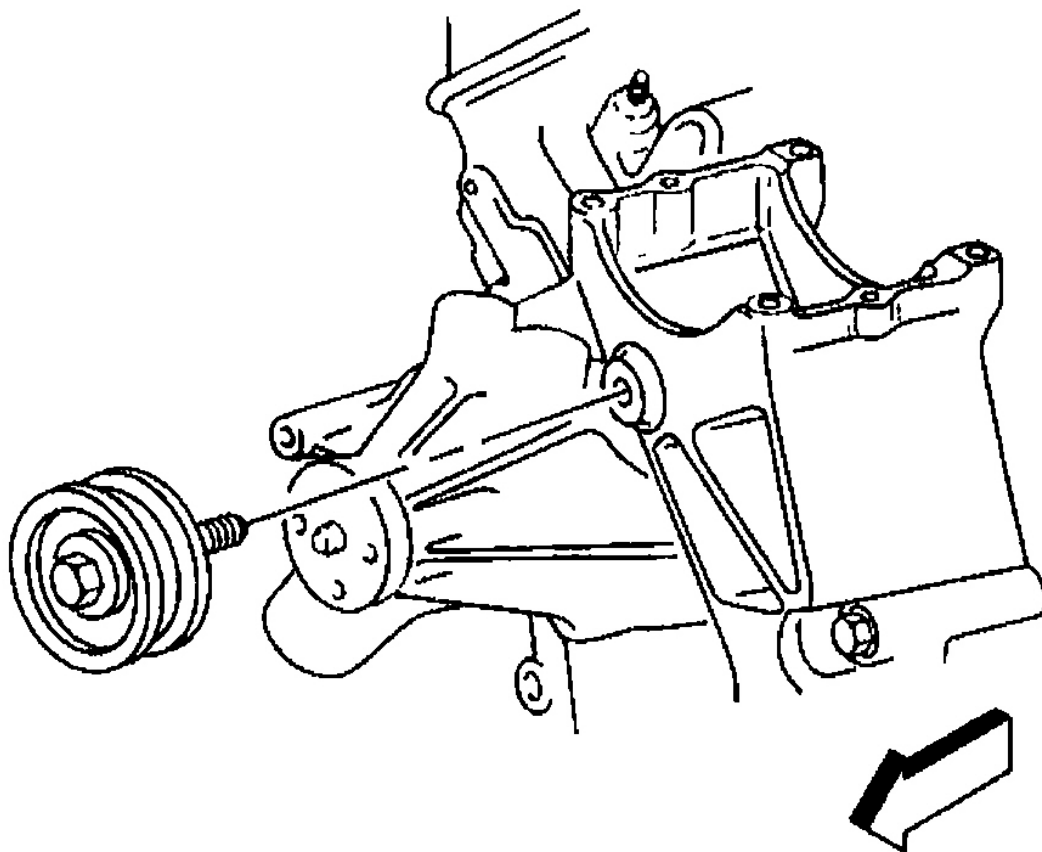
Installation Procedure

1. Install the drive belt idler pulley and bolt to the engine.

Tighten

Tighten the bolt to 50 N.m (37 lb ft).

2. Install the drive belt. Refer to Drive Belt Replacement.



G01688410

Fig. 33: Installing Drive Belt Idler Pulley & Bolt
Courtesy of GENERAL MOTORS CORP.

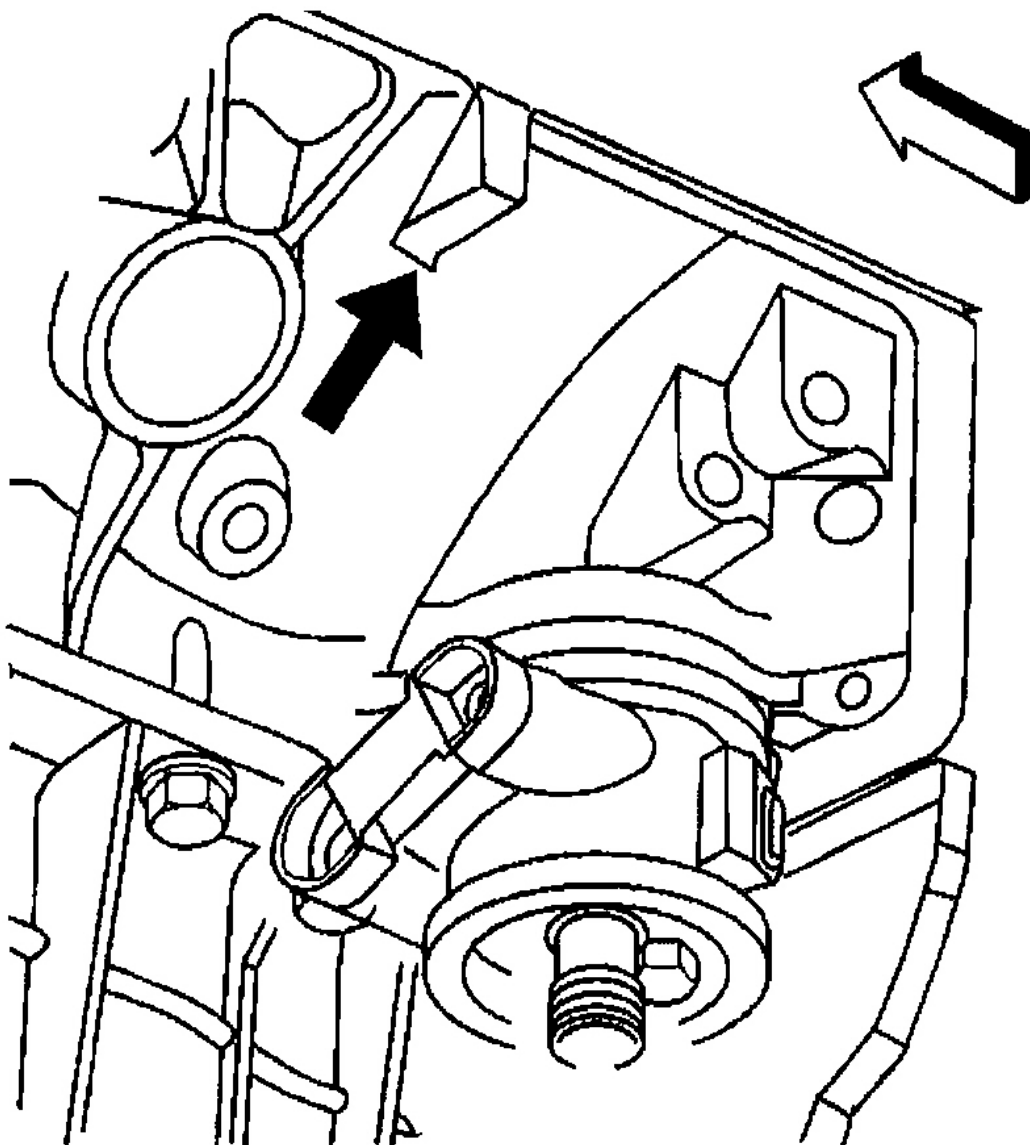
ENGINE MOUNT INSPECTION

Front Engine Mount

- NOTE:** Broken or deteriorated mounts can cause misalignment and destruction of certain drive train components. When a single mount breaks, the remaining mounts are subjected to abnormally high stresses.
- NOTE:** When raising or supporting the engine for any reason, do not use a jack under the oil pan, any sheet metal, or the crankshaft pulley. Due to the small clearance between the oil pan and the oil pump screen, jacking against the oil pan may

cause the pan to be bent against the pump screen. This will result in a damaged oil pickup unit.

1. Raise the engine in order to remove the weight from the mount and to place a slight tension on the rubber cushion.



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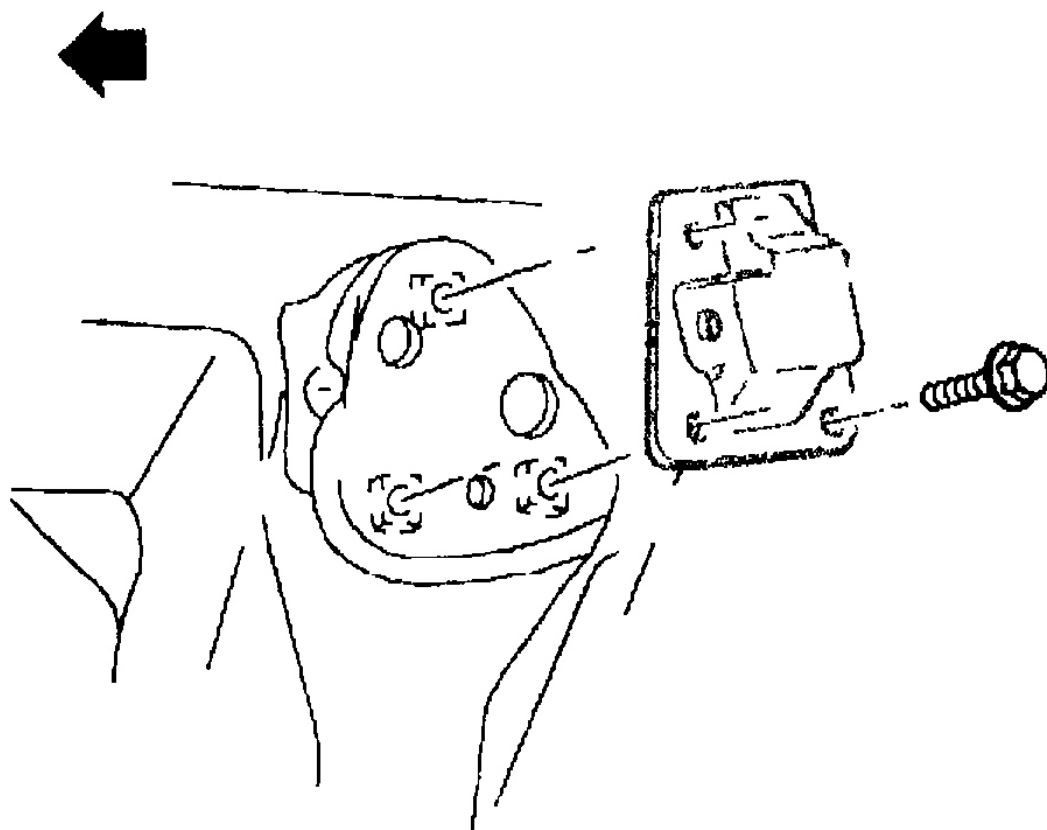
Fig. 34: Inspecting Engine Mount
Courtesy of GENERAL MOTORS CORP.

2. Use a jack on the square tab at the rear of the engine block. Observe both mount while raising the engine.
3. Replace the mount if any of the following conditions exist:
 - Hard rubber surface covered with heat check cracks
 - The rubber cushion separated from the metal plate of the mount
 - The rubber cushion is split through the center
4. If there is movement between a metal plate of the mount and its attaching points, lower the engine and tighten the bolts or nuts attaching the mount to the engine, the frame or the bracket.

ENGINE MOUNT REPLACEMENT - LEFT

Removal Procedure

1. Disconnect the battery negative cable.
2. Raise the vehicle.
3. Remove the engine mount through-bolt and nut for the side being replaced.



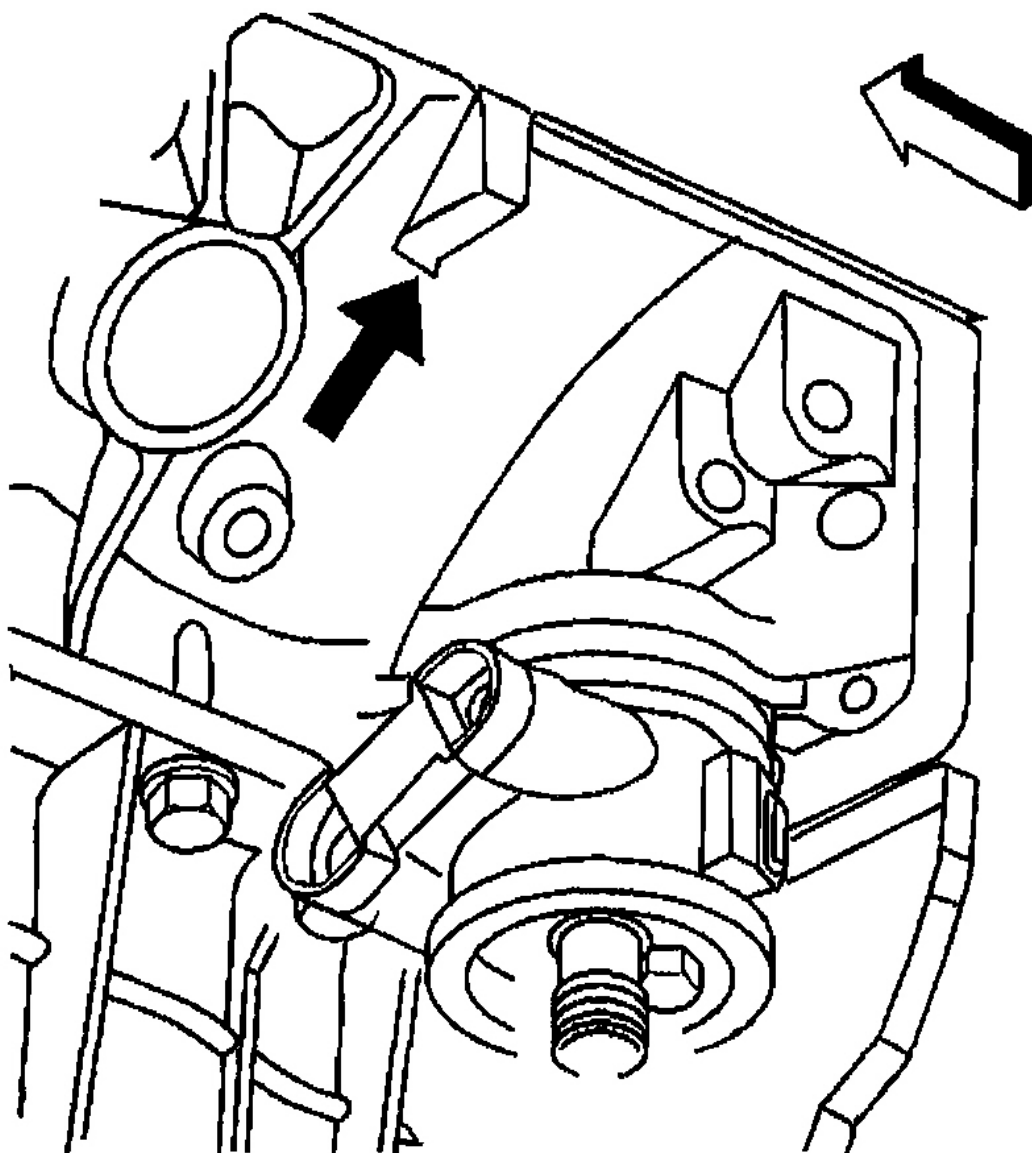
G01688412

Fig. 35: Removing Engine Mount

Courtesy of GENERAL MOTORS CORP.

NOTE: When raising or supporting the engine for any reason, do not use a jack under the oil pan, any sheet metal, or the crankshaft pulley. Lifting the engine in an unapproved manner may cause component damage.

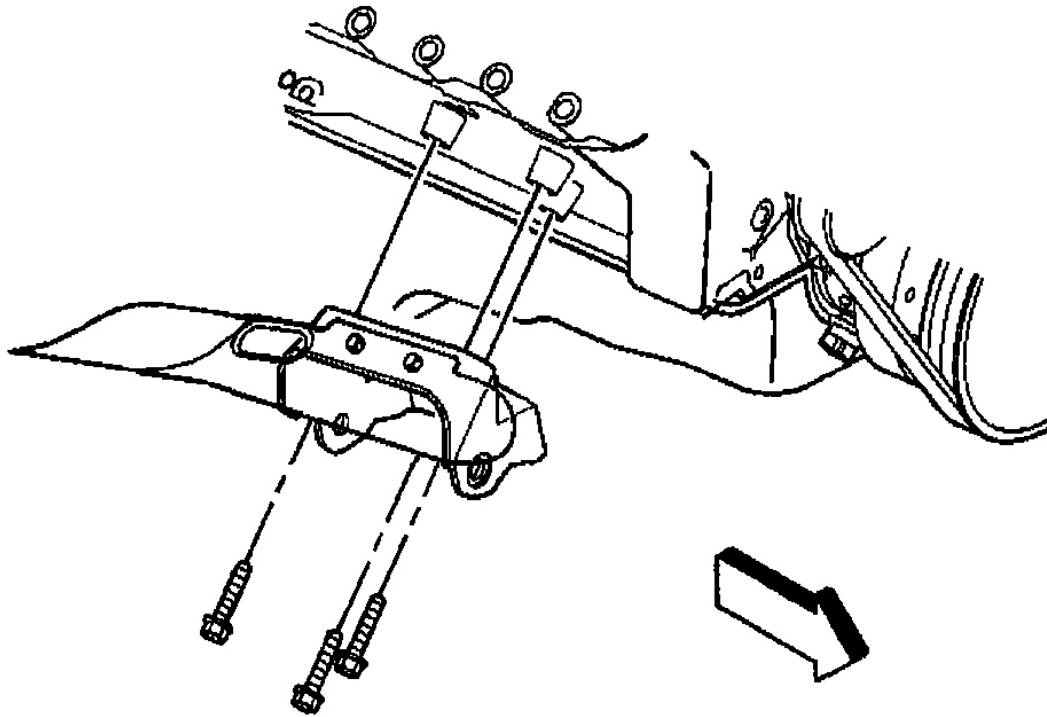
4. Use a jack on the square tab at the rear of the engine block raise the engine.
5. Remove the bolts for the frame side mount.
6. Remove the frame side mount.



G01688413

Fig. 36: Locating Square Tab At Rear Of Engine
Courtesy of GENERAL MOTORS CORP.

7. Remove the bolts for the engine side mount.
8. Remove the engine side mount and the shield.



G01688414

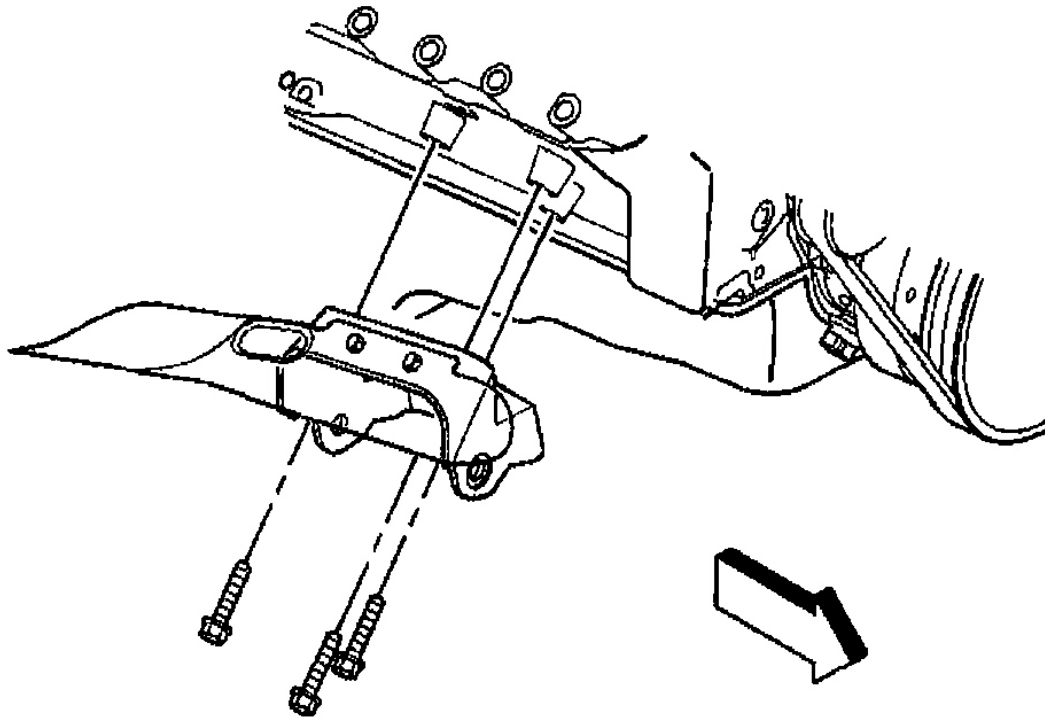
Fig. 37: Removing Engine Side Mount, Shield & Bolts
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the mount and shield to the engine.
2. Install the remaining bolts.

Tighten

Tighten the bolts to 54 N.m (40 lb ft).



G01688415

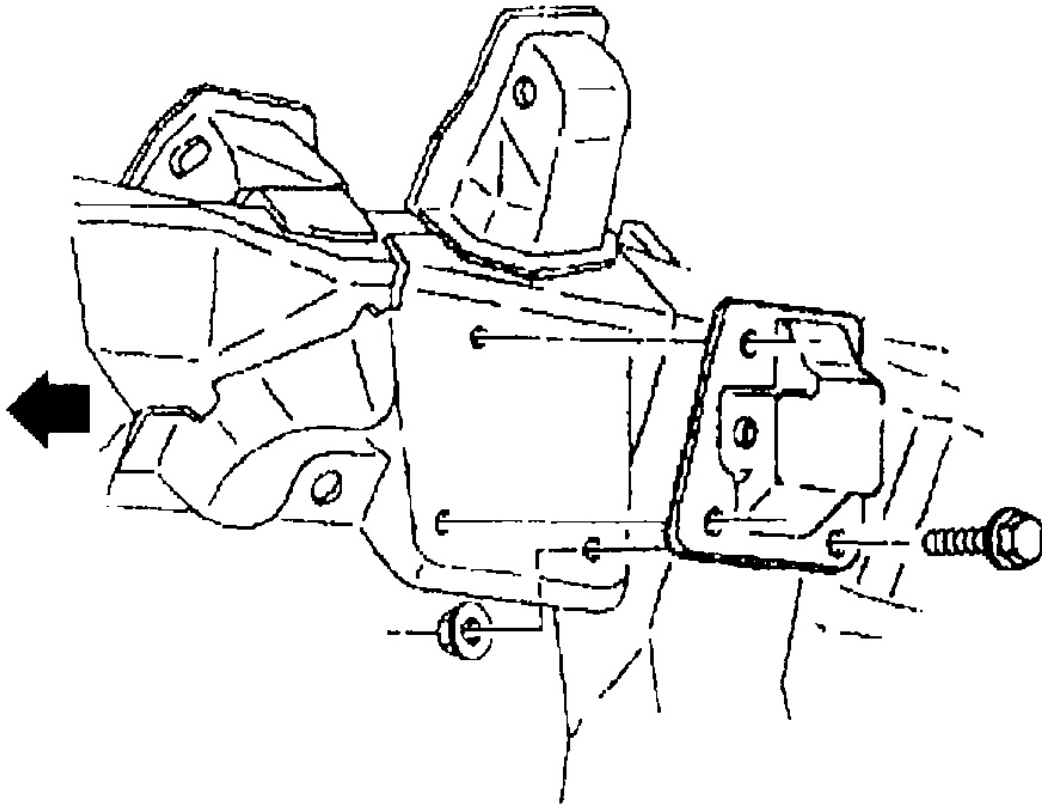
Fig. 38: Installing Engine Side Mount, Shield & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Install the mount to the frame.
4. Install the bolts.

Tighten

Tighten the bolts to 58 N.m (43 lb ft).

5. Lower the engine.



G01688416

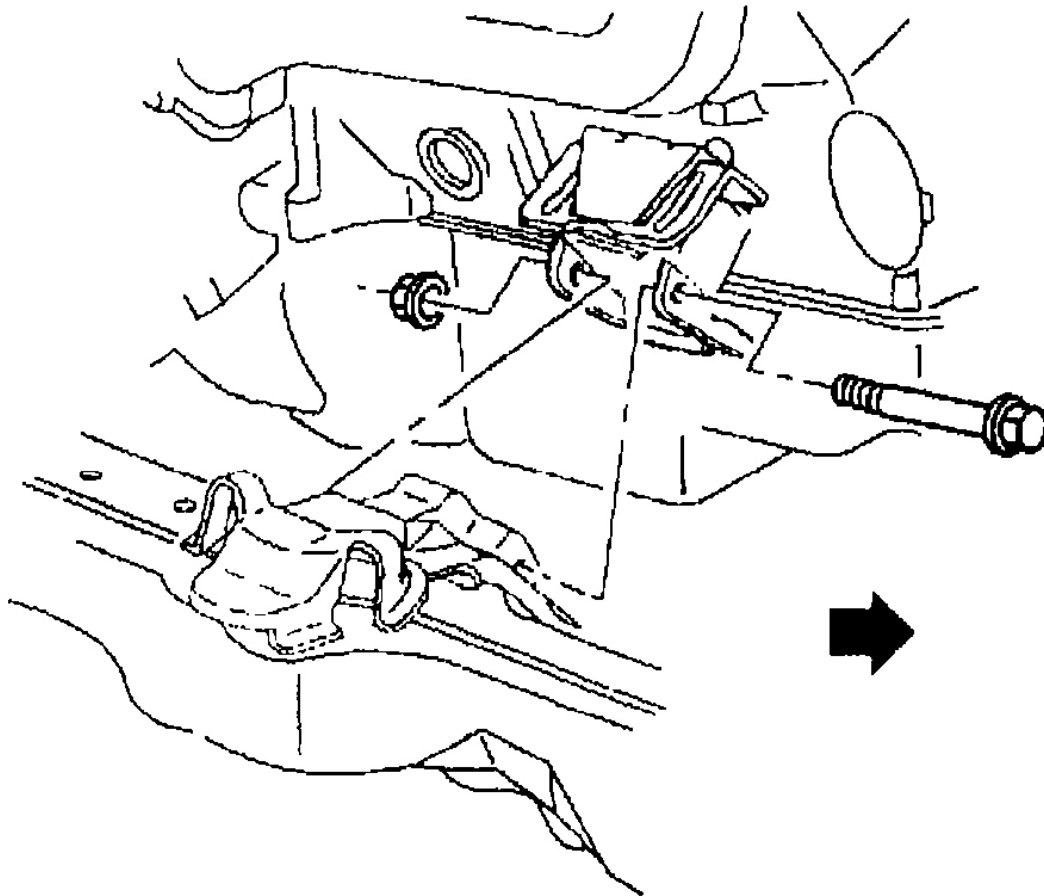
Fig. 39: Installing Engine Mount & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Install the through-bolt and nut.

Tighten

Tighten to 95 N.m (70 lb ft).

7. Lower the vehicle.
8. Connect the battery negative cable.



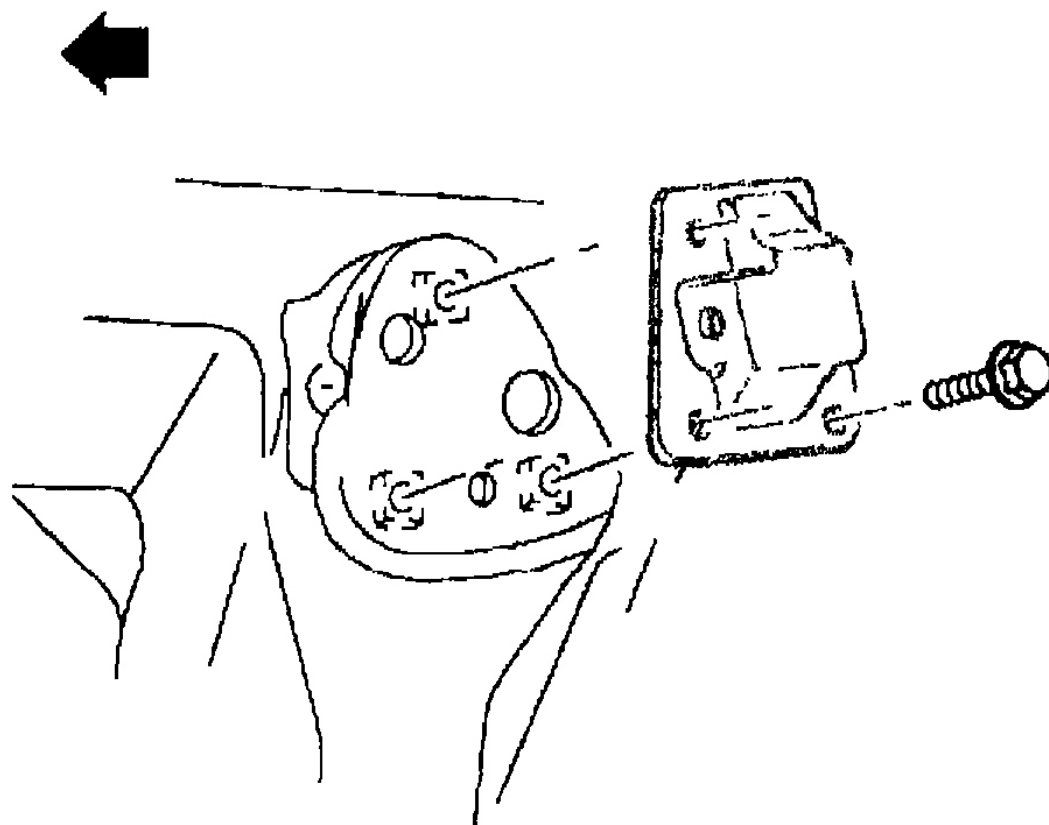
G01688417

Fig. 40: Installing Through-Bolt & Nut
Courtesy of GENERAL MOTORS CORP.

ENGINE MOUNT REPLACEMENT - RIGHT

Removal Procedure

1. Disconnect the battery negative cable.
2. Raise the vehicle.
3. Remove the engine mount through-bolt and nut for the side being replaced.

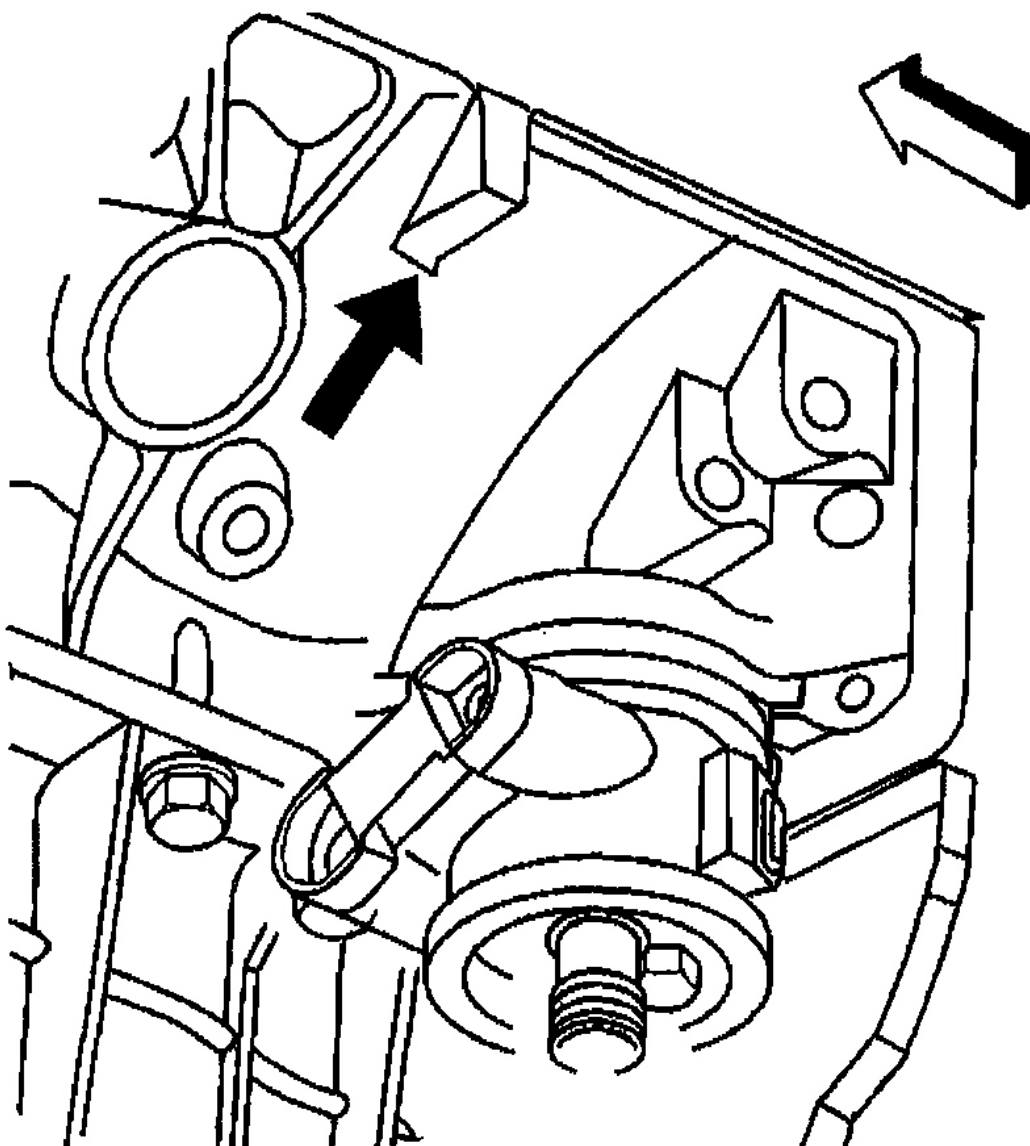


G01688418

Fig. 41: Removing Engine Mount Through-Bolt & Nut
Courtesy of GENERAL MOTORS CORP.

NOTE: When raising or supporting the engine for any reason, do not use a jack under the oil pan, any sheet metal, or the crankshaft pulley. Lifting the engine in an unapproved manner may cause component damage.

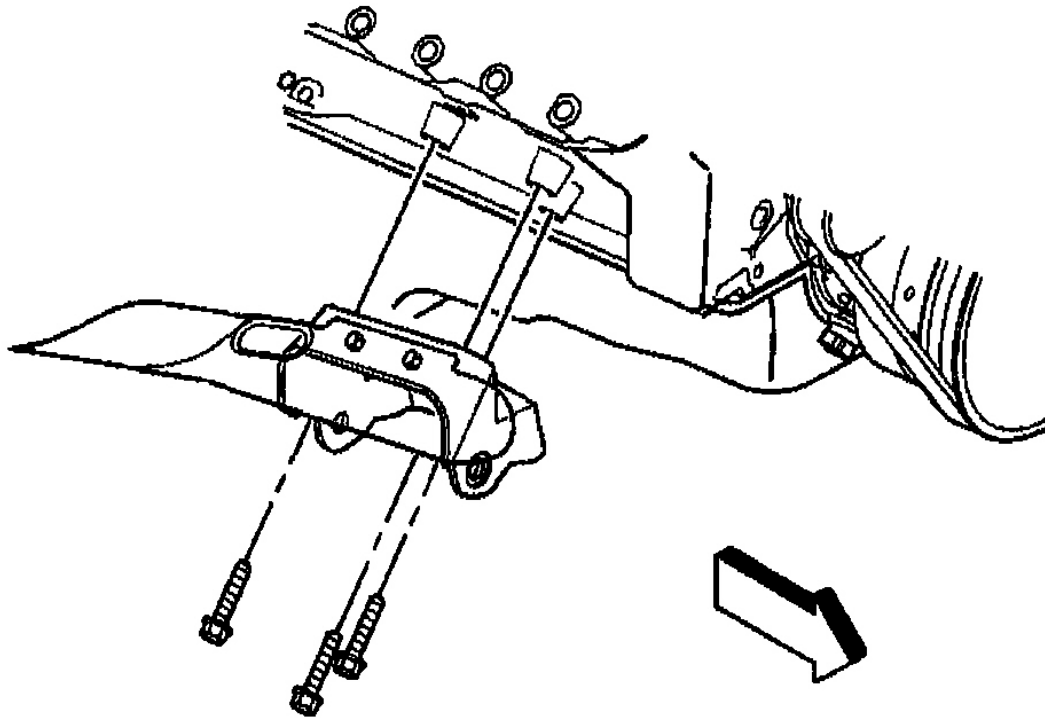
4. Use a jack on the square tab at the rear of the engine block raise the engine.
5. Remove the bolts for the frame side mount.
6. Remove the frame side mount.



G01688419

Fig. 42: Removing Frame Side Mount & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the bolts for the engine side mount.
8. Remove the engine side mount and the shield.



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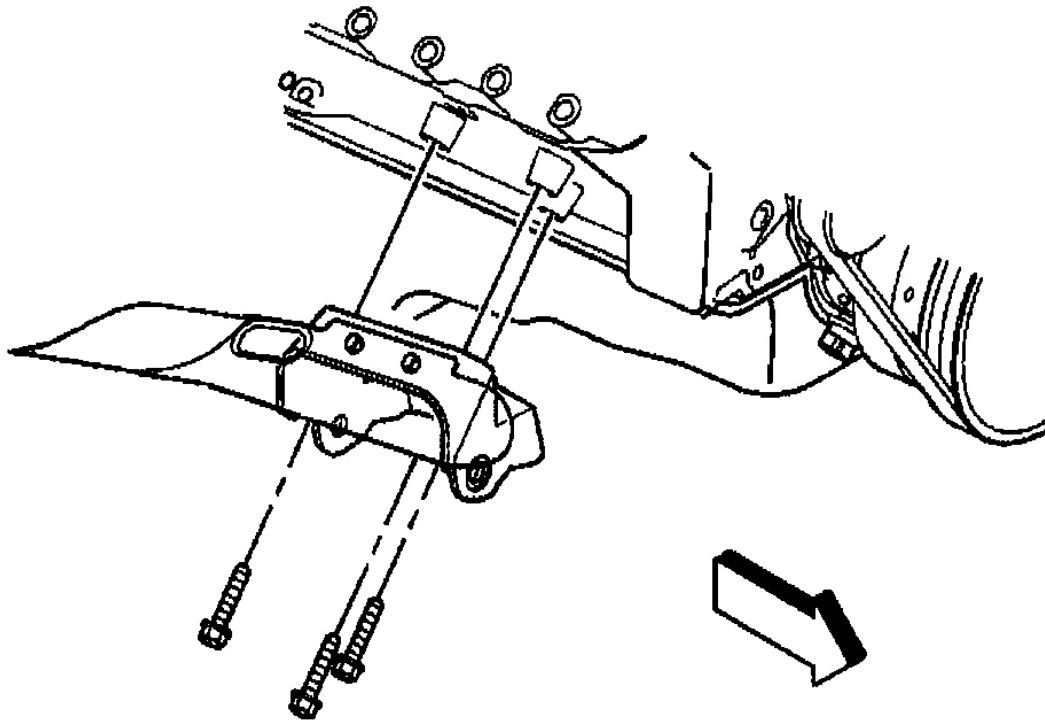
Fig. 43: Removing Engine Side Mount, Shield & Bolts
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the mount and shield to the engine.
2. Install the remaining bolts.

Tighten

Tighten the bolts to 54 N.m (40 lb ft).



G01688421

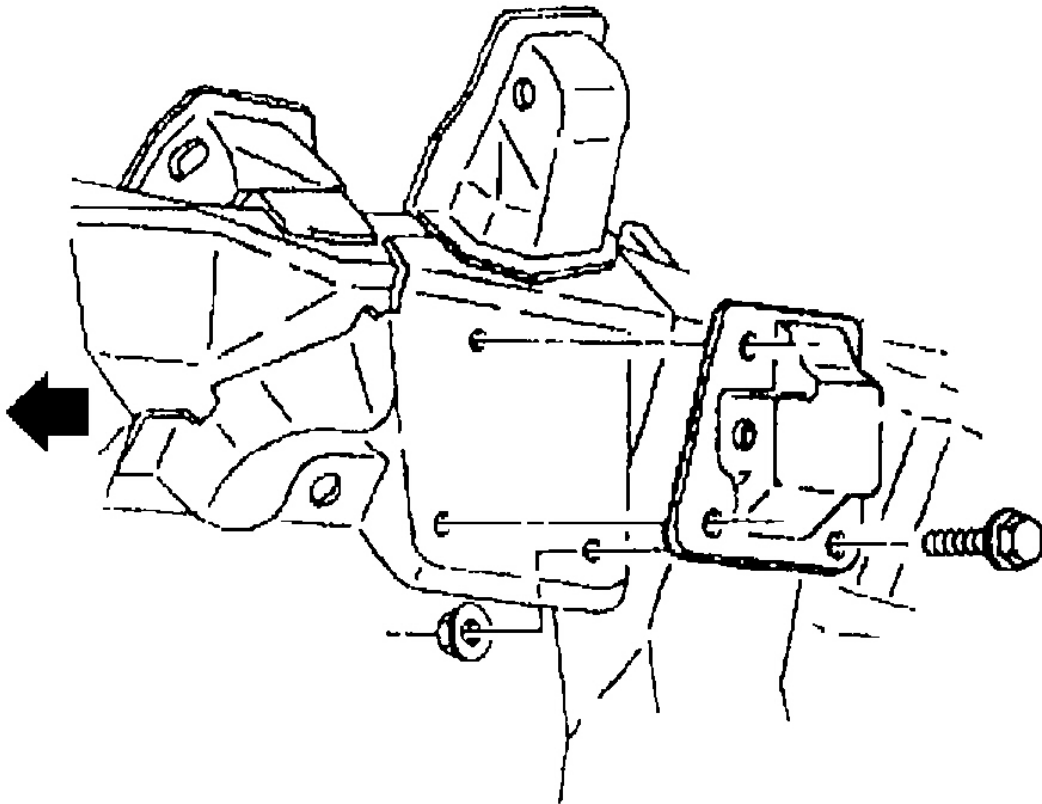
Fig. 44: Installing Engine Side Mount, Shield & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Install the mount to the frame.
4. Install the bolts.

Tighten

Tighten the bolts to 58 N.m (43 lb ft).

5. Lower the engine.



G01688422

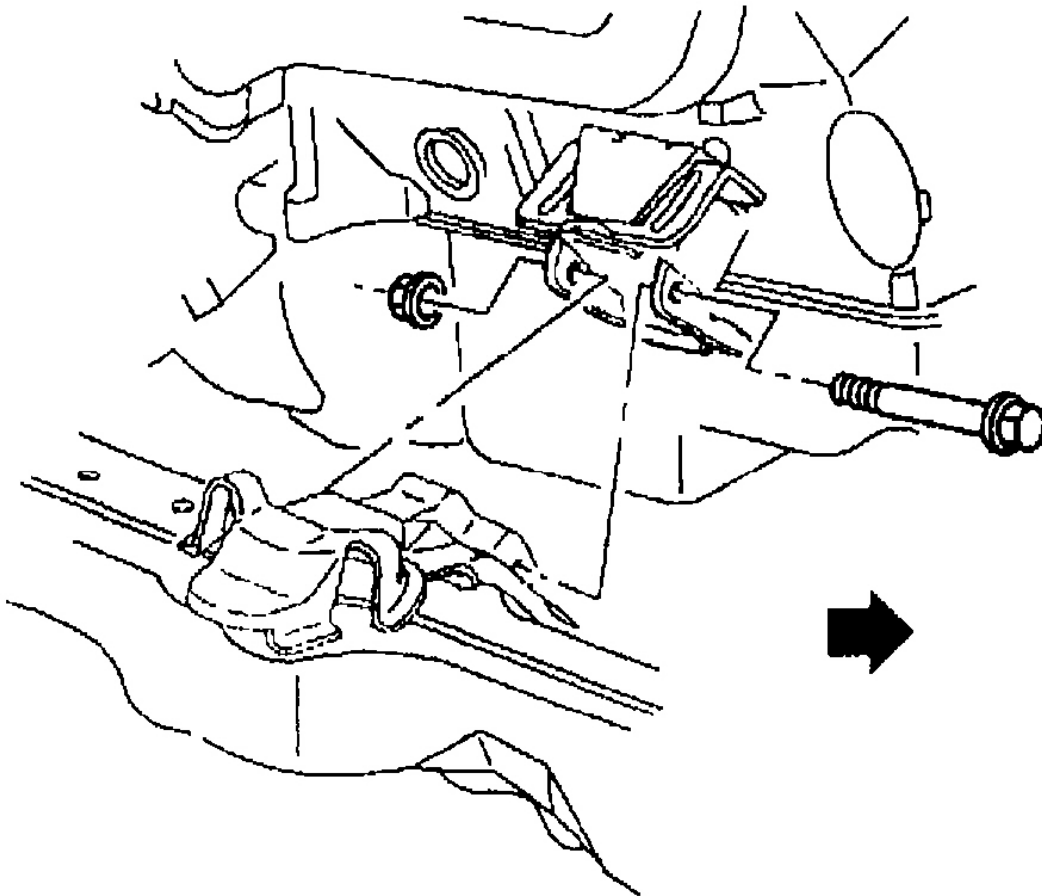
Fig. 45: Installing Engine Mount & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Install the through-bolt and nut.

Tighten

Tighten to 95 N.m (70 lb ft).

7. Lower the vehicle.
8. Connect the battery negative cable.



G01688423

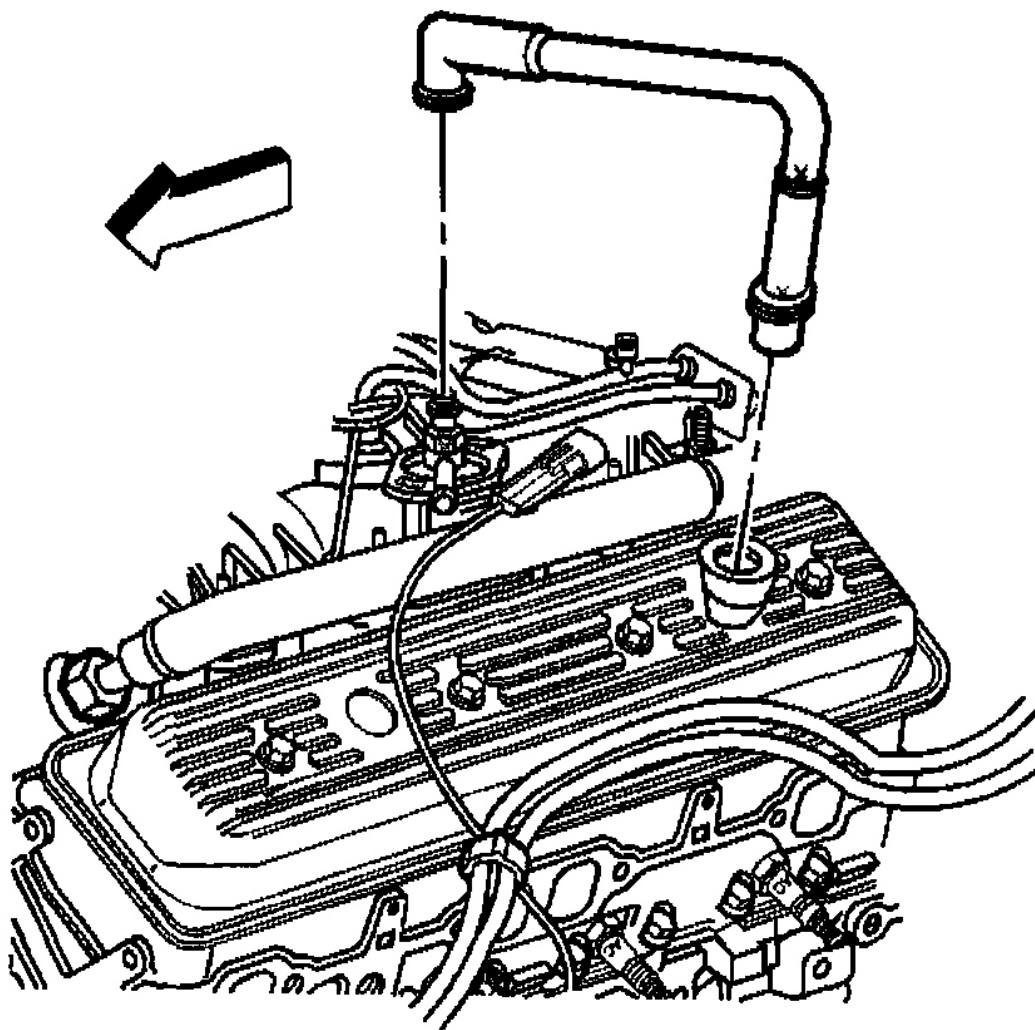
Fig. 46: Installing Through-Bolt & Nut
Courtesy of GENERAL MOTORS CORP.

INTAKE MANIFOLD REPLACEMENT - UPPER

Removal Procedure

1. Disconnect the battery negative cable.
2. Remove the engine cover.
3. Remove the air cleaner intake duct.
4. Disconnect the following electrical connectors:
 - Fuel injector electrical connector.
 - Manifold absolute pressure (MAP) sensor.
 - EVAP canister purge solenoid valve.

- Idle air control (IAC) solenoid.
 - Throttle position (TP) sensor.
5. Remove the vacuum brake booster hose, if equipped.
 6. Remove the PCV tube at the intake manifold. Twist to unlock the PCV tube.

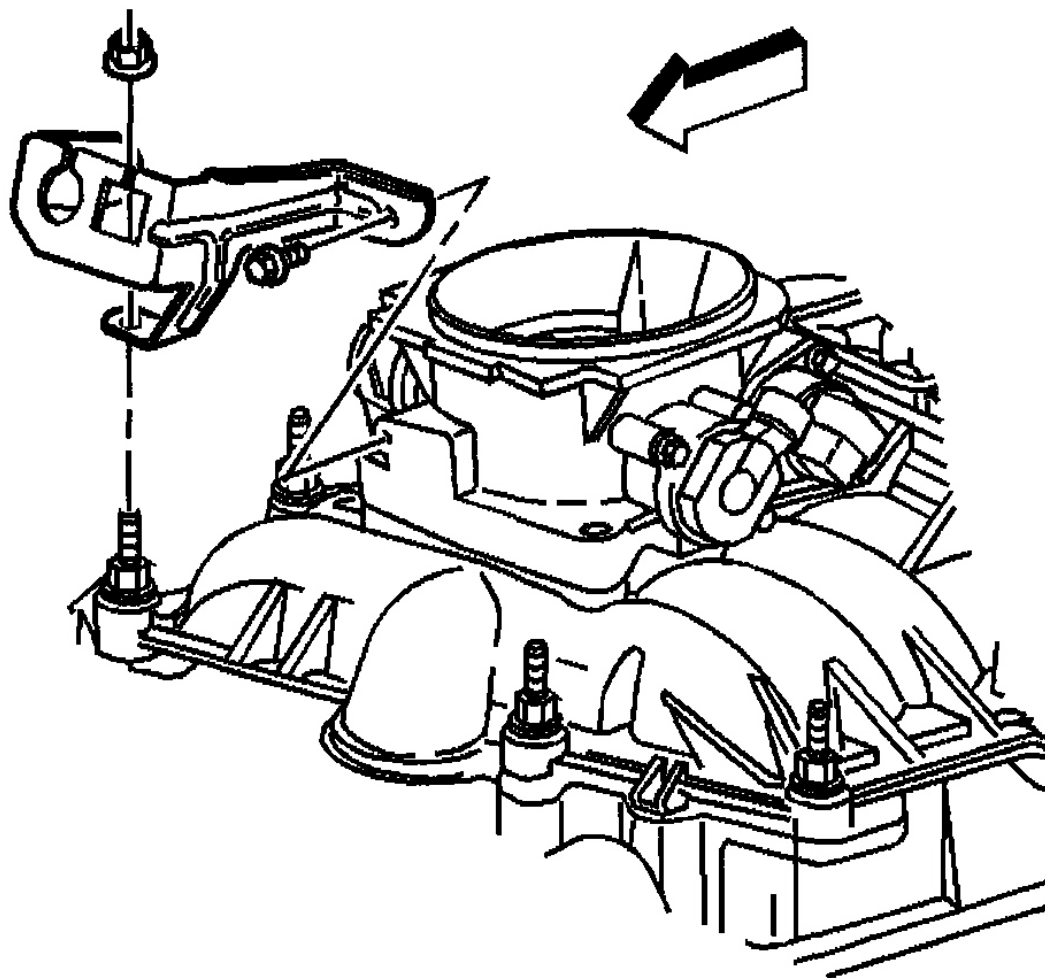


G01688424

Fig. 47: Removing Vacuum Brake Booster Hose & PCV Tube
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the spark plug wires from the left side of the distributor cap. Refer to Link Spark Plug Wire Harness Replacement in Engine Electrical.
8. Remove the fuel pipes from the rear of the engine.

9. Remove AIR Bypass hose assembly, if so equipped.
10. Remove the EVAP canister purge solenoid valve from the engine.
11. Remove the accelerator control cable and the cruise control cable, if equipped, from the throttle shaft.
12. Remove the accelerator control cable bracket from the throttle body and the intake manifold and set it aside.



G01688425

Fig. 48: Removing Accelerator Control Cable Bracket
Courtesy of GENERAL MOTORS CORP.

13. Remove the upper intake manifold bolts from the engine and then remove the upper intake manifold.
14. Clean all sealing surfaces.



Installation Procedure

1. Install the upper intake manifold to the engine.

Tighten

- 1.1. Tighten the upper intake manifold studs on the first pass to 12 N.m (44 lb in).
- 1.2. Tighten the upper intake manifold studs on the second pass to 10 N.m (89 lb in).

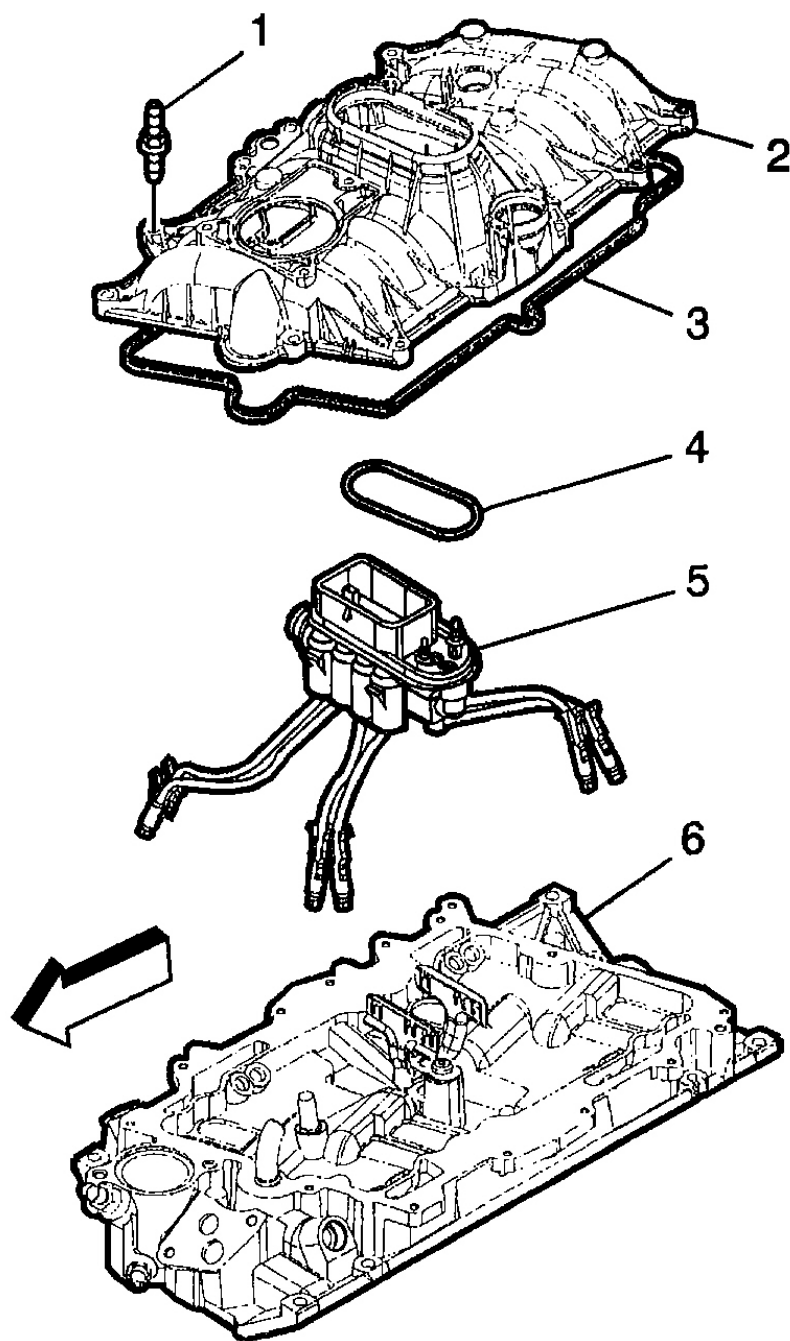
NOTE: **Manufacturer does not provide bolt tightening sequence for upper intake manifold.**

2. Install the accelerator control cable bracket (3) to the throttle body and the lower intake manifold.

Tighten

Tighten the bolts and nut to 12 N.m (106 lb in).

3. Install the accelerator control cable and the cruise control cable, if equipped, to the throttle shaft.
4. Install the EVAP canister purge solenoid valve to the engine.
5. Install the fuel pipes to the rear of the engine.



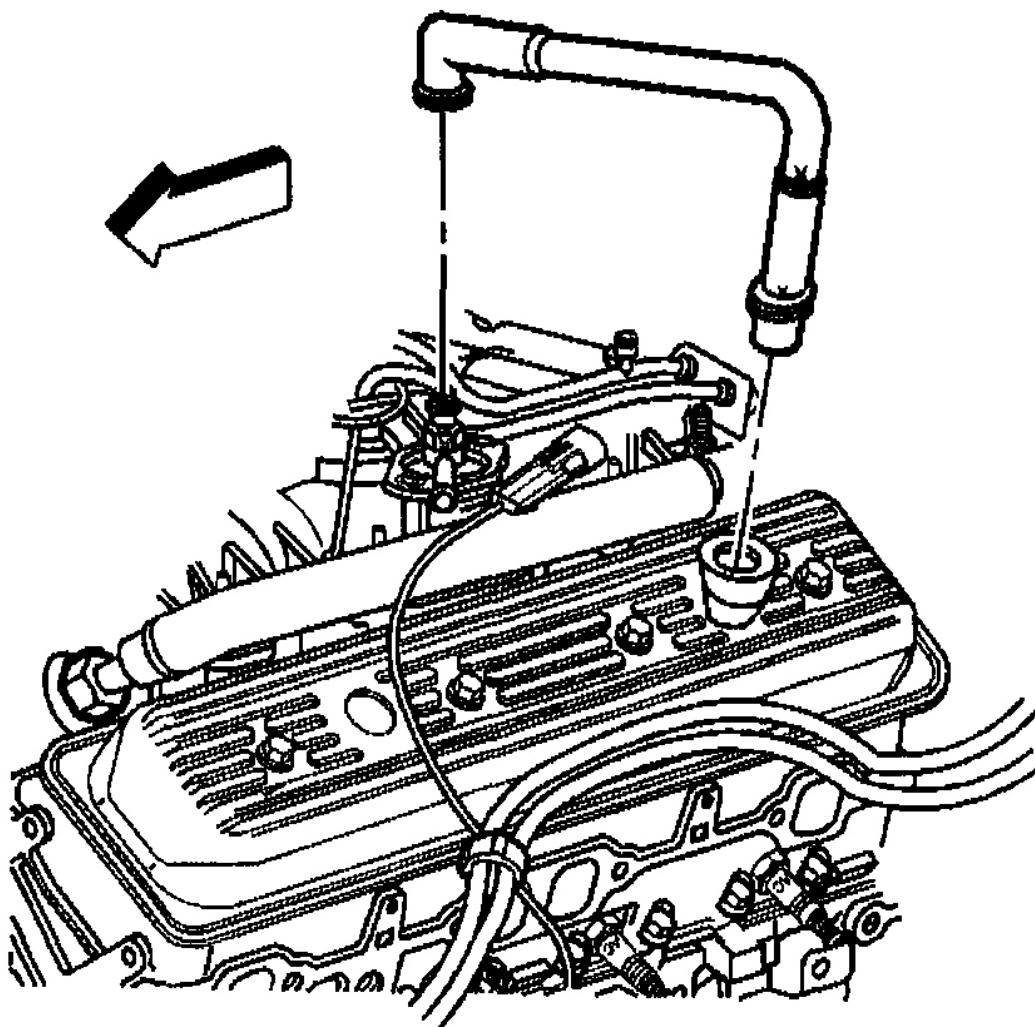
G01688427

Fig. 50: Installing Upper Intake Manifold
Courtesy of GENERAL MOTORS CORP.

6. Connect the spark plug wires to the left side of the distributor cap.

The wires and the distributor cap are numbered in order to aid assembly.

7. Install AIR bypass hose assembly, if so equipped.
8. Install the PCV tube to the intake manifold. Twist to lock the PCV tube.
9. Install the vacuum brake booster hose to the intake manifold, if equipped.



G01688428

Fig. 51: Installing AIR Bypass Hose Assembly, PCV Tube & Vacuum Brake Booster Hose
Courtesy of GENERAL MOTORS CORP.

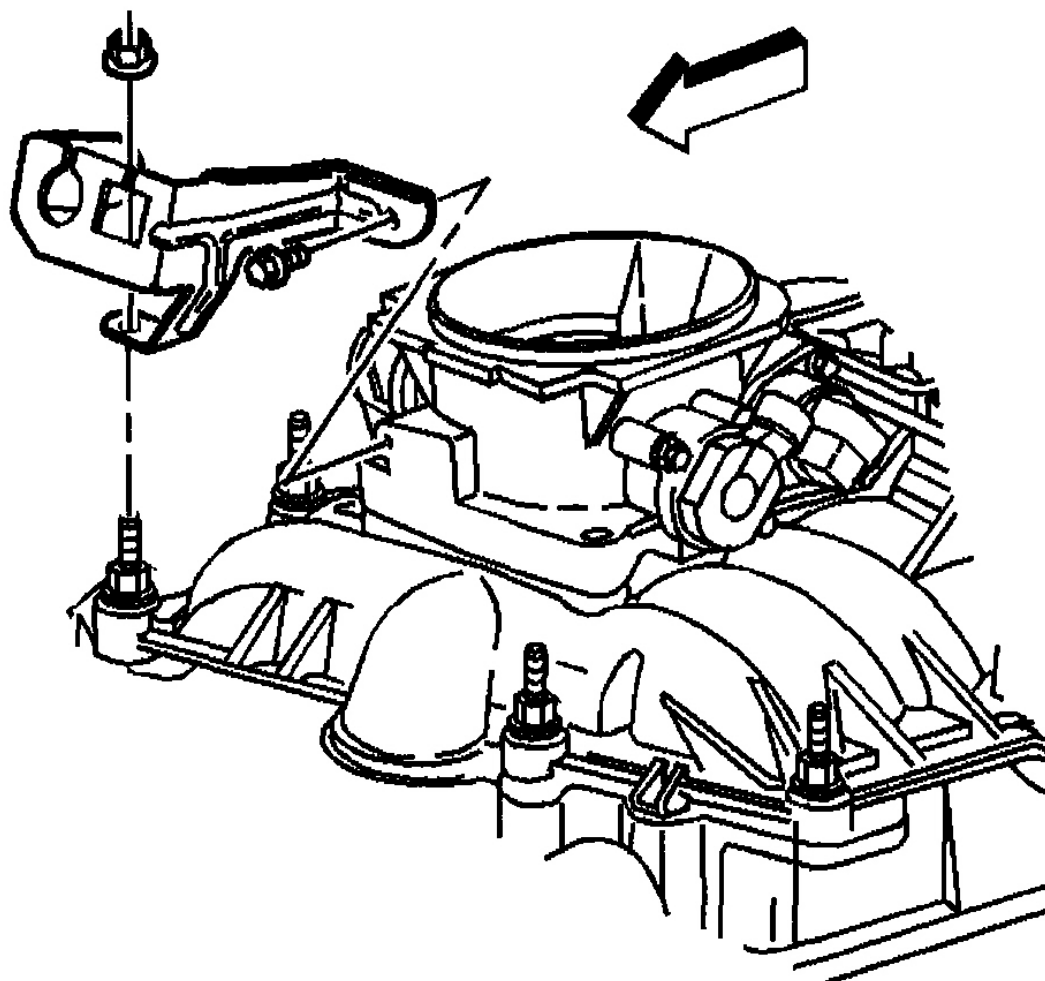
10. Connect the following electrical connectors:
 - Fuel injector electrical connector.

- Manifold absolute pressure (MAP) sensor.
 - EVAP canister purge solenoid valve.
 - Idle air control (IAC) solenoid.
 - Throttle position (TP) sensor.
11. Install the air cleaner intake duct.
 12. Install the engine cover.
 13. Connect the battery negative cable.

INTAKE MANIFOLD REPLACEMENT - LOWER

Removal Procedure

1. Disconnect the battery negative cable
2. Drain the engine coolant.
3. Remove the air cleaner intake duct.
4. Remove the engine cover.
5. Remove the coolant reservoir.
6. Remove the following coolant hoses:
 - 6.1. Upper radiator hose.
 - 6.2. Inlet heater hose.
 - 6.3. Outlet heater hose.
 - 6.4. Coolant by-pass hose.
7. Disconnect the following electrical connectors.
 - SCPI injector electrical connector.
 - Manifold absolute pressure (MAP) sensor.
 - EVAP canister purge solenoid valve.
 - Idle air control (IAC) motor.
 - Throttle position (TP) sensor.
 - Exhaust gas recirculation (EGR) valve.
 - Engine coolant temperature (ECT) sensor.
8. Remove AIR bypass hose assembly, if so equipped.
9. Use a twisting motion in order to remove the brake booster vacuum hose, if equipped.
10. Remove the distributor from the engine.
11. Remove the fuel pipes from the rear of the engine.
12. Remove the accelerator control cable and the cruise control cables, if equipped, from the throttle shaft.
13. Remove the accelerator control cable bracket from the throttle body and the lower intake manifold.



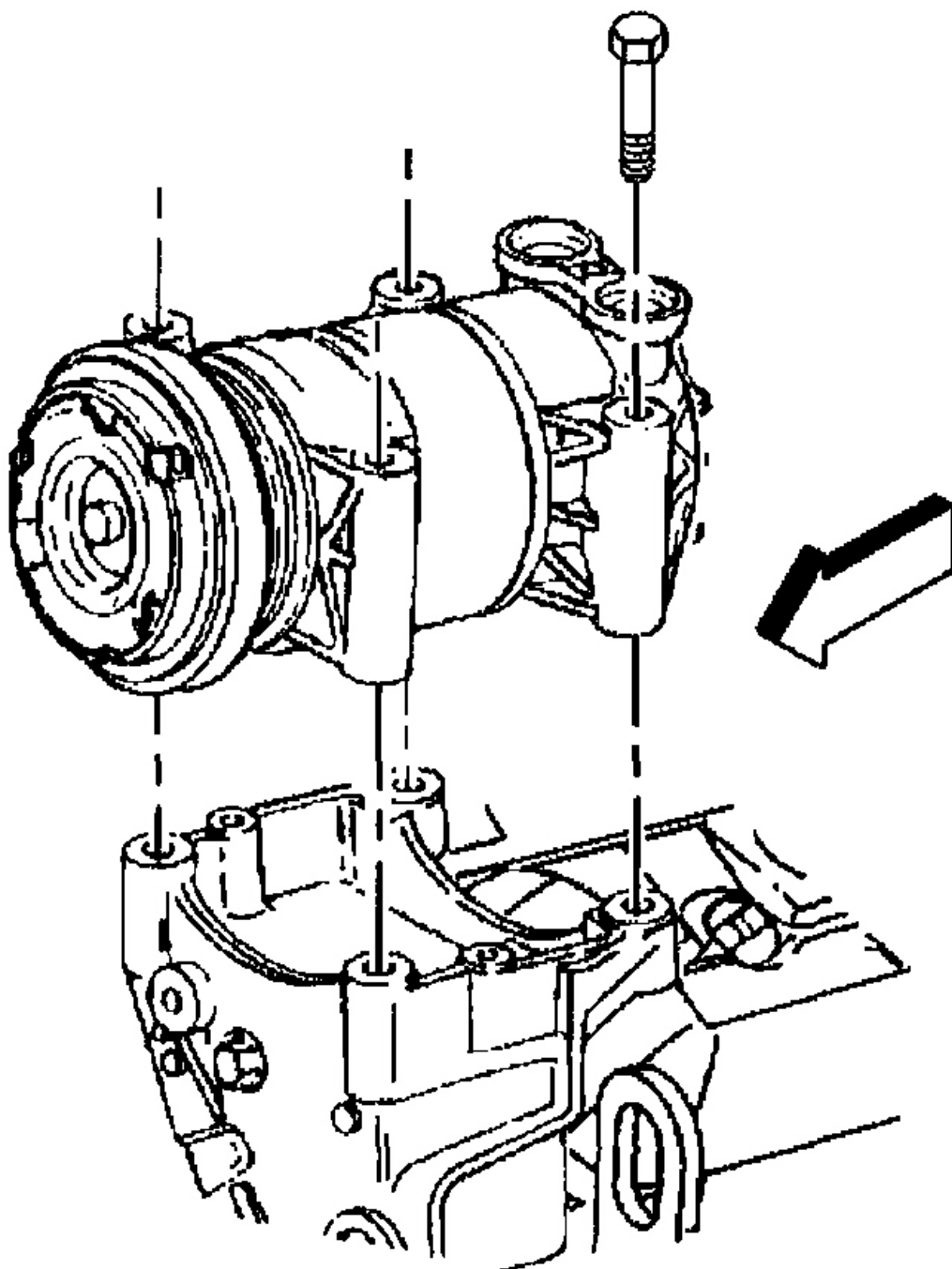
G01688429

Fig. 52: Removing Accelerator Control Cable Bracket
 Courtesy of GENERAL MOTORS CORP.

14. Remove the ignition coil and ICM bracket.
15. Remove the EGR pipe from the intake manifold.

Important: It is not necessary to discharge the A/C refrigerant.

16. Remove the air conditioning (A/C) compressor, if equipped, and set aside.
17. Remove the power steering pulley from the power steering pump.
18. Remove the power steering pump mounting bracket.
19. Remove the left side valve rocker arm cover. Refer to **Valve Rocker Arm Cover Replacement - Left** or **Valve Rocker Arm Cover Replacement - Right**.



G01688430

Fig. 53: Removing Power Steering Pump Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

20. Remove the right side valve rocker arm cover. Refer to **Valve Rocker Arm Cover Replacement - Left** or **Valve Rocker Arm Cover Replacement - Right**.
21. Remove the lower intake manifold from the engine.
22. Clean all sealing surfaces.

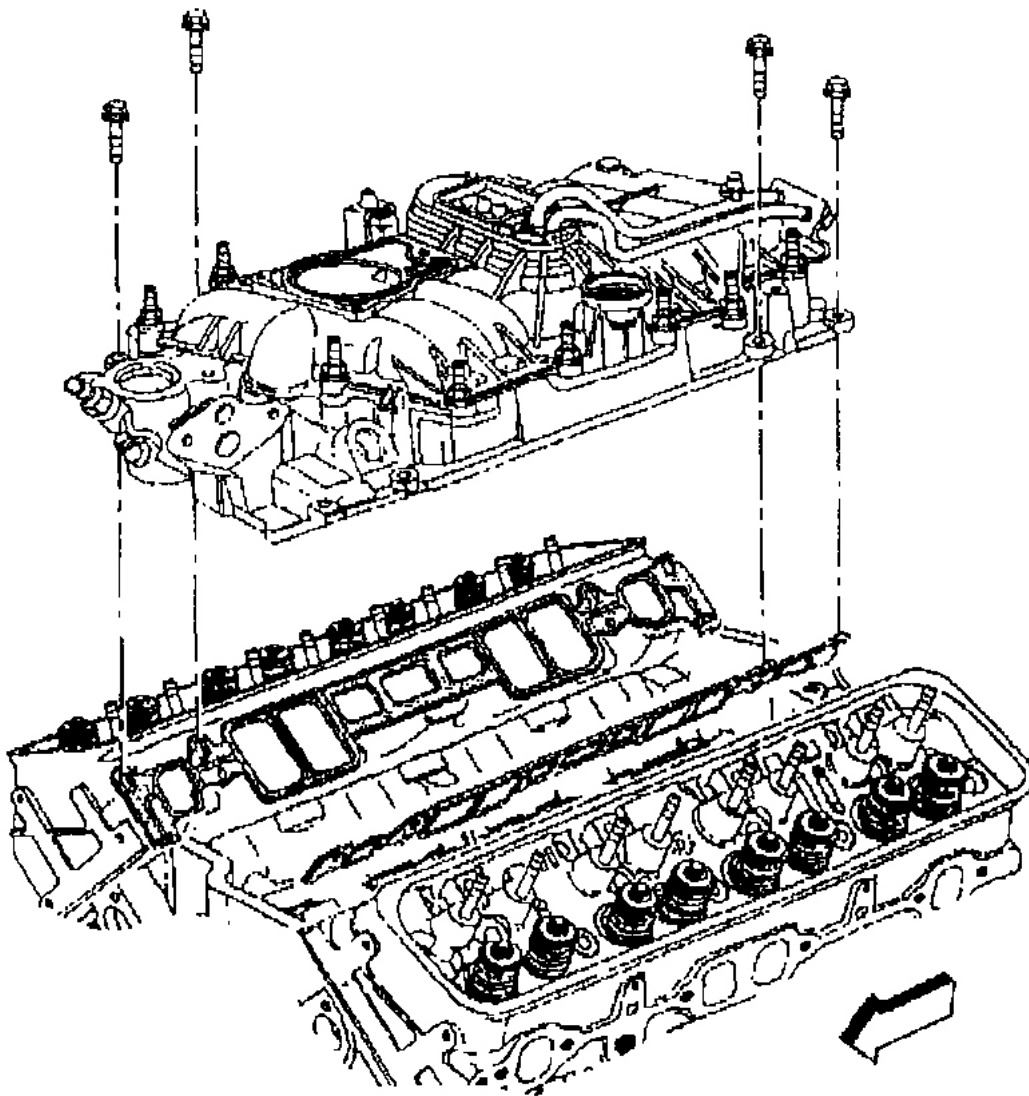
**G01688431**

Fig. 54: Removing Lower Intake Manifold
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the lower intake manifold to the engine.
2. Install the left side valve rocker arm cover. Refer to **Valve Rocker Arm Cover Replacement - Left** or **Valve Rocker Arm Cover Replacement - Right**.
3. Install the right side valve rocker arm cover. Refer to **Valve Rocker Arm Cover Replacement - Left** or **Valve Rocker Arm Cover Replacement - Right**.
4. Install the power steering pump mounting bracket.
5. Install the air conditioning (A/C) compressor, if equipped.

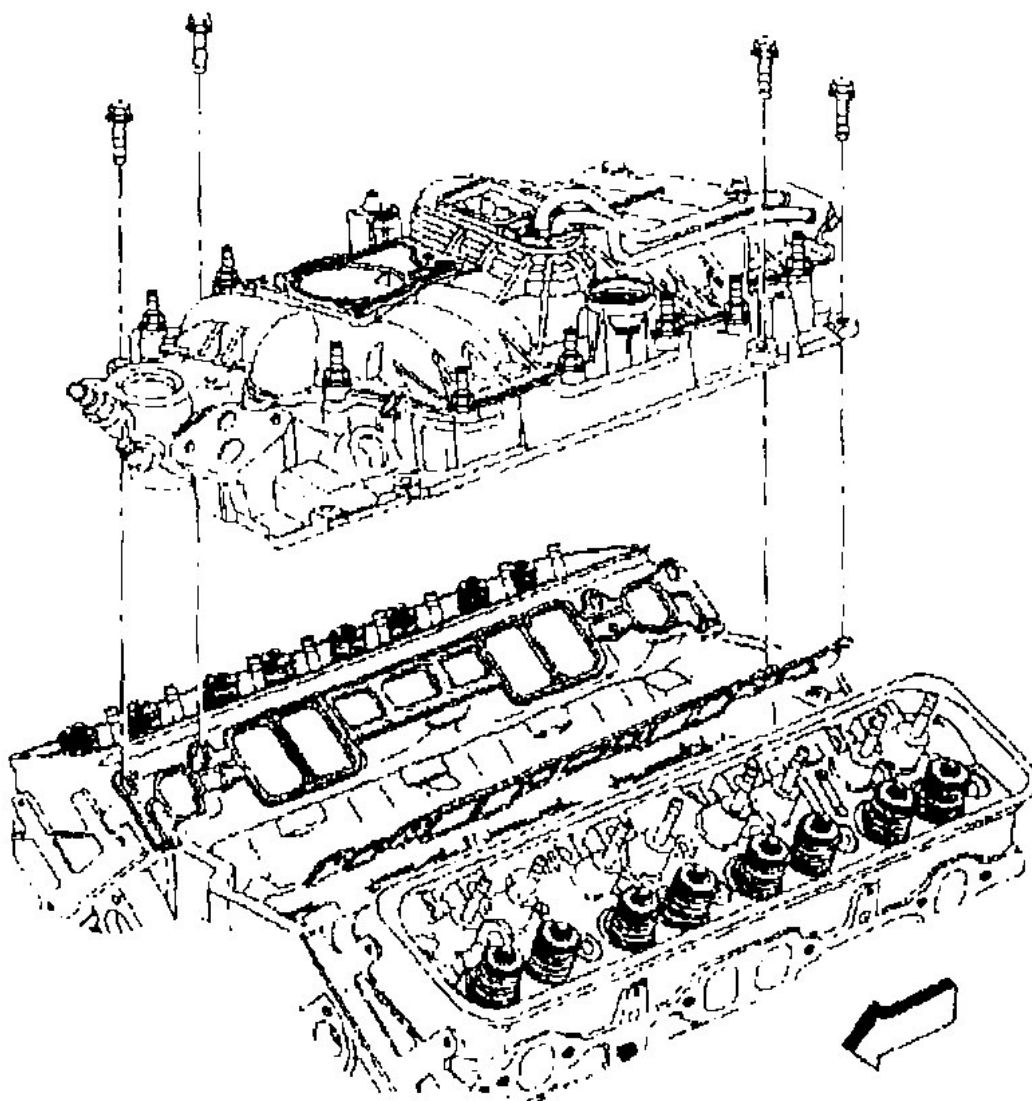
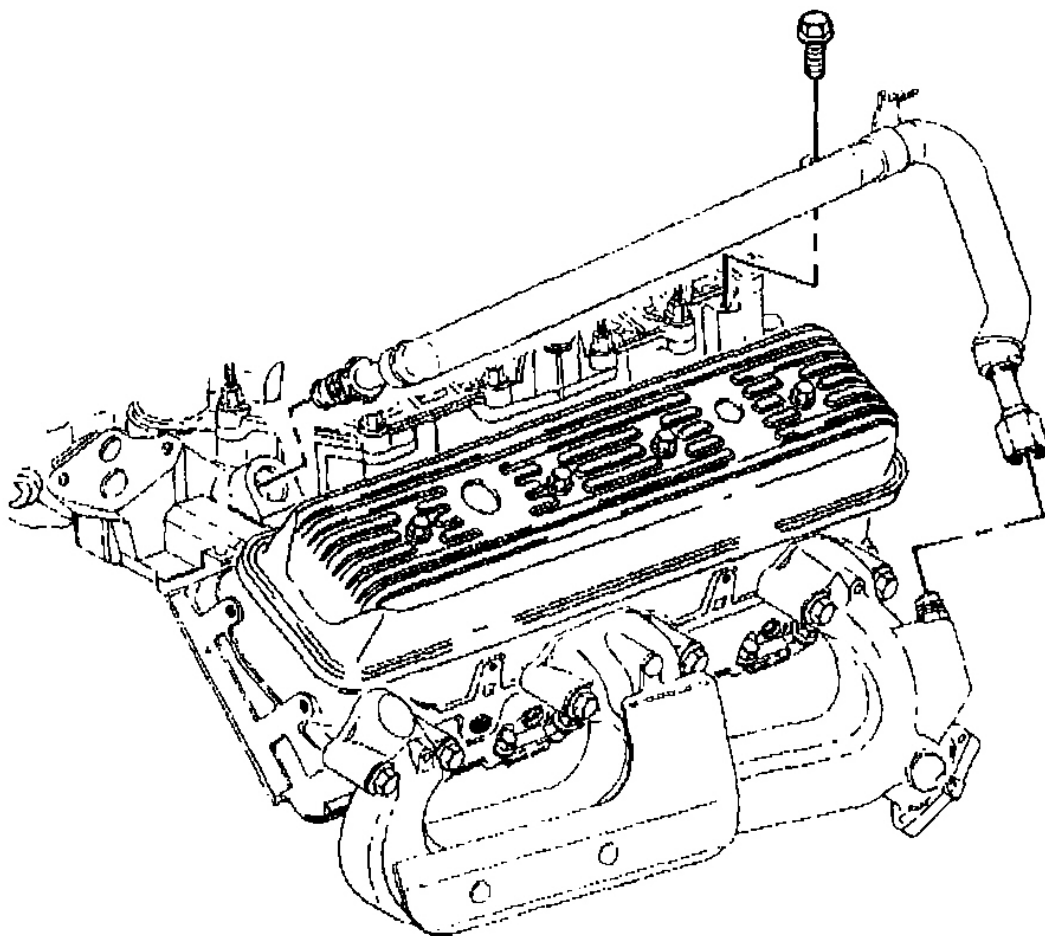
**G01688432**

Fig. 55: Installing Power Steering Pump Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

6. Connect the exhaust gas recirculation (EGR) pipe to the bracket and the front of the intake manifold.
7. Install the ignition coil and the ICM bracket
8. Install AIR bypass hose assembly, if so equipped.

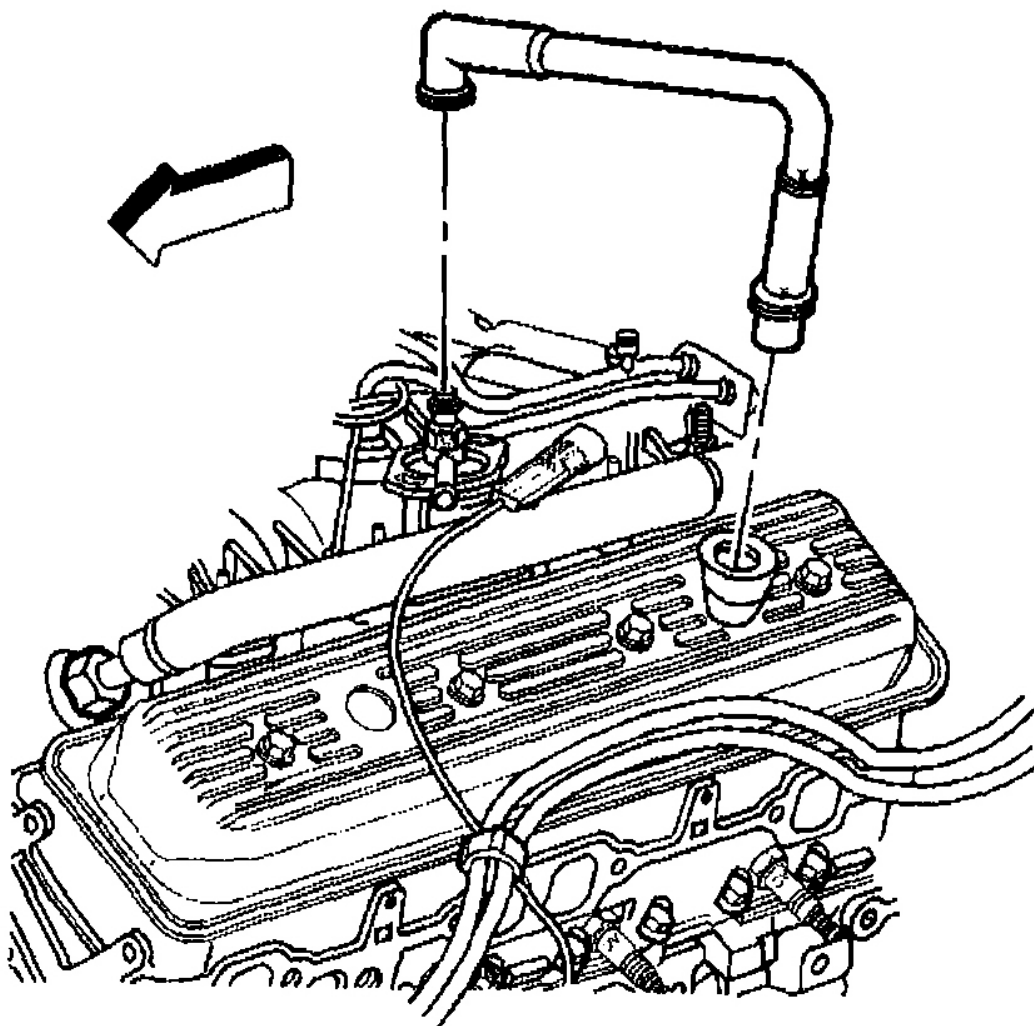


G01688433

Fig. 56: Installing Air Bypass Hose Assembly
Courtesy of GENERAL MOTORS CORP.

9. Install the accelerator control cable bracket to the throttle body and the lower intake manifold.
10. Install the accelerator control cable and the cruise control cable, if equipped, to the throttle shaft.
11. Install the fuel pipes to the rear of the engine.
12. Install the distributor to the engine.

13. Install the PCV tube at intake manifold using a twisting motion in order to lock.
14. Install the vacuum brake booster hose, if equipped.



G01688434

Fig. 57: Installing PCV Tube & Vacuum Brake Booster Hose
Courtesy of GENERAL MOTORS CORP.

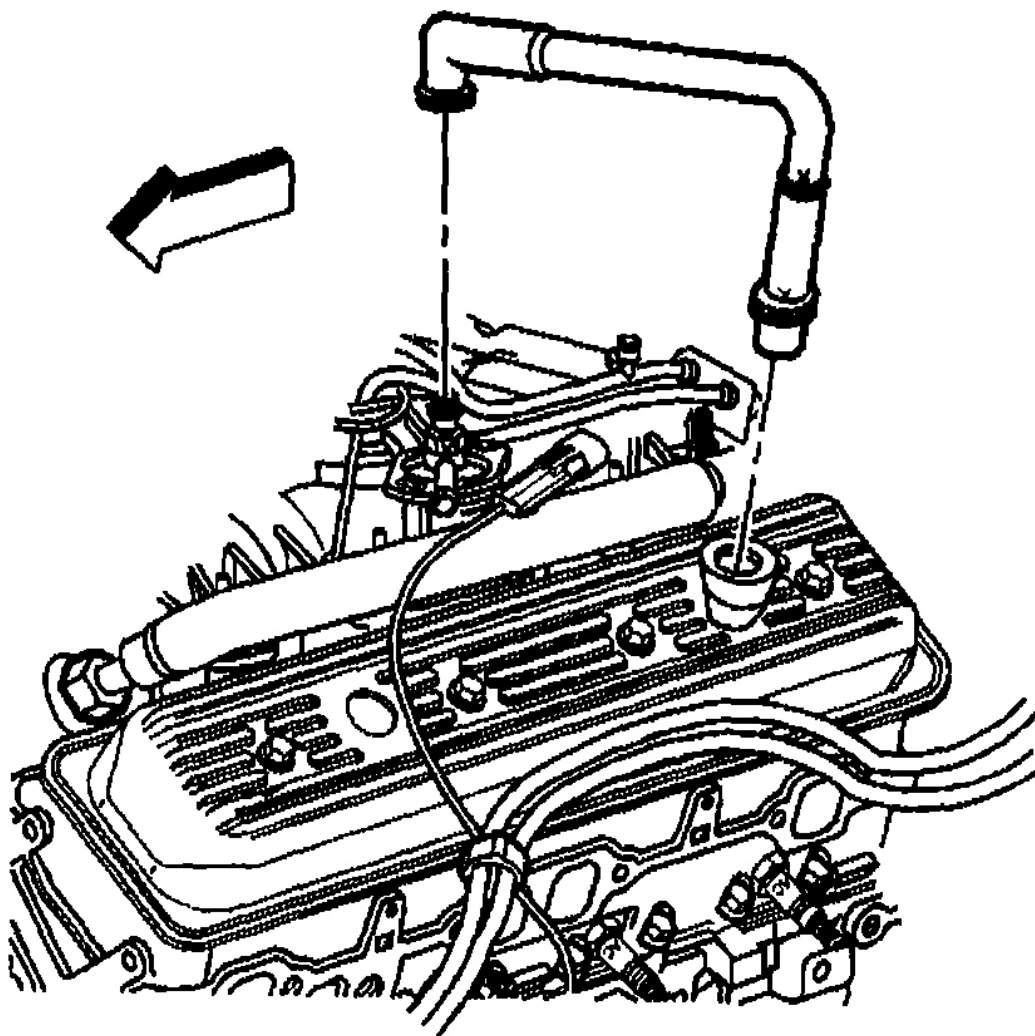
15. Connect the following electrical connectors:
 - SCPI injector electrical connector.
 - Manifold absolute pressure (MAP) sensor.
 - EVAP canister purge solenoid valve.
 - Idle air control (IAC) motor.

- Throttle position (TP) sensor.
 - Exhaust gas recirculation (EGR) valve.
 - Engine coolant temperature (ECT) sensor.
16. Install the AIR bypass hose assembly, if so equipped.
 17. Install the brake booster vacuum hose, if so equipped.
 18. Install the upper radiator hose.
 19. Install the inlet heater hose.
 20. Install the outlet heater hose.
 21. Install the coolant bypass hose.
 22. Install the coolant reservoir.
 23. Install the engine cover.
 24. Install the air cleaner assembly.
 25. Fill the engine with coolant.
 26. Connect the battery negative cable.

VALVE ROCKER ARM COVER REPLACEMENT - LEFT

Removal Procedure

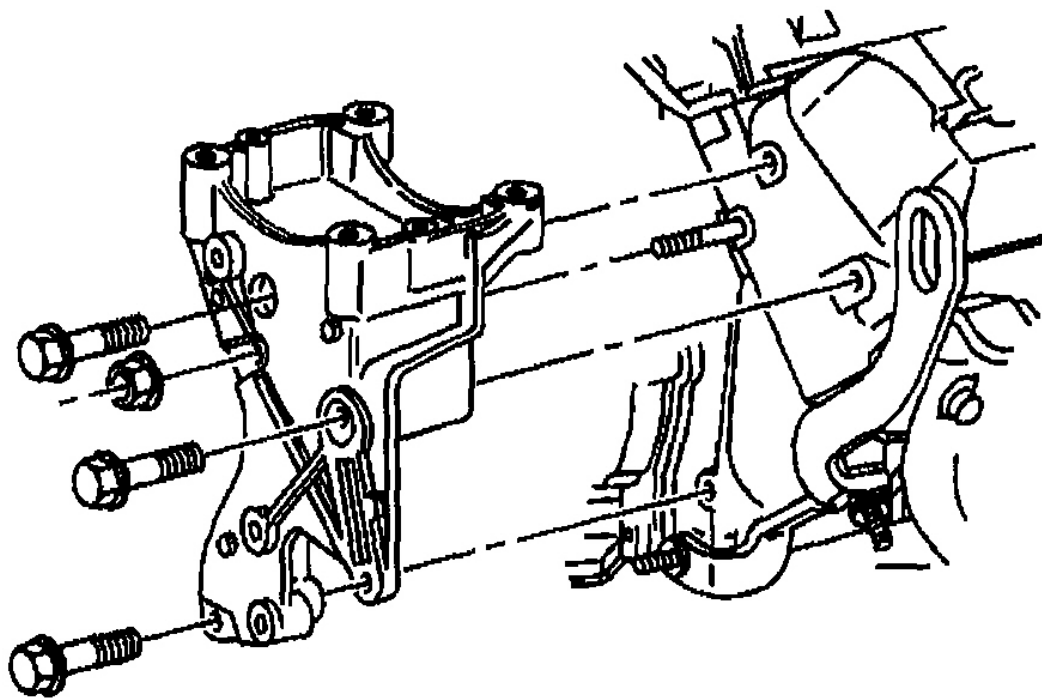
1. Remove the engine cover.
2. Disconnect the spark plug wires from the distributor cap.
3. Remove the PCV valve from the valve rocker arm cover and set it aside.
4. Disconnect the ECT sensor electrical connector.



G01688435

Fig. 58: Identifying Breather Tube
Courtesy of GENERAL MOTORS CORP.

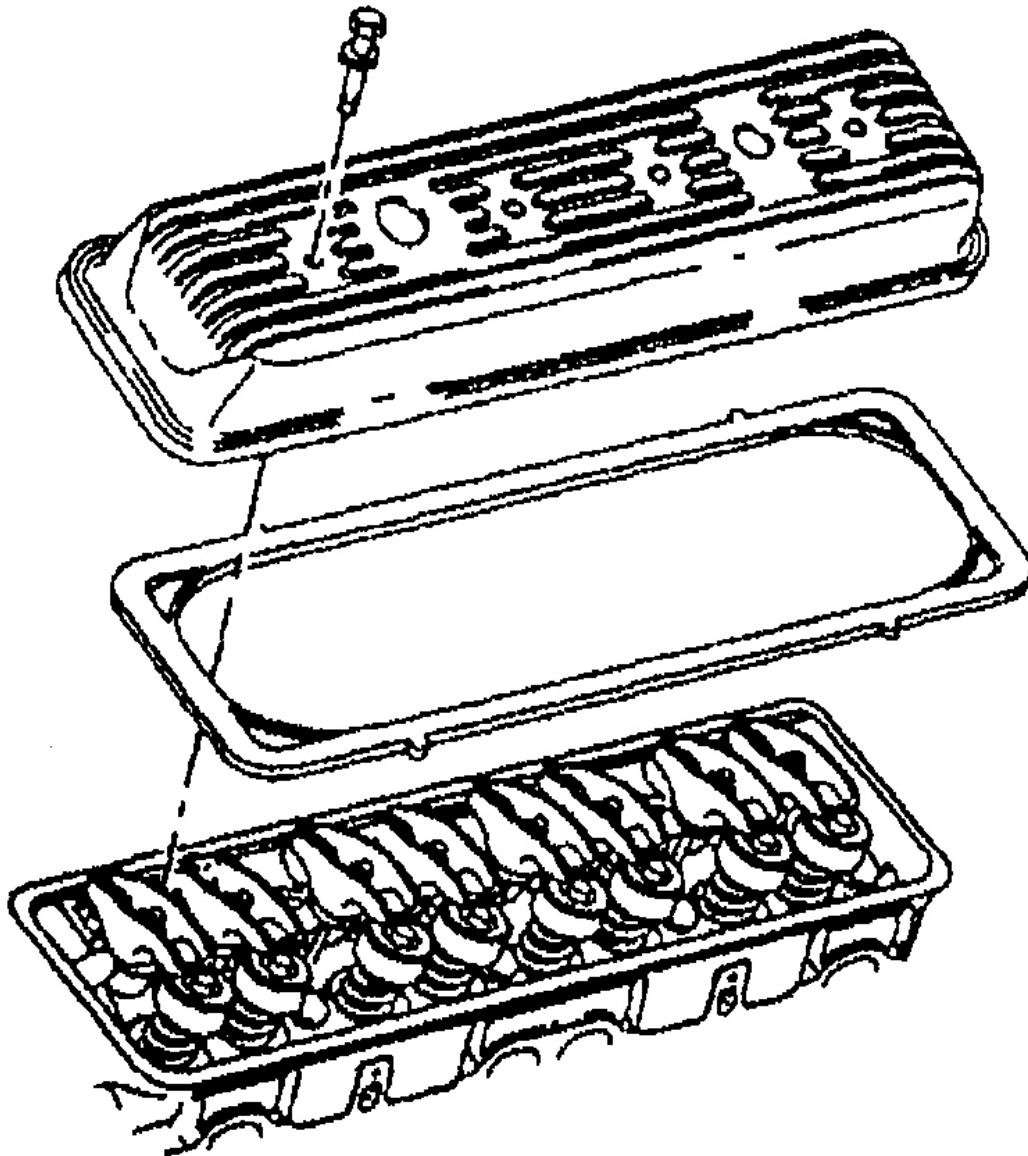
5. Remove AIR bypass hose assembly, if so equipped.
6. In order to gain access, remove the A/C compressor, if equipped.
7. Remove the power steering pulley from the power steering pump.
8. Remove the power steering pump mounting bracket.
9. Lay the power steering pump and the power steering pump bracket aside.



G01688436

Fig. 59: Removing Power Steering Pump Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

10. Remove the left valve rocker arm cover and gasket from the engine.
11. Clean all sealing surfaces.



G01688437

Fig. 60: Removing Left Valve Rocker Arm Cover & Gasket
Courtesy of GENERAL MOTORS CORP.

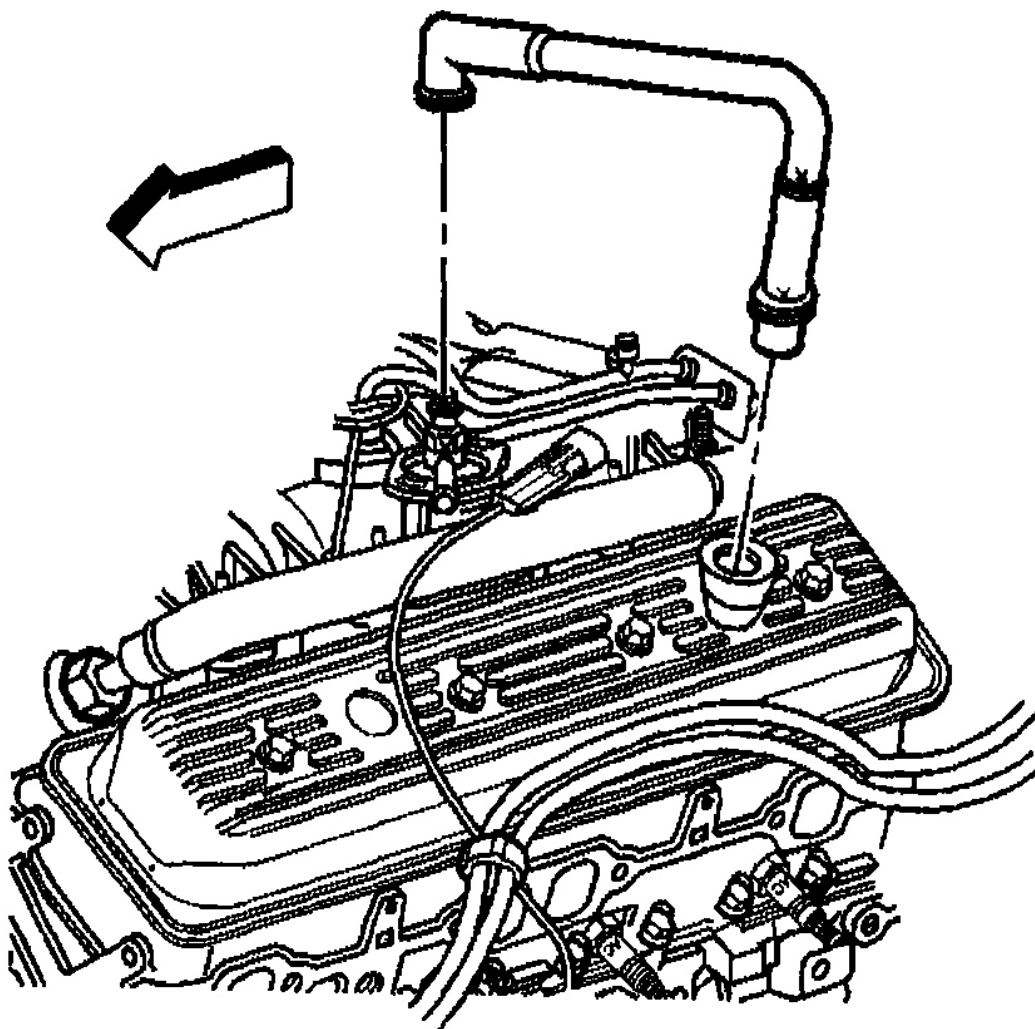
Installation Procedure

1. Install the left valve rocker arm cover and gasket to the engine.

Tighten

Tighten the bolts to 12 N.m (106 lb in).

2. Install the power steering pump bracket.
3. Install the Power Steering Pump
4. Install the A/C compressor, if equipped.



G01688438

Fig. 61: Identifying Breather Tube
Courtesy of GENERAL MOTORS CORP.

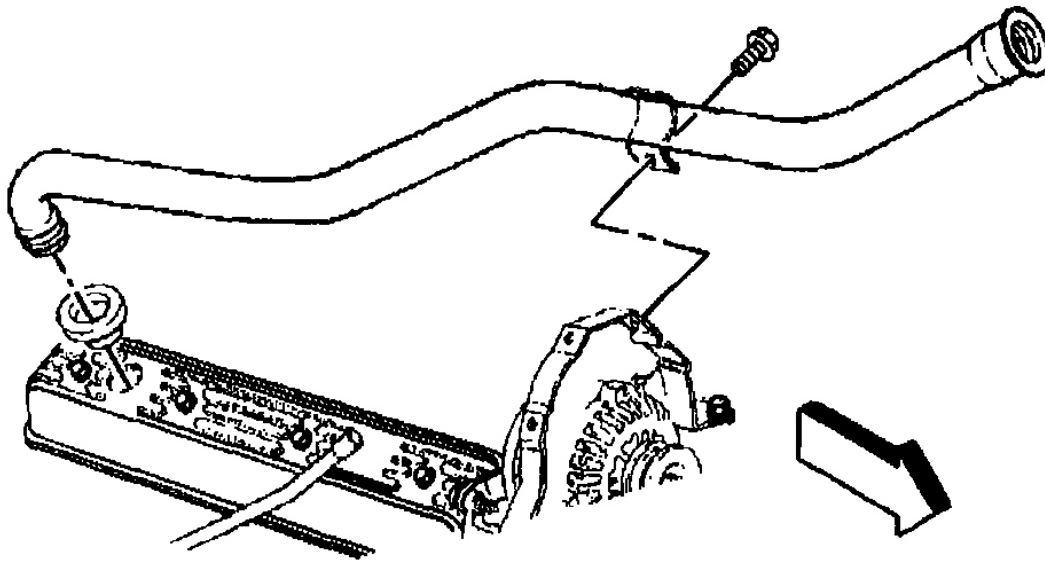
5. Connect the ETC sensor electrical connector.
6. Install the PCV valve to the valve rocker arm cover.

7. Install AIR bypass hose assembly, if so equipped.
8. Connect the spark plug wires to the distributor cap.
9. Install the engine cover.

VALVE ROCKER ARM COVER REPLACEMENT - RIGHT

Removal Procedure

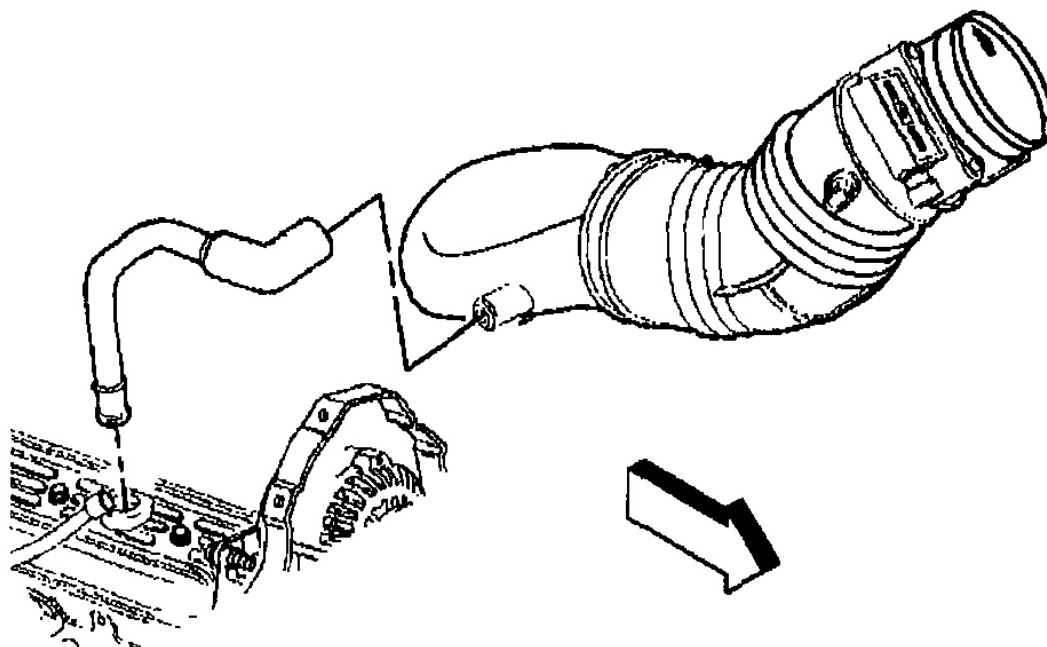
1. Remove the engine cover.
2. Remove the screw retaining the oil fill tube to the generator and drive belt tensioner bracket.
3. Remove the oil fill tube from the engine.
4. Disconnect the ignition control module (ICM) electrical connector.
5. Open the engine electrical harness retainer.
6. Reposition the engine electrical harness over the ignition coil.



G01688439

Fig. 62: Removing Oil Fill Tube & Screw
Courtesy of GENERAL MOTORS CORP.

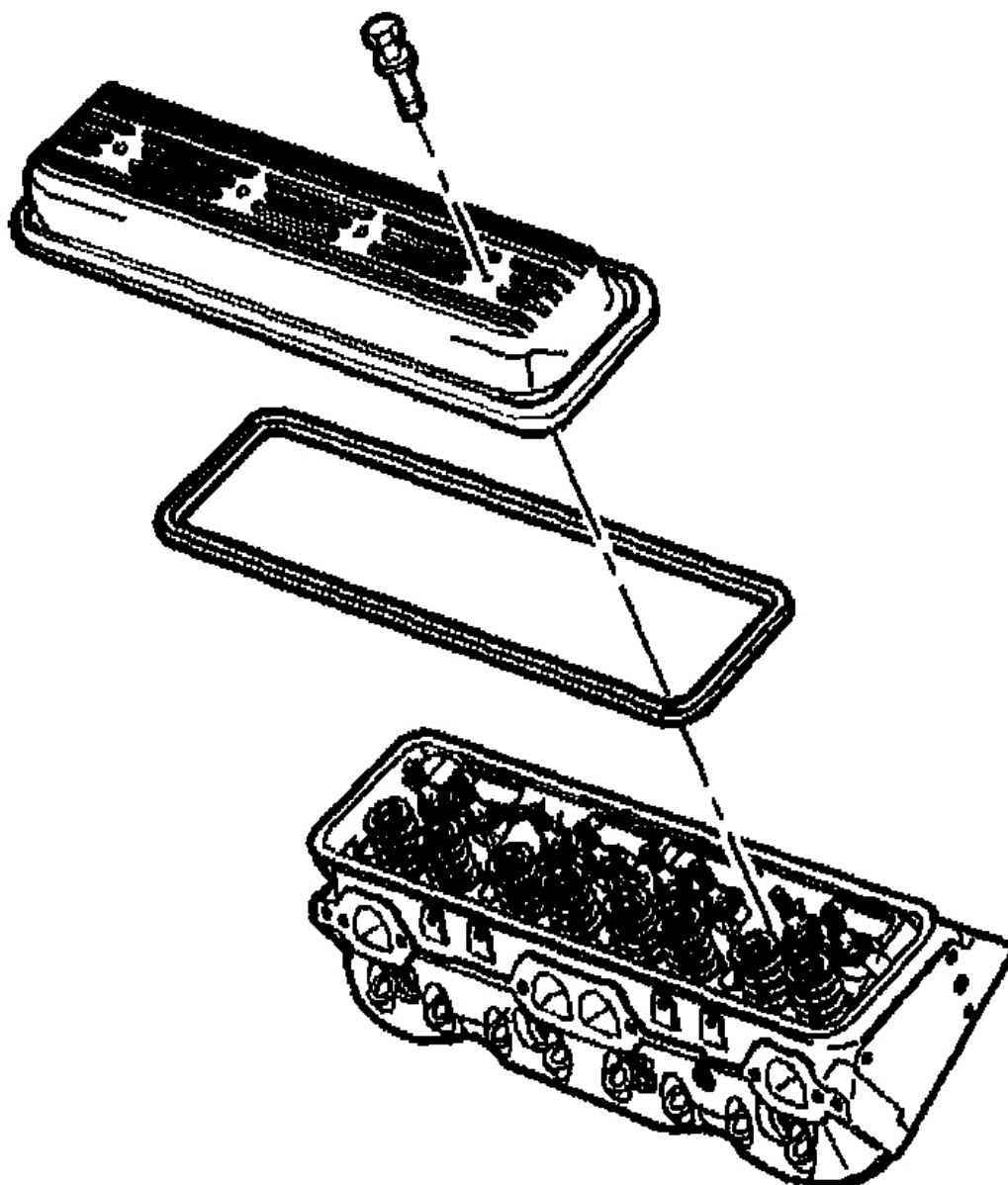
7. Disconnect the spark plug wires from the distributor cap.
8. Remove AIR bypass hose assembly, if so equipped.
9. Remove the crankcase vent tube from the right side valve rocker arm cover.



G01688440

Fig. 63: Removing Crankcase Vent Tube
Courtesy of GENERAL MOTORS CORP.

10. Remove the valve cover from the engine.
11. Clean all sealing surfaces.



G01688441

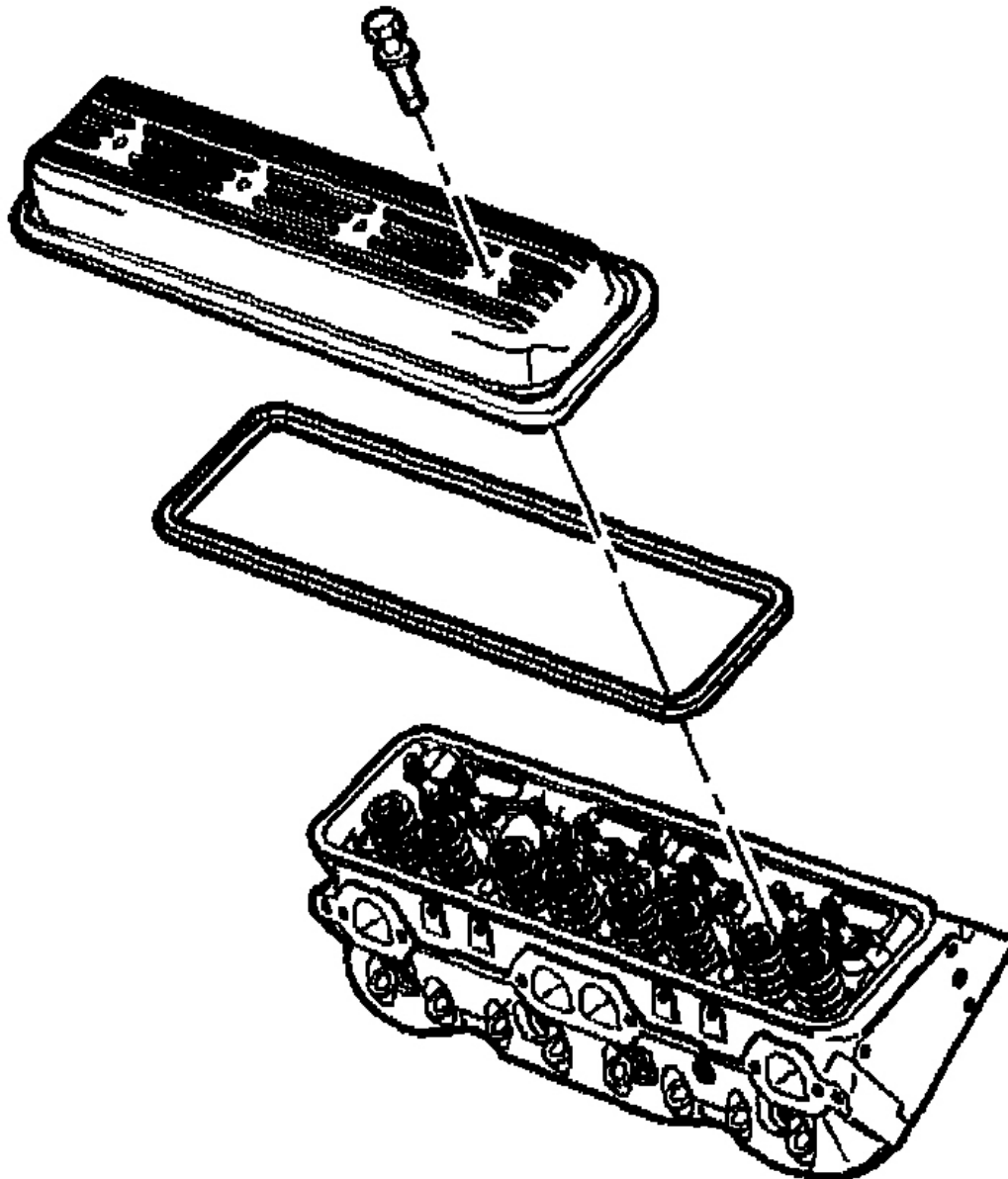
Fig. 64: Removing Valve Cover
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the right valve cover and gasket to the engine.

Tighten

Tighten the bolts to 12 N.m (106 lb in).



G01688442

Fig. 65: Installing Right Valve Cover & Gasket
Courtesy of GENERAL MOTORS CORP.

2. Install the crankcase vent tube to the right side valve cover.
3. Connect the spark plug wires to the distributor cap.
4. The wires and the distributor cap are numbered in order to aid assembly.
5. Install AIR bypass hose assembly, if so equipped.
6. Reposition the engine electrical harness into the harness retainer.
7. Close the engine electrical harness retainer.
8. Connect the ignition control module (ICM) electrical connector.
9. Install the engine oil fill tube to the engine.
10. Install the engine cover.

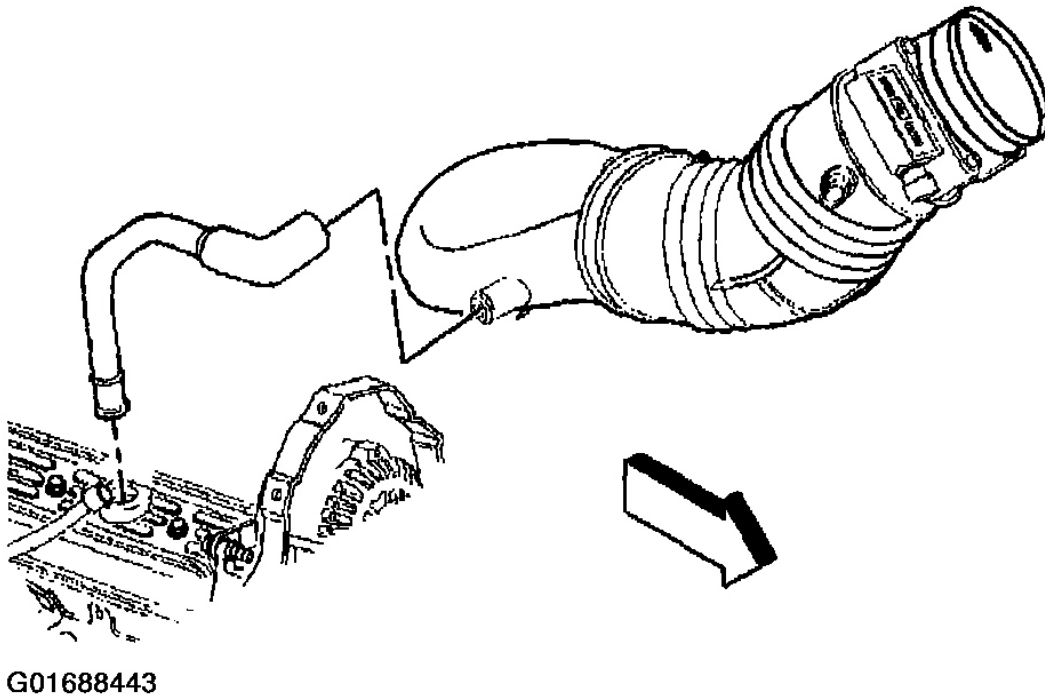


Fig. 66: Installing Crankcase Vent Tube
Courtesy of GENERAL MOTORS CORP.

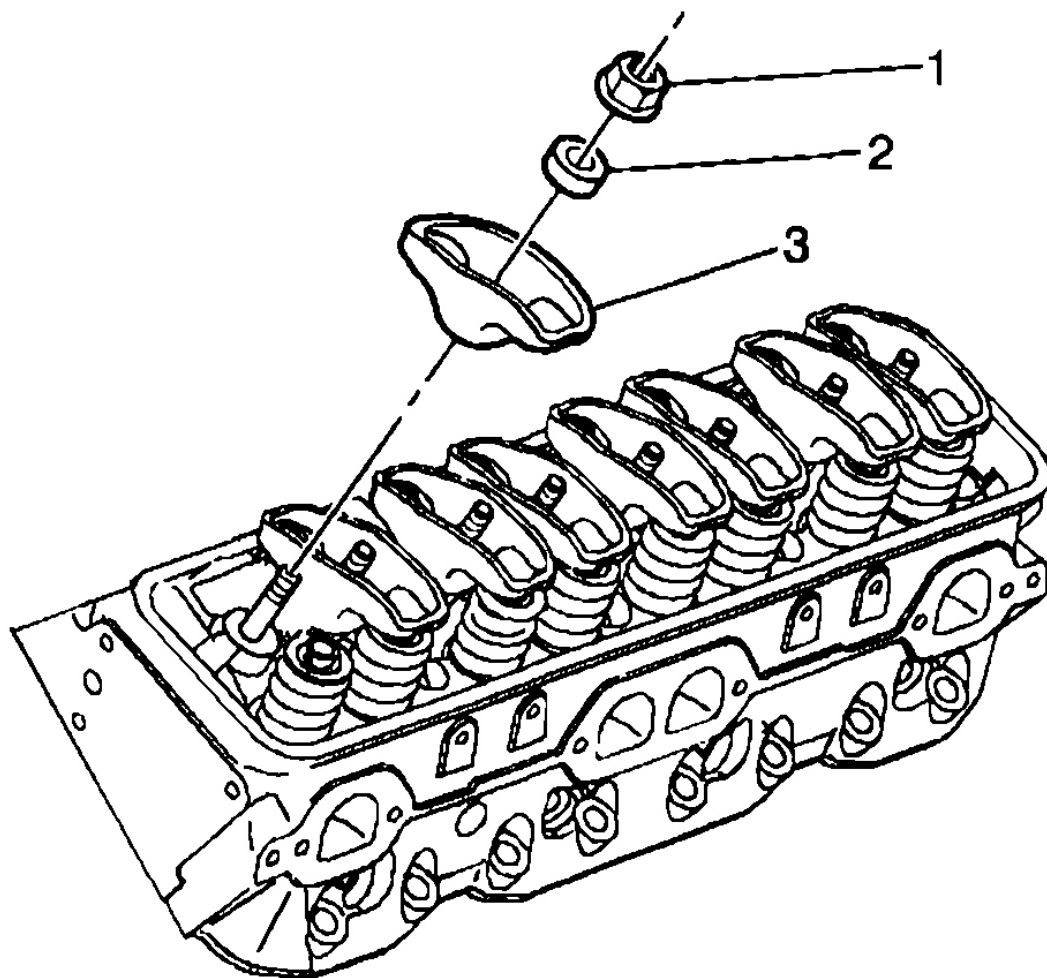
VALVE ROCKER ARM AND PUSH ROD REPLACEMENT

Removal Procedure

1. Remove the valve rocker arm cover. Refer to **Valve Rocker Arm Cover Replacement - Left** or **Valve Rocker Arm Cover Replacement - Right**.

Important: Store used components in order so that they can be reassembled in the same location.

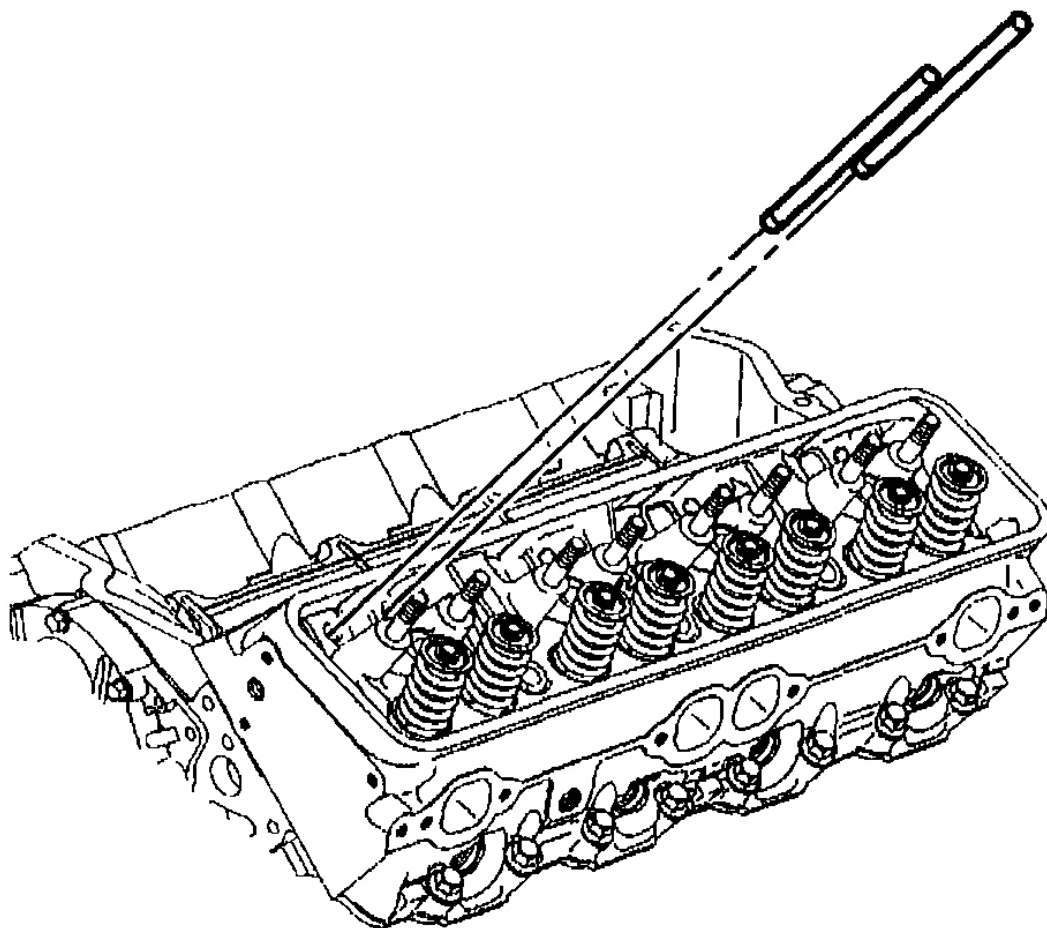
2. Remove the valve rocker arm nut (1).
3. If only the valve pushrod is being replaced, back the valve rocker arm nut off until the valve rocker arm can rotate away from the pushrod.
4. Then remove the valve pushrod.
5. Remove the valve rocker arm (3) with the valve rocker arm ball.



G01688444

Fig. 67: Removing Valve Rocker Arm, Nut & Ball
Courtesy of GENERAL MOTORS CORP.

6. Remove the valve pushrod.
7. Clean and inspect all parts. Refer to **Valve Rocker Arm And Push Rod Replacement**.

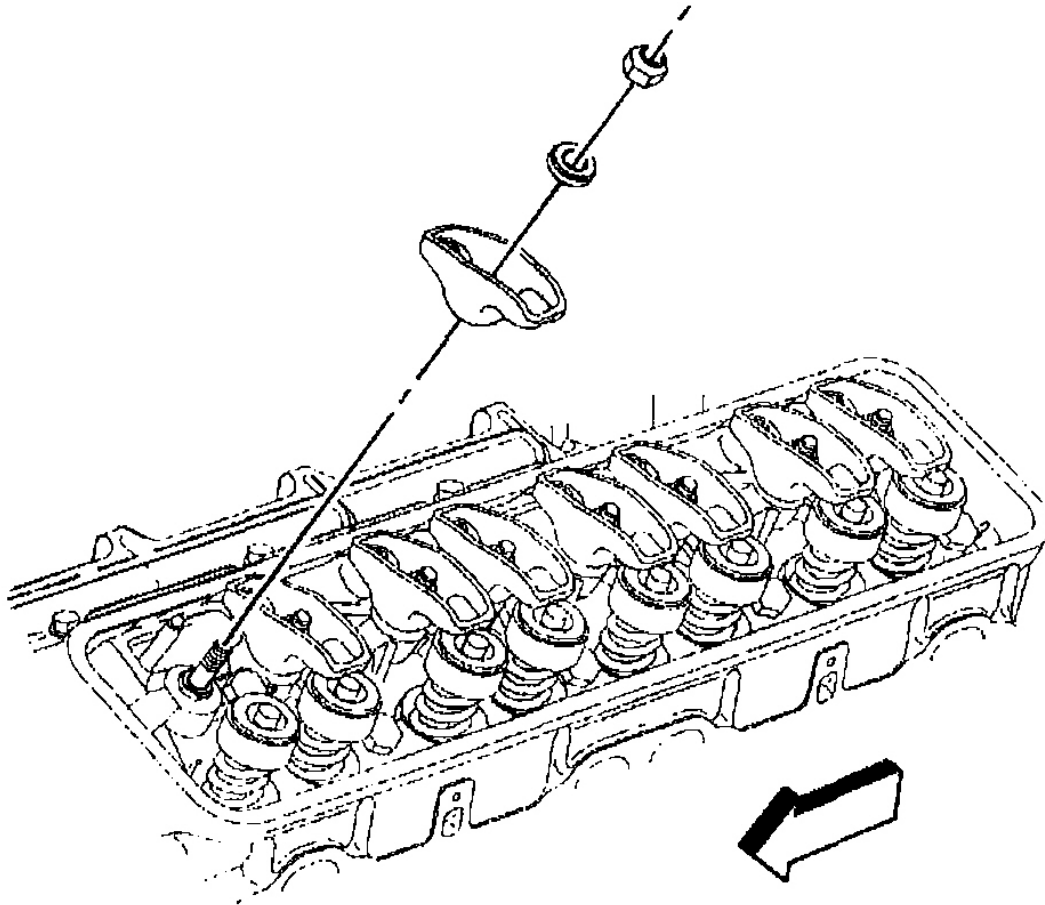


G01688445

Fig. 68: Removing Valve Pushrod
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the valve pushrods and valve rocker arms. Refer to **Valve Rocker Arm And Push Rod Replacement**.
2. Adjust the valve lash. Refer to **Valve Lash Adjustment**.
3. Install the valve rocker arm covers. Refer to **Valve Rocker Arm Cover Replacement - Left** or **Valve Rocker Arm Cover Replacement - Right**.

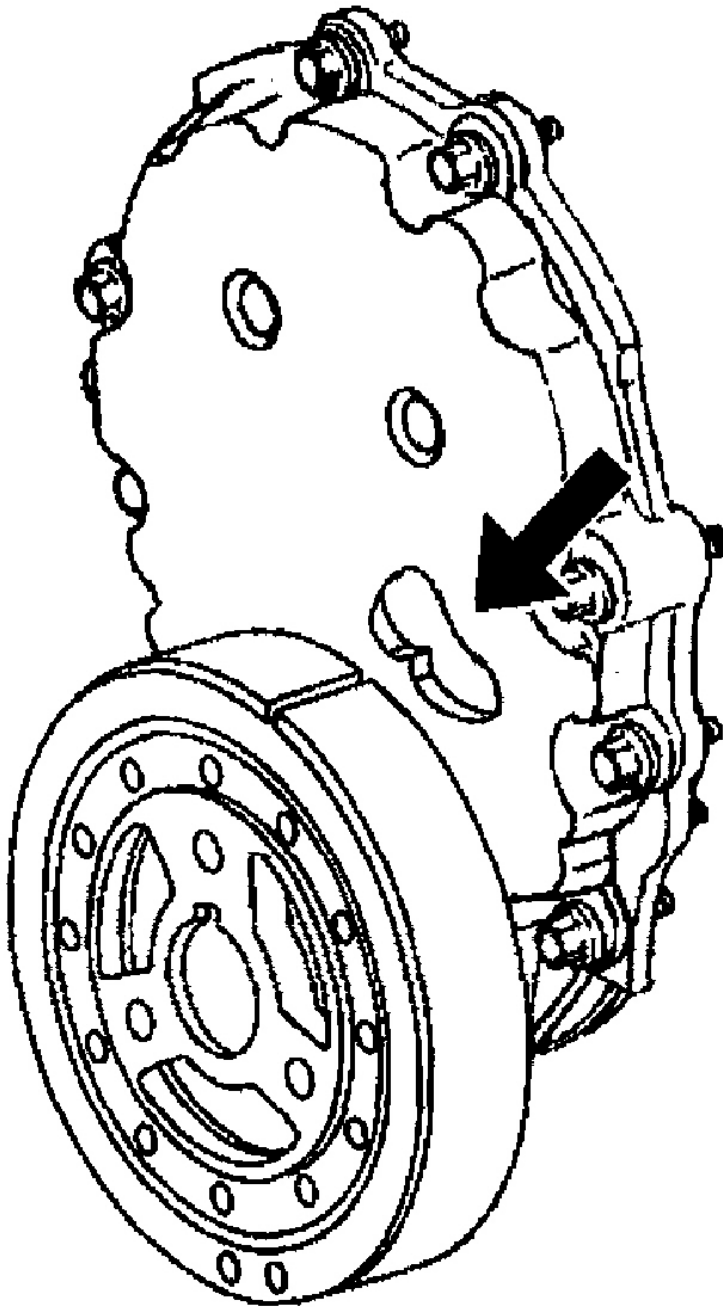


G01688446

Fig. 69: Installing Valve Rocker Arm, Nut & Ball
Courtesy of GENERAL MOTORS CORP.

VALVE LASH ADJUSTMENT

1. Turn the valve rocker arm nuts clockwise until all of the valve lash is removed.
2. Turn the crankshaft clockwise until the alignment mark on the crankshaft balancer is aligned with the notch in the engine front cover tab.
3. Look at the number 1 cylinder valves as the crankshaft balancer alignment mark approaches the notch in the engine front cover tab. If a valve moves as the alignment mark moves into position, the engine is in the number 6 firing position. If this happens, turn the crankshaft clockwise 1 revolution in order to reach the number 1 cylinder firing position.



G01688821

Fig. 70: Turning Valve Rocker Arm Nuts & Crankshaft Clockwise
Courtesy of GENERAL MOTORS CORP.

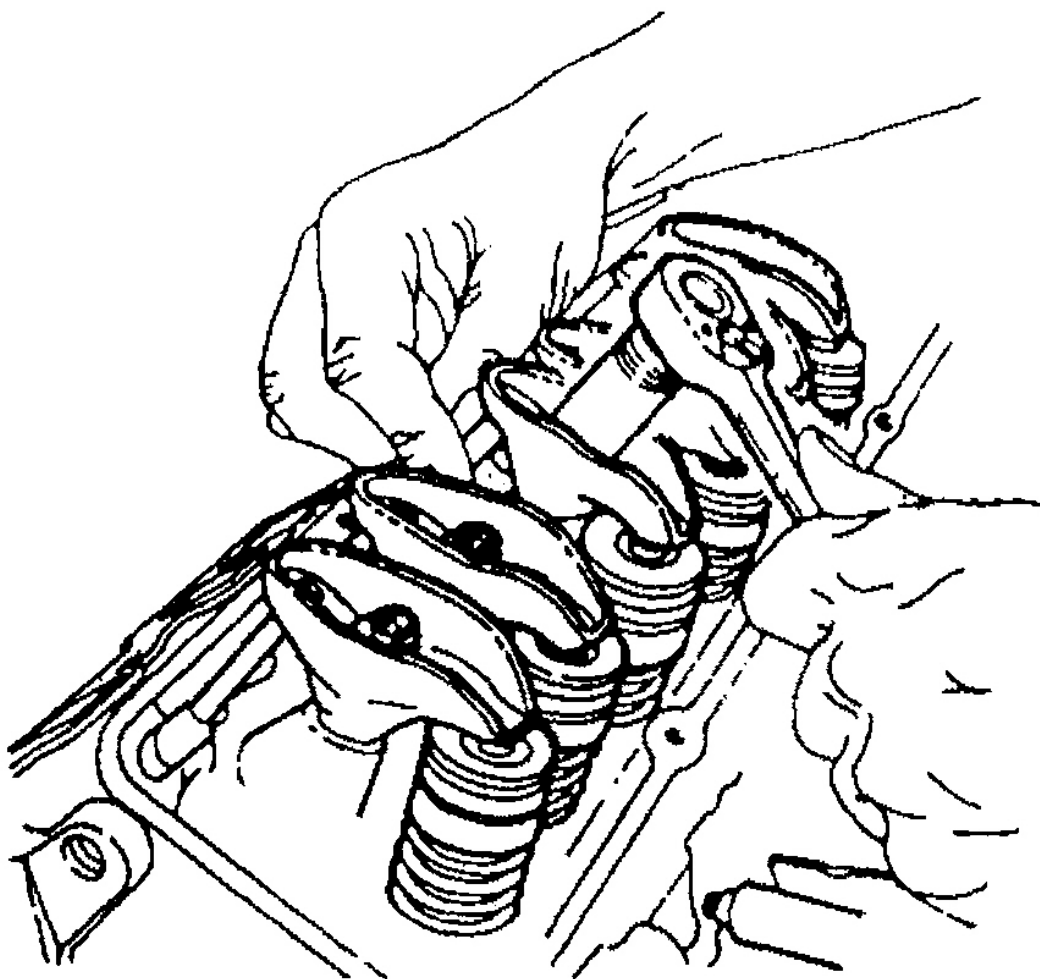
4. With the engine in the number 1 firing position, adjust the exhaust valves for cylinders number 1, 3, 4, and 8 and the intake valves for cylinders number 1, 2, 5, and 7.

4.1. Turn the valve rocker arm nut counter clockwise until the valve lash is felt in the valve pushrod.

4.2. Turn the valve rocker arm nut clockwise until all the valve lash is removed.

Zero valve lash can be felt by moving the valve pushrod up and down between your thumb and forefinger until there is no more up and down movement of the valve push rod.

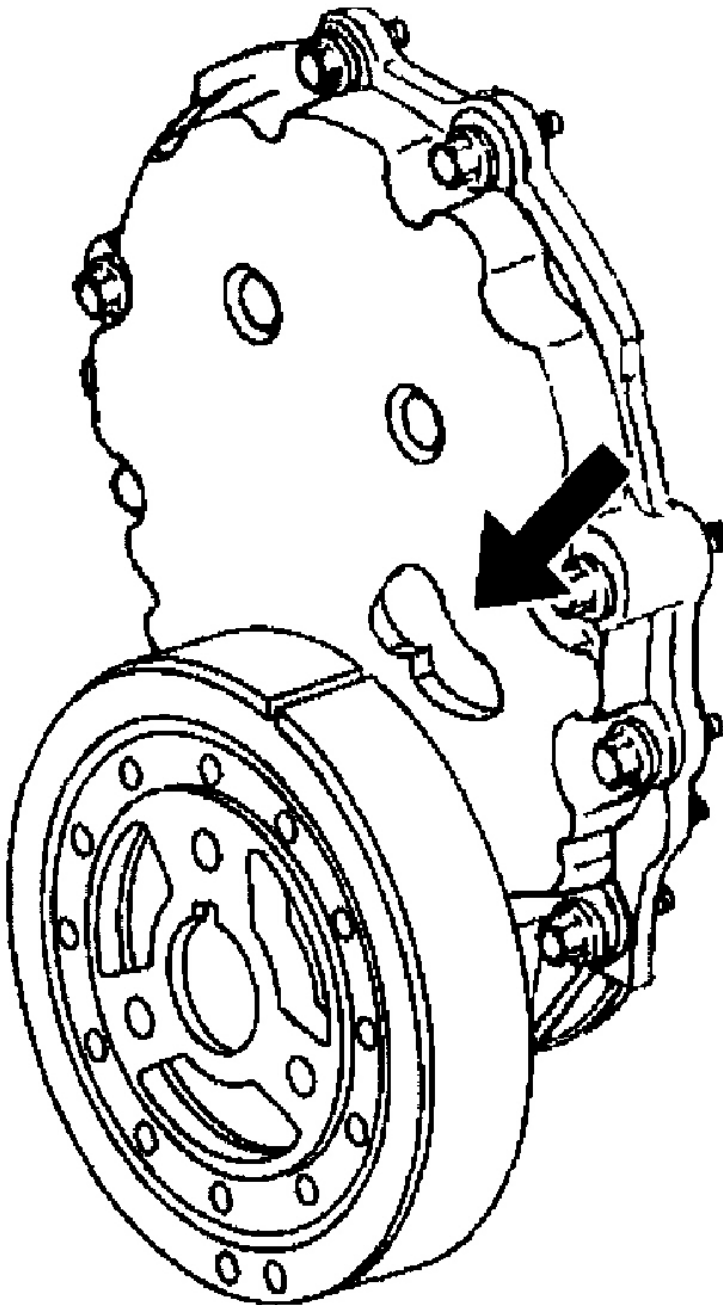
4.3. When all the valve lash is removed, then turn the valve rocker arm nut clockwise 1 additional turn (360 degrees).



G01688822

Fig. 71: Turning Valve Rocker Arm Nut
Courtesy of GENERAL MOTORS CORP.

5. Turn the crankshaft clockwise 1 revolution until the alignment mark on the crankshaft balancer is aligned with the notch in the engine front cover tab.



G01688823

Fig. 72: Aligning Crankshaft Balancer With Notch In Engine Front Cover Tab
Courtesy of GENERAL MOTORS CORP.

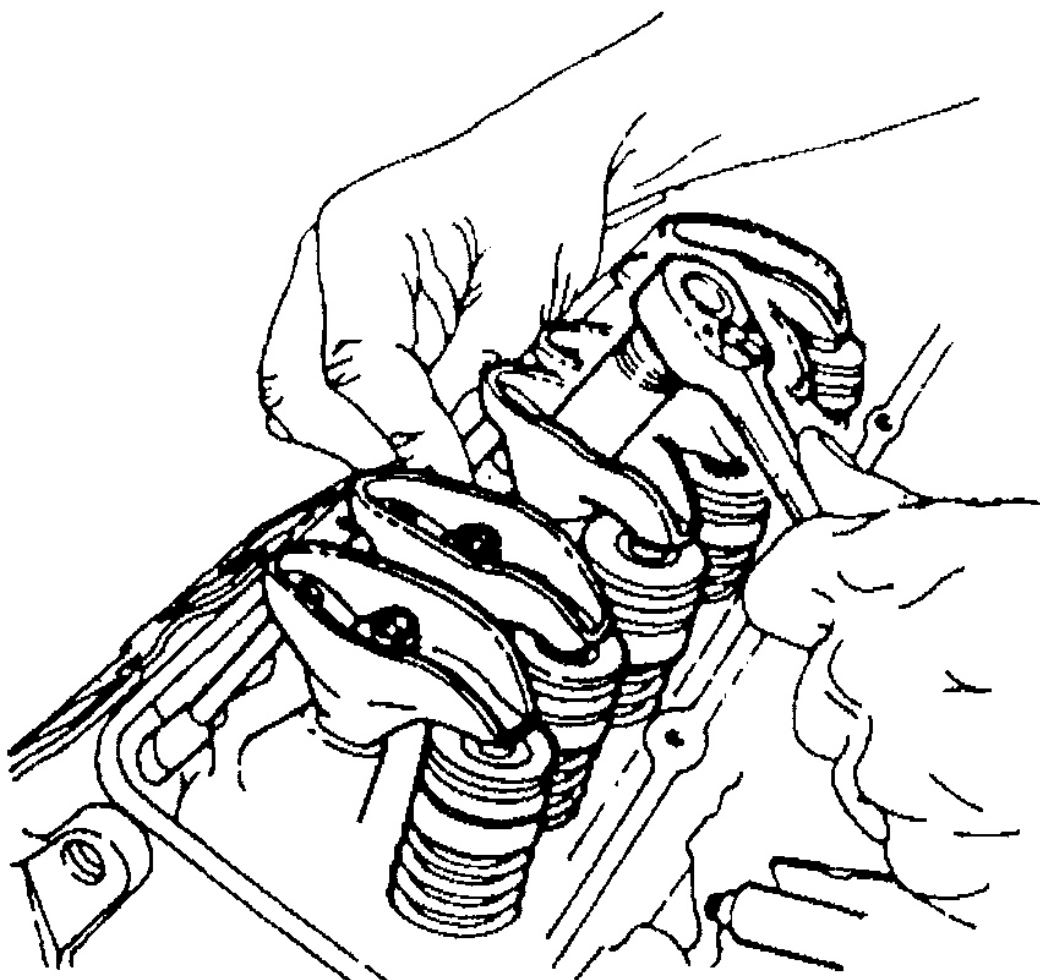
6. With the engine in the number 6 firing position, adjust the exhaust valves for cylinders number 2, 5, 6, and 7 and the intake valves for cylinders number 3, 4, 6, and 8.

6.1. Turn the valve rocker arm nut counter clockwise until the valve lash is felt in the valve pushrod.

6.2. Turn the valve rocker arm nut clockwise until all the valve lash is removed.

Zero valve lash can be felt by moving the valve pushrod up and down between your thumb and forefinger until there is no more up and down movement of the valve push rod.

6.3. When all the valve lash is removed, then turn the valve rocker arm nut clockwise 1 additional turn (360 degrees).



G01688824

Fig. 73: Turning Valve Rocker Arm Nut

Courtesy of GENERAL MOTORS CORP.

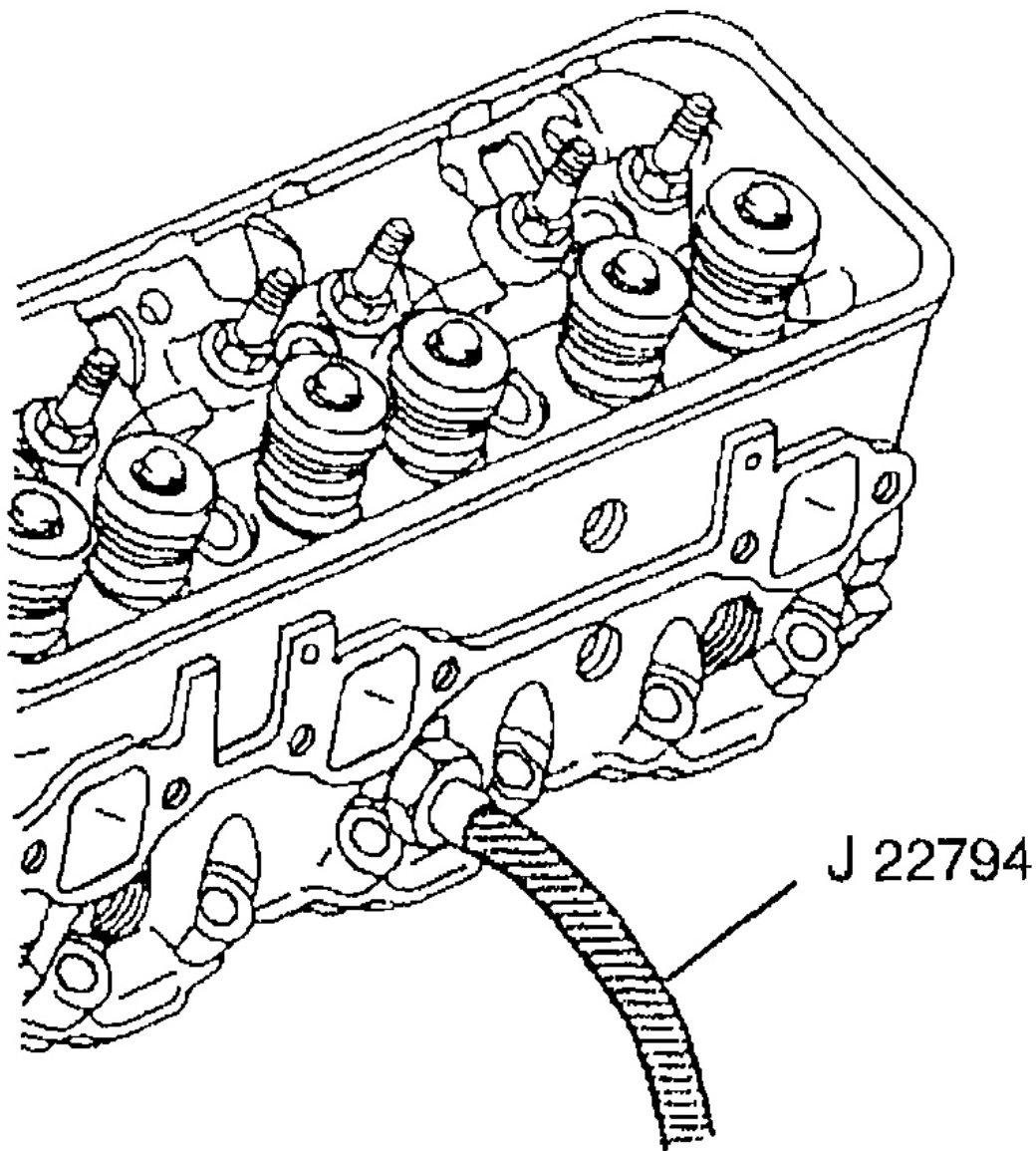
VALVE STEM OIL SEAL AND VALVE SPRING REPLACEMENT

Tools Required

- **J 22794** Spark Plug Port Adapter
- **J 38606** Valve Spring Compressor
- **J 5892-D** Valve Spring Compressor
- **J 42073** Valve Stem Oil Seal Installer

Removal Procedure

1. Remove the valve rocker arm covers. Refer to **Valve Rocker Arm Cover Replacement - Left** or **Valve Rocker Arm Cover Replacement - Right**.
2. Remove the spark plugs.
3. Install the **J 22794** into the spark plug hole.



G01688447

Fig. 74: Installing J 22794 Into Spark Plug Hole
Courtesy of GENERAL MOTORS CORP.

4. Apply compressed air in order to hold the valves in place.
5. Install the valve rocker arm nut.
6. Use the **J 5892-D** in order to compress the valve spring.

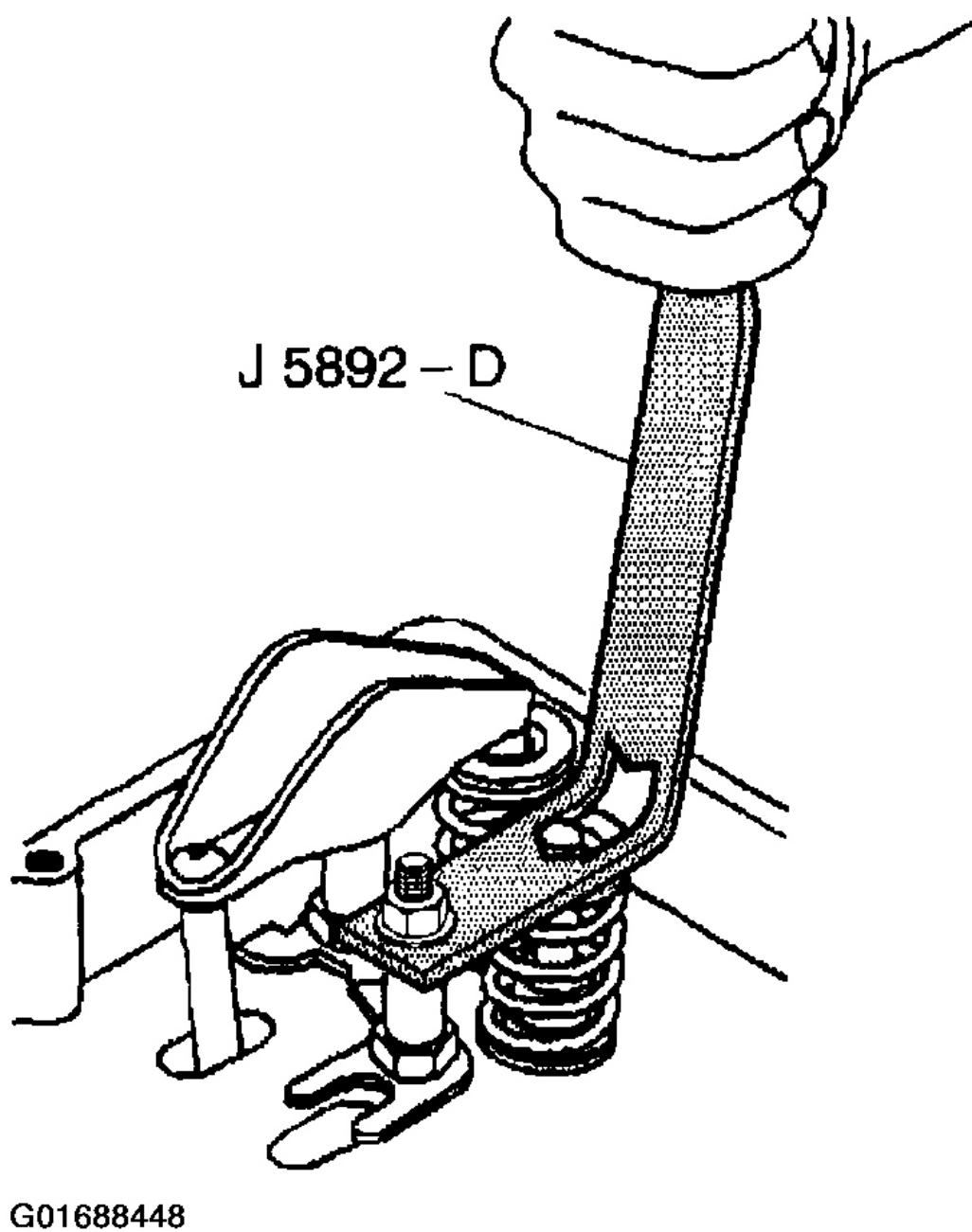


Fig. 75: Compressing Valve Spring Using J 5892-D
Courtesy of GENERAL MOTORS CORP.

7. Use the **J 38606** if clearance does not permit use of J 5892-D.

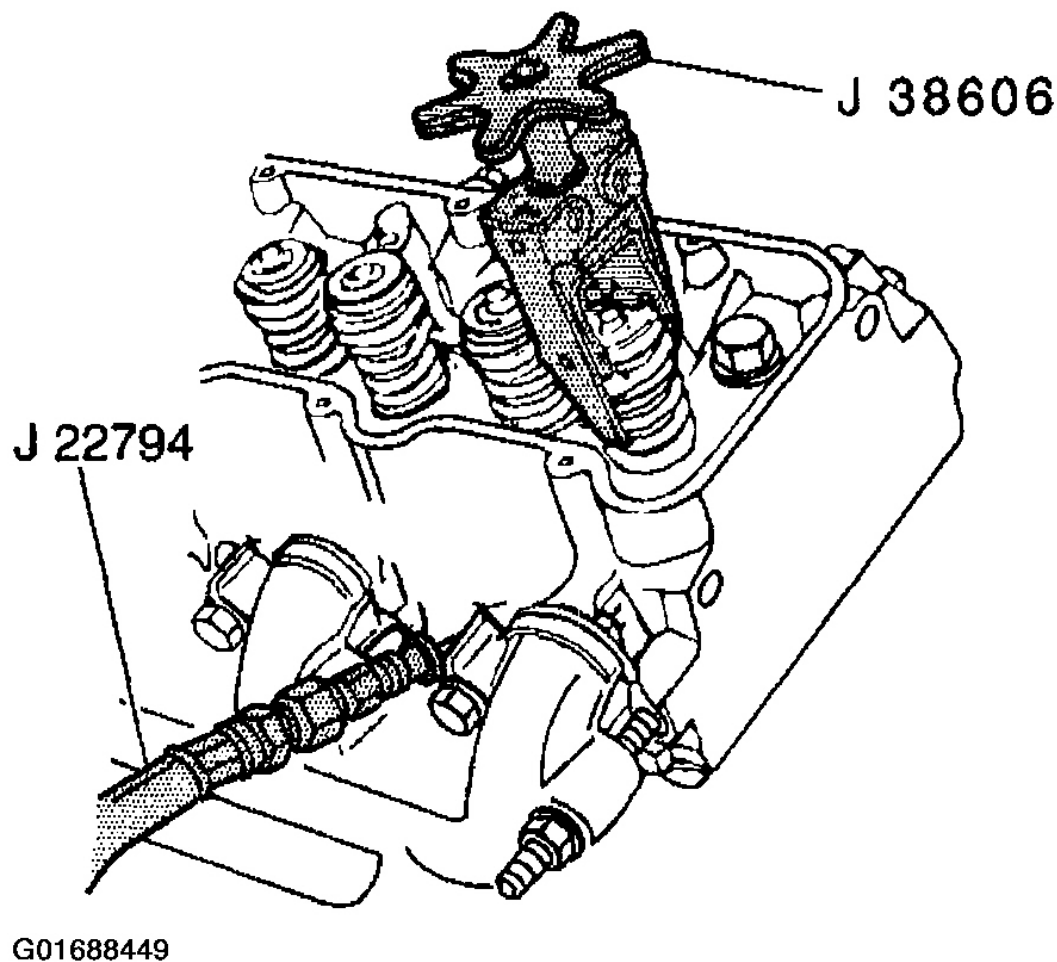
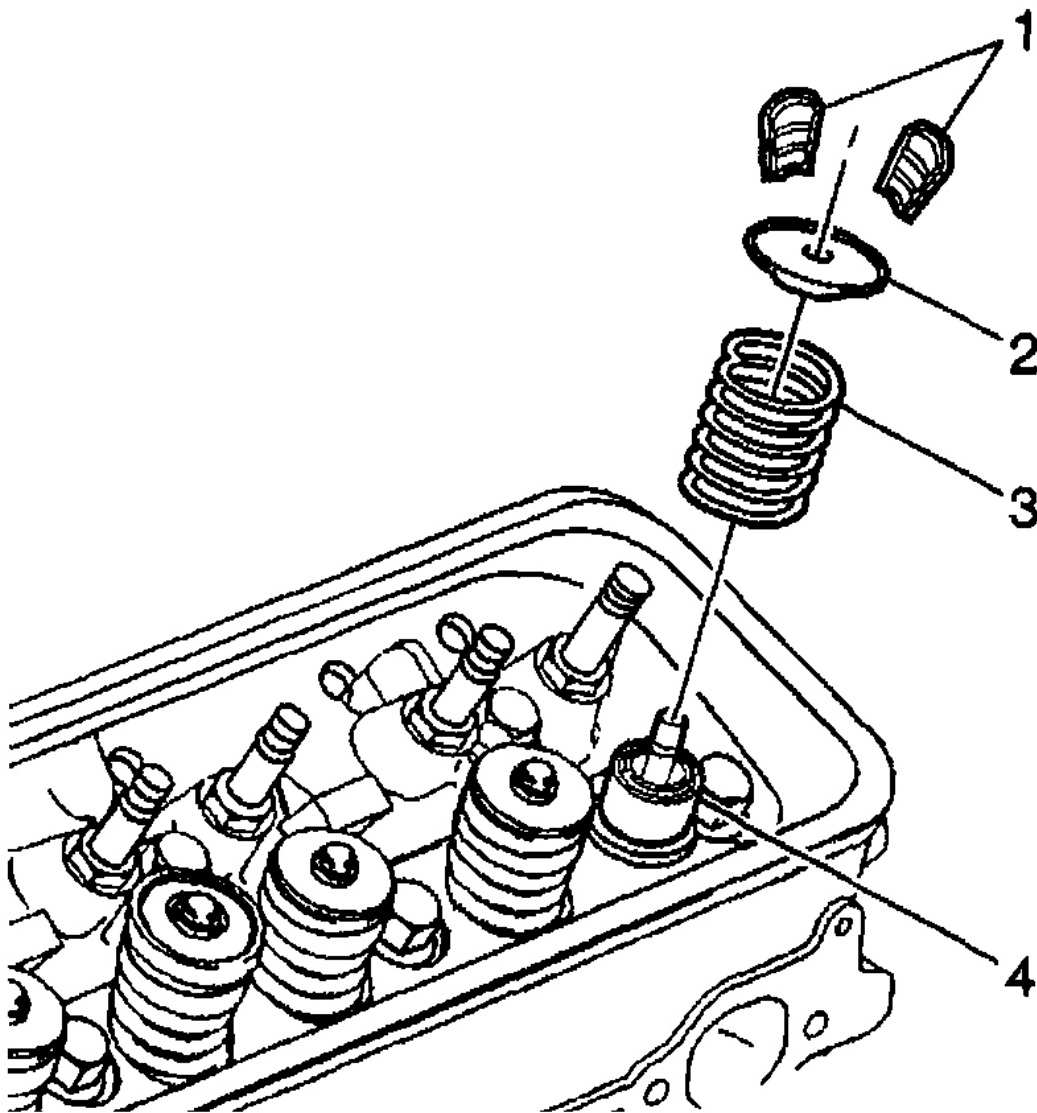


Fig. 76: View Of J 38606 & J 5892-D
Courtesy of GENERAL MOTORS CORP.

8. Remove the valve stem keys (1).
9. Carefully release the valve spring tension.
10. Remove the **J 5892-D** or the **J 38606**.
11. Remove the valve spring cap (2) and valve spring (3).
12. Remove the valve stem oil seal (4).

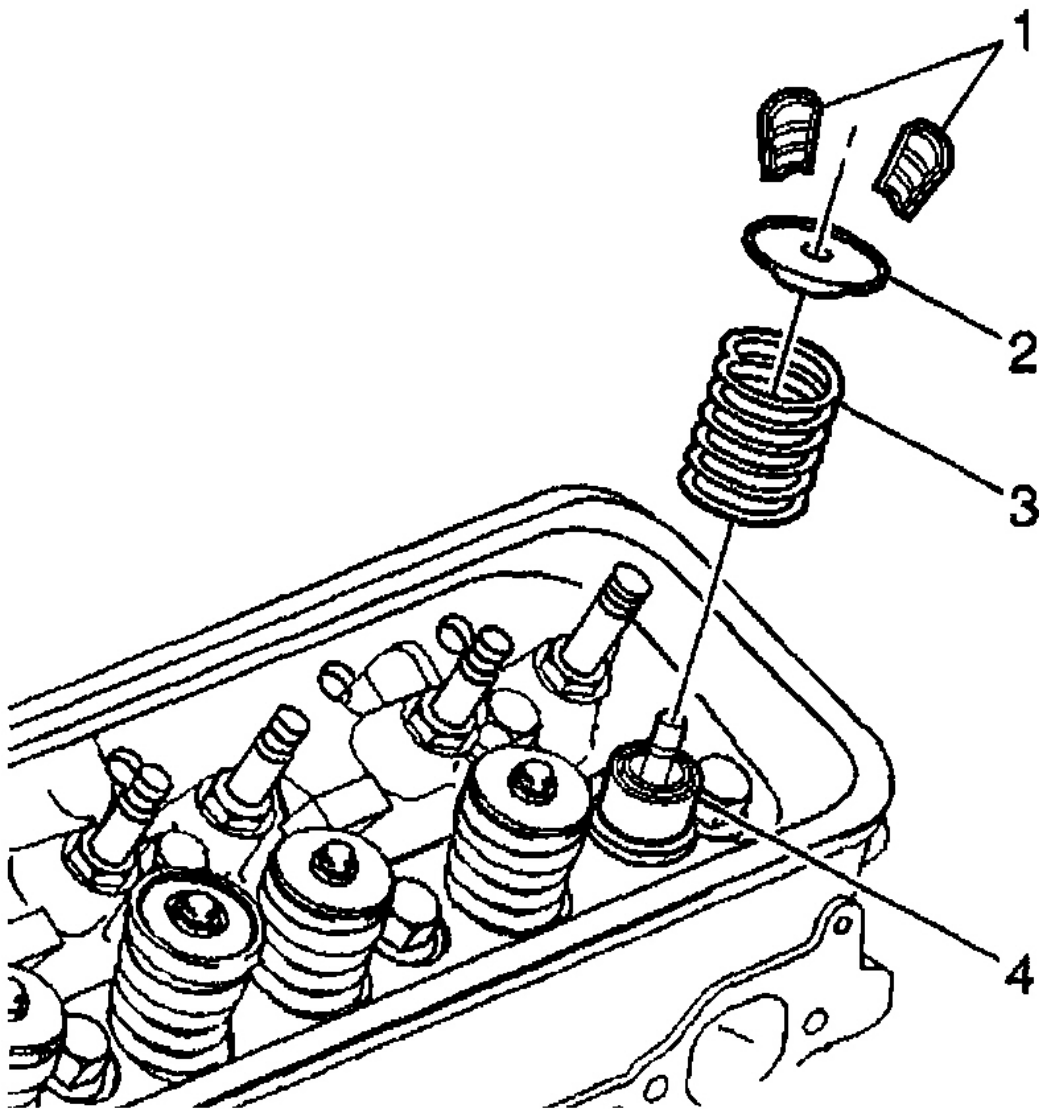


G01688450

Fig. 77: Removing Valve Spring Components
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

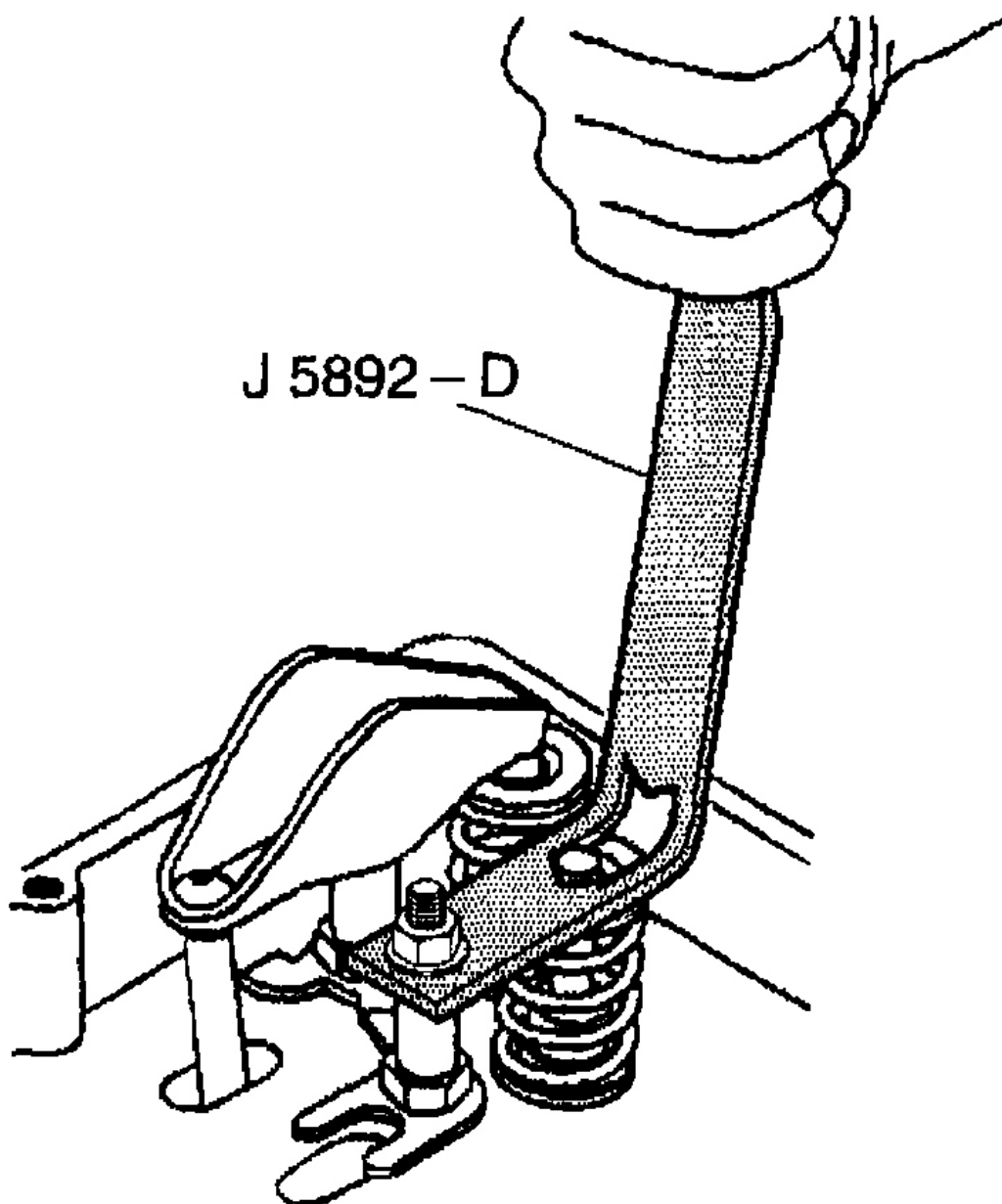
1. Select the proper valve stem oil seal for the specific valve guide.
2. Install the valve spring (3) and the valve spring cap (2).



G01688451

Fig. 78: Installing Valve Spring Components
Courtesy of GENERAL MOTORS CORP.

3. Use the **J 5892-D** in order to compress the valve spring.



G01688452

Fig. 79: Compressing Valve Spring Using J 5892-D
Courtesy of GENERAL MOTORS CORP.

4. Use the **J 38606** if clearance does not permit use of **J 5892-D**.
5. Install the valve stem keys.

6. Use grease in order to hold the valve stem keys in place.
7. Carefully release the valve spring pressure, making sure the valve stem keys stay in place.

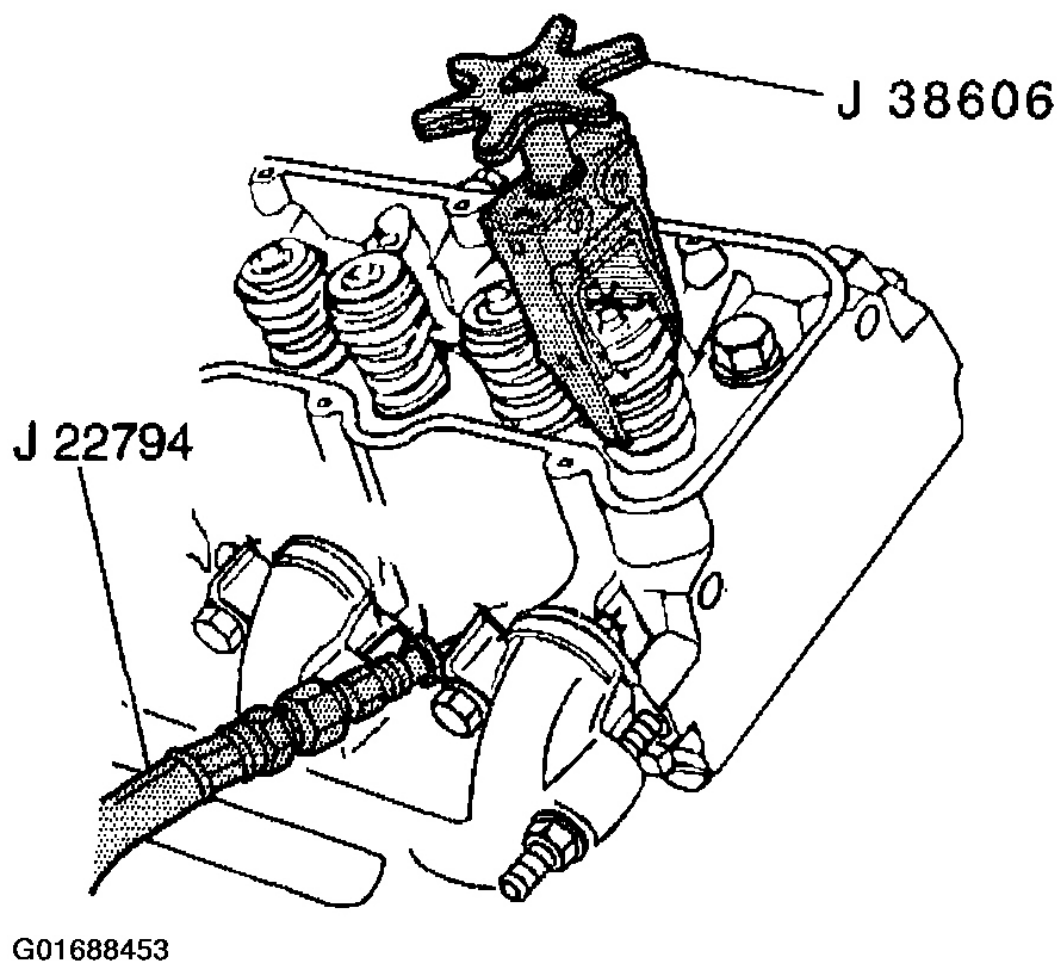
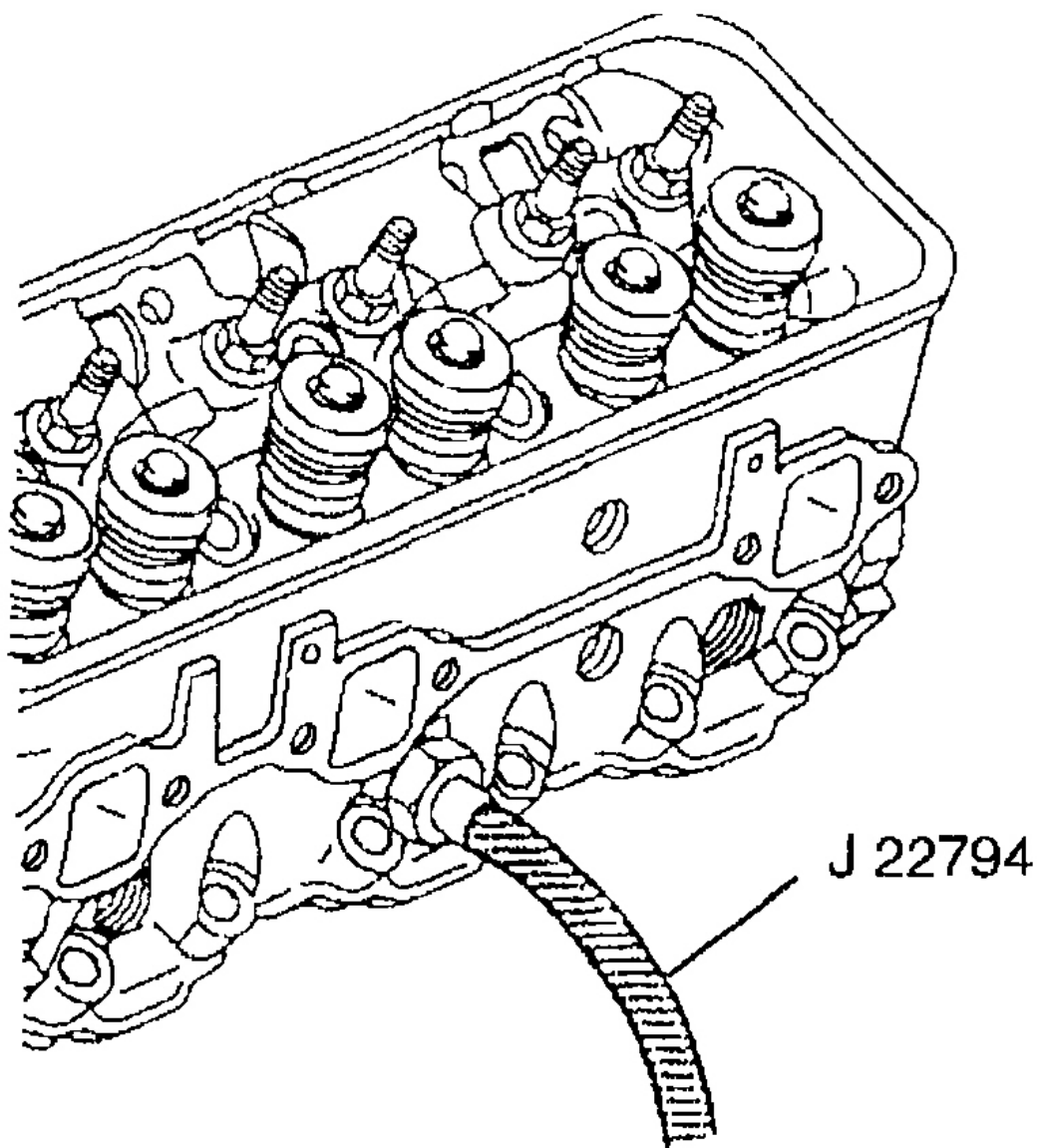


Fig. 80: View Of J 38606 & J 5892-D
Courtesy of GENERAL MOTORS CORP.

8. Remove the **J 5892-D** or the **J 38606** and the **J 23590**.
9. Install the spark plugs.
10. Install the valve rocker arm covers. Refer to **Valve Rocker Arm Cover Replacement - Left** or **Valve Rocker Arm Cover Replacement - Right**.



G01688454

Fig. 81: Removing J 22794 From Spark Plug Hole
Courtesy of GENERAL MOTORS CORP.

VALVE LIFTER REPLACEMENT

Tools Required

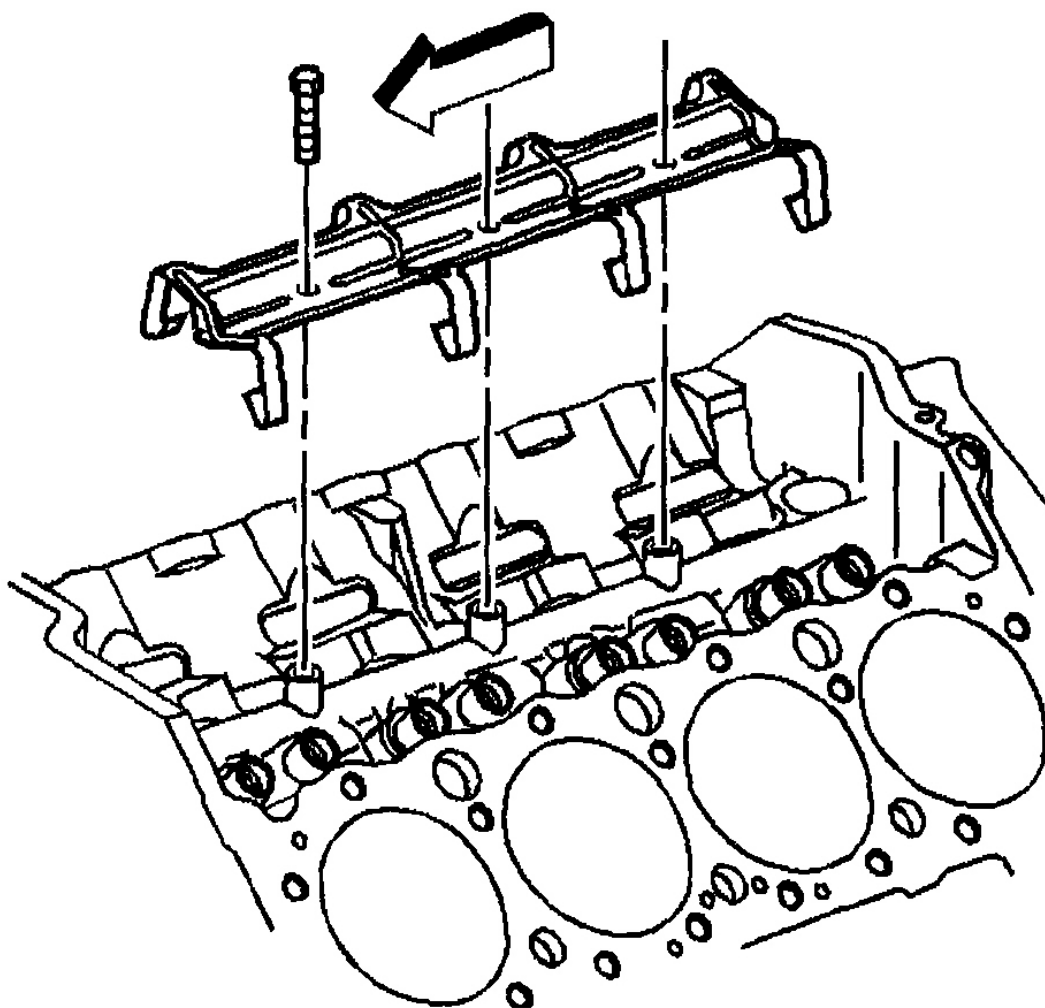
J 3049-A Valve Lifter Remover

Removal Procedure

1. Remove the intake manifold. Refer to **Intake Manifold Replacement - Upper** or **Intake Manifold Replacement - Lower**.
2. Remove the valve push rods. Refer to **Valve Rocker Arm And Push Rod Replacement**.

Important: The valve lifters and guides must be installed in the same location from which they were removed.

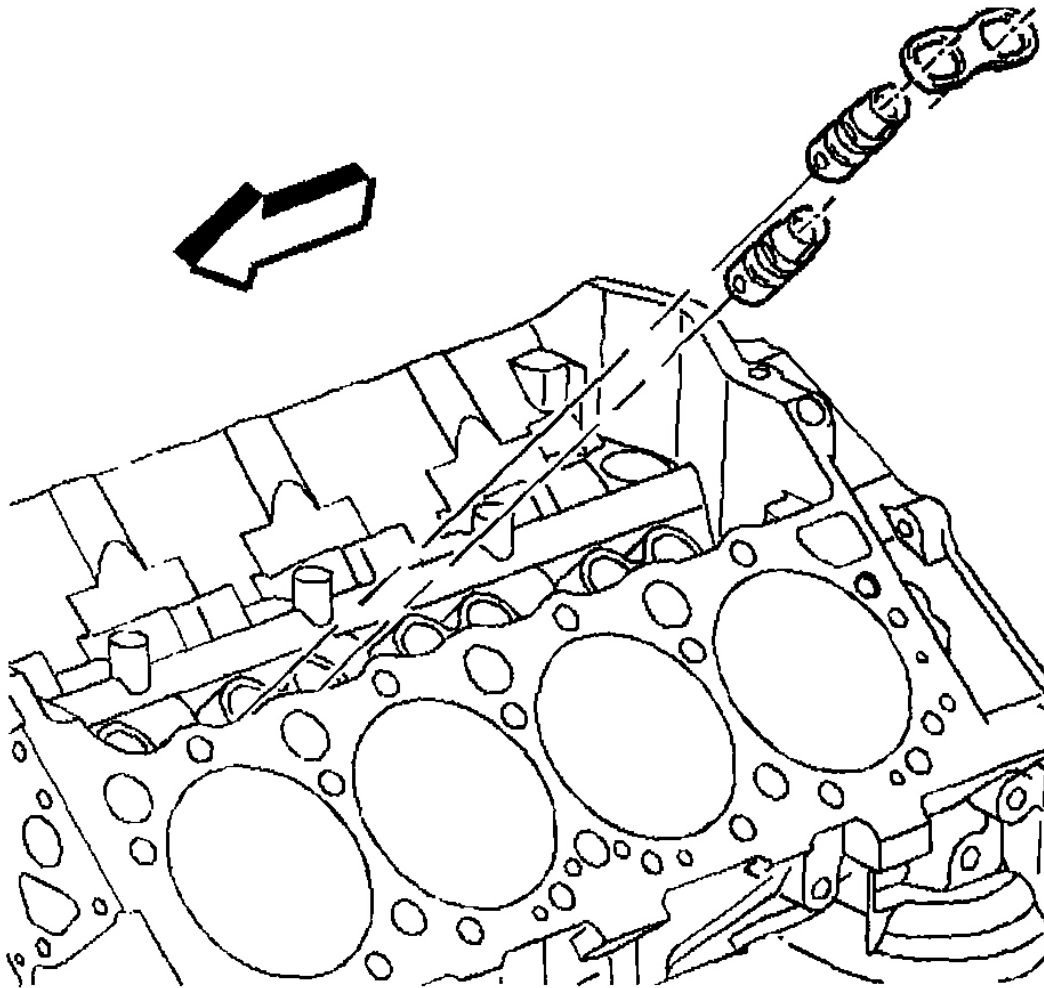
3. Remove the valve lifter guide retainer and the valve lifter guides.



G01688455

Fig. 82: Removing Valve Lifter Guide Retainer
Courtesy of GENERAL MOTORS CORP.

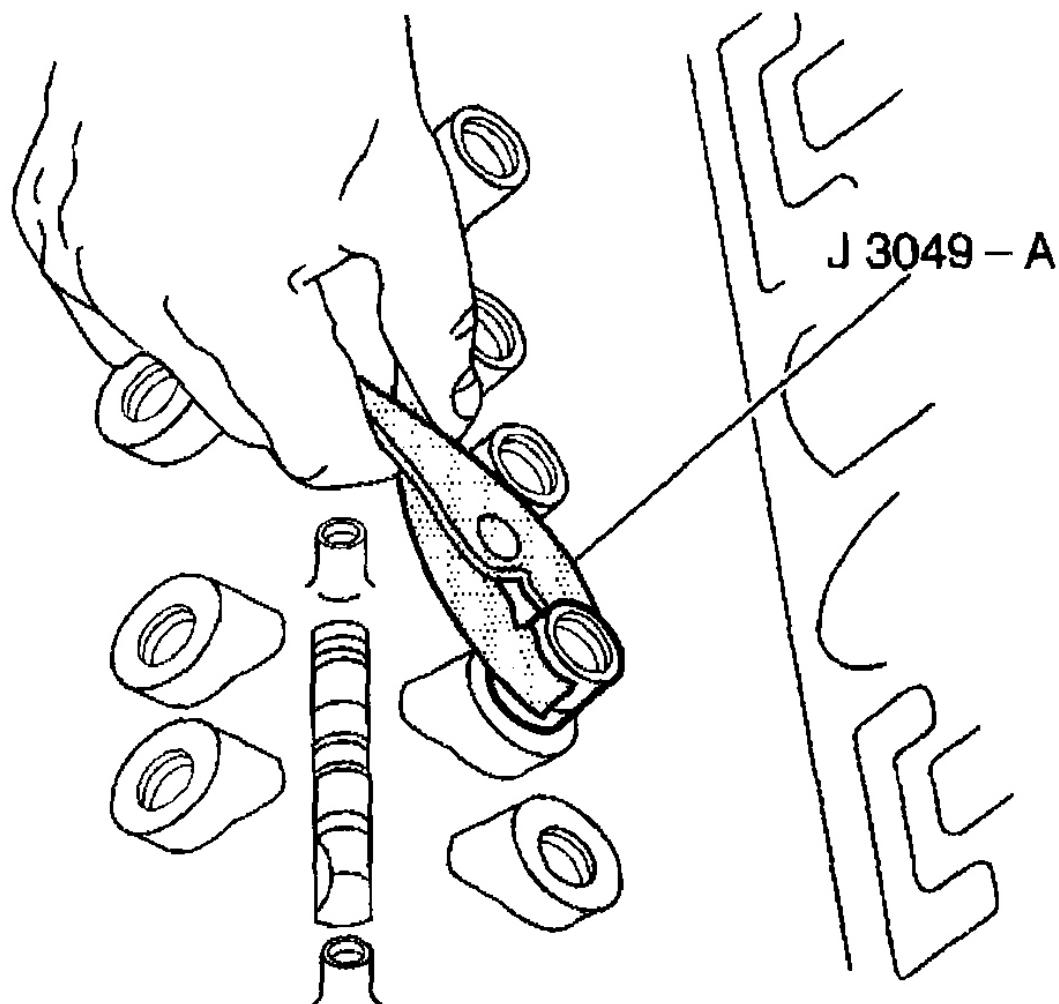
4. Remove the valve lifters one at a time. Refer to **Valve Lifter Replacement**.
5. Place the valve lifters and valve lifter guides in an organizer rack.



G01688456

Fig. 83: Removing Valve Lifters & Guides
Courtesy of GENERAL MOTORS CORP.

6. A stuck valve lifter can be removed using the **J 3049-A**.



G01688457

Fig. 84: Removing Stuck Valve Lifter Using J 3049-A
 Courtesy of GENERAL MOTORS CORP.

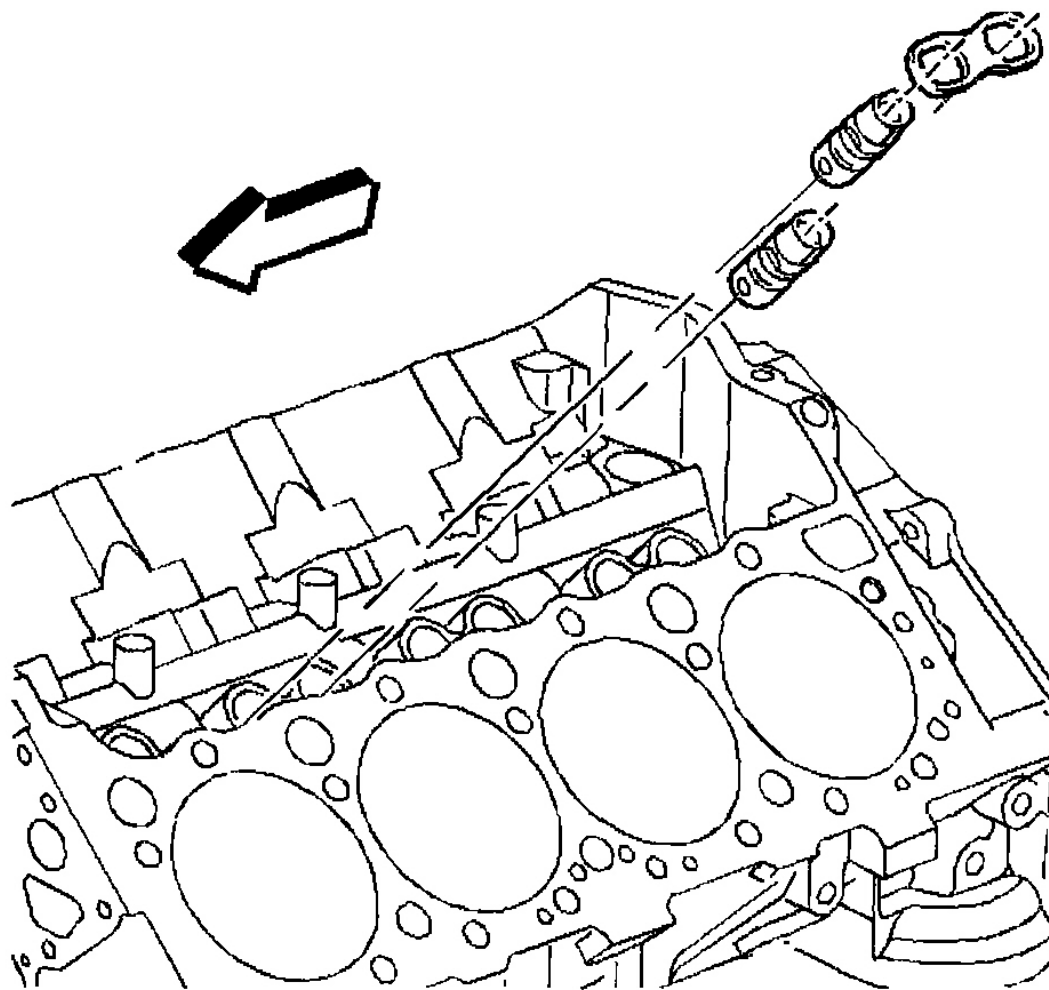
Installation Procedure

Important:

- When new valve lifters or a new camshaft is installed, change the engine oil and the oil filter. Refer to **Engine Oil and Oil Filter Replacement**.
- Add Engine Oil Supplement GM P/N 1051396 or the equivalent to the engine oil.
- Replace all the valve lifters when a new camshaft is installed.

1. Install the valve lifters one at a time. Refer to **Valve Lifter Replacement**.

2. Install the valve push rods.
3. Install the intake manifold. Refer to **Intake Manifold Replacement - Upper** or **Intake Manifold Replacement - Lower**.



G01688458

Fig. 85: Installing Valve Push Rods
Courtesy of GENERAL MOTORS CORP.

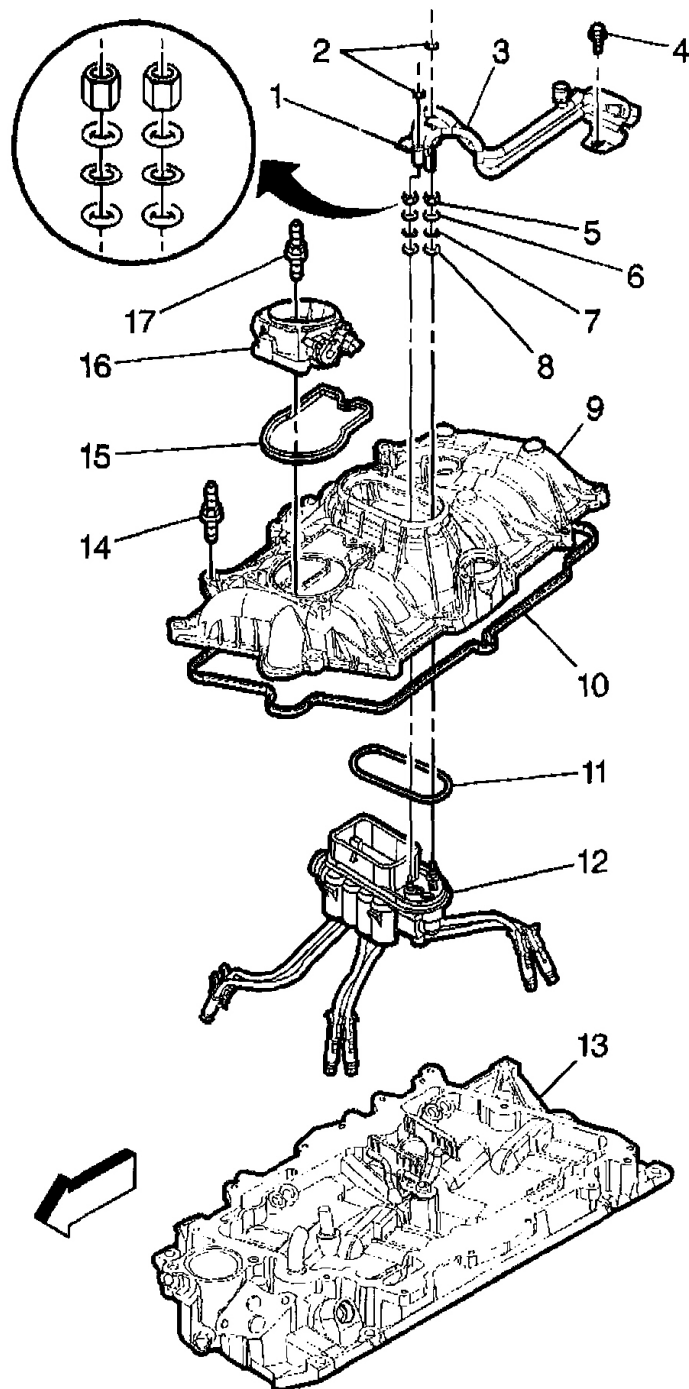
CYLINDER HEAD REPLACEMENT - LEFT

Tools Required

J 36660-A Electronic Torque Angle Meter

Removal Procedure

1. Remove the drive belt. Refer to **Drive Belt Replacement**.
2. Remove the A/C compressor from the power steering pump bracket, if equipped, and set it aside.
3. Remove the lower intake manifold. Refer to **Intake Manifold Replacement - Upper** or **Intake Manifold Replacement - Lower**.
4. Remove the exhaust manifold.
5. Remove the valve rocker arm cover. Refer to **Valve Rocker Arm Cover Replacement - Left**.
6. Remove the valve rocker arms and valve push rods. Refer to **Valve Rocker Arm And Push Rod Replacement**.
7. Remove the power steering pump pulley.
8. Remove the power steering pump mounting bracket.
9. Disconnect the wiring bracket (3) from the rear of the right cylinder head.

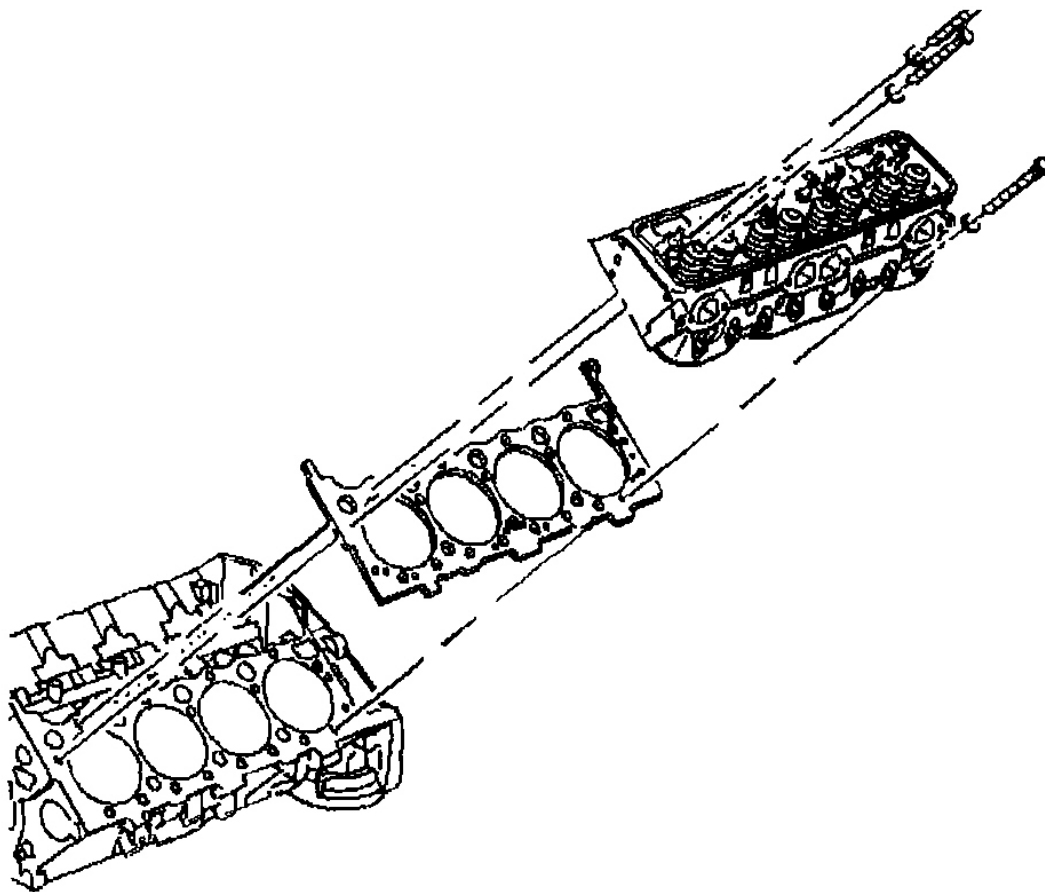


G01688459

Fig. 86: Removing Power Steering Pump Mounting Bracket & Wiring Bracket
 Courtesy of GENERAL MOTORS CORP.

10. Remove the cylinder head and the gasket. Refer to Cylinder Head Replacement - Left and Cylinder Head Replacement - Right.

11. Clean all sealing surfaces.

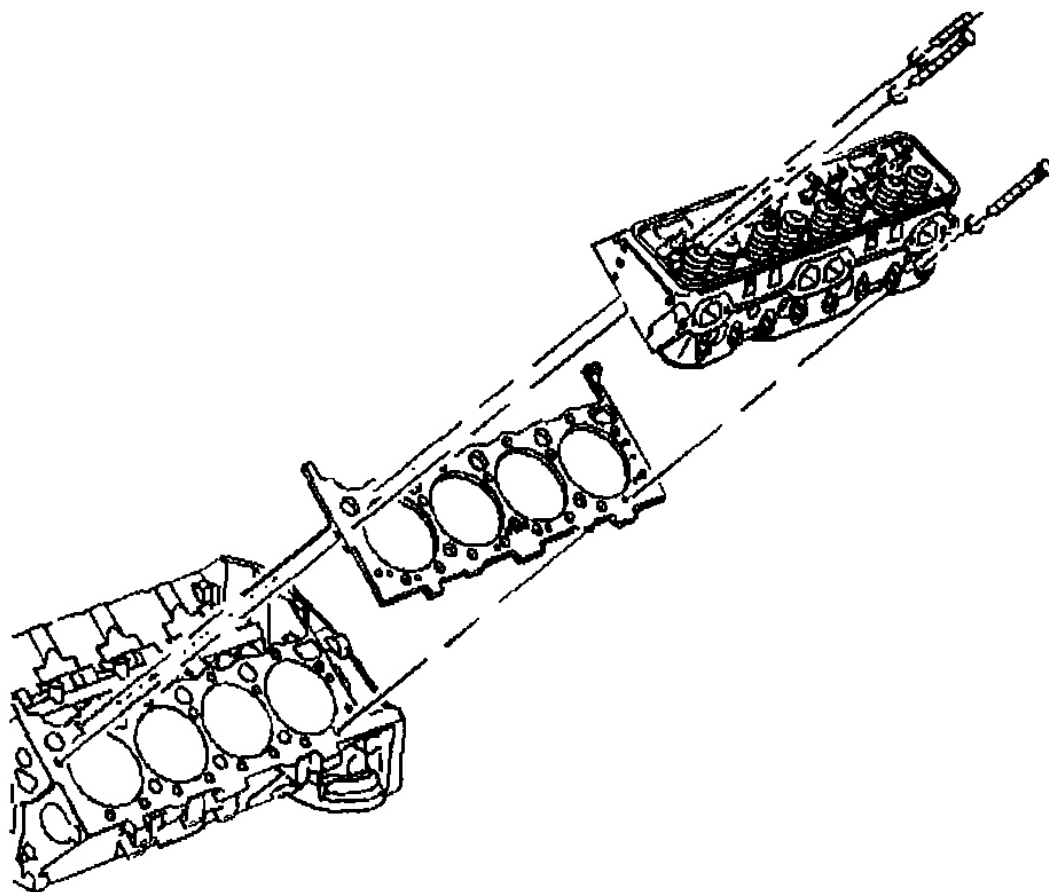


G01688460

Fig. 87: Removing Generator & Drive Belt Tensioner Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the cylinder head. Refer to **Cylinder Head Replacement - Left** and **Cylinder Head Replacement - Right**.
2. Install the valve rocker arms and the valve push rods. Refer to **Valve Rocker Arm And Push Rod Replacement**.
3. For the left cylinder head, install the power steering pump mounting bracket.
4. Install the power steering pump pulley.
5. For the right cylinder head, install the generator and drive belt tensioner mounting bracket.
6. Install the exhaust manifold.



G01688461

Fig. 88: Installing Generator & Drive Belt Tensioner Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

7. Install Oil Indicator Tube. Refer to **Oil Level Indicator and Tube Replacement**.
8. Install the lower intake manifold. Refer to **Intake Manifold Replacement - Upper** or **Intake Manifold Replacement - Lower**.
9. Install the valve rocker arm covers. Refer to **Valve Rocker Arm Cover Replacement - Left**.
10. Install the A/C compressor, if equipped.
11. Install the drive belt. Refer to **Drive Belt Replacement**.

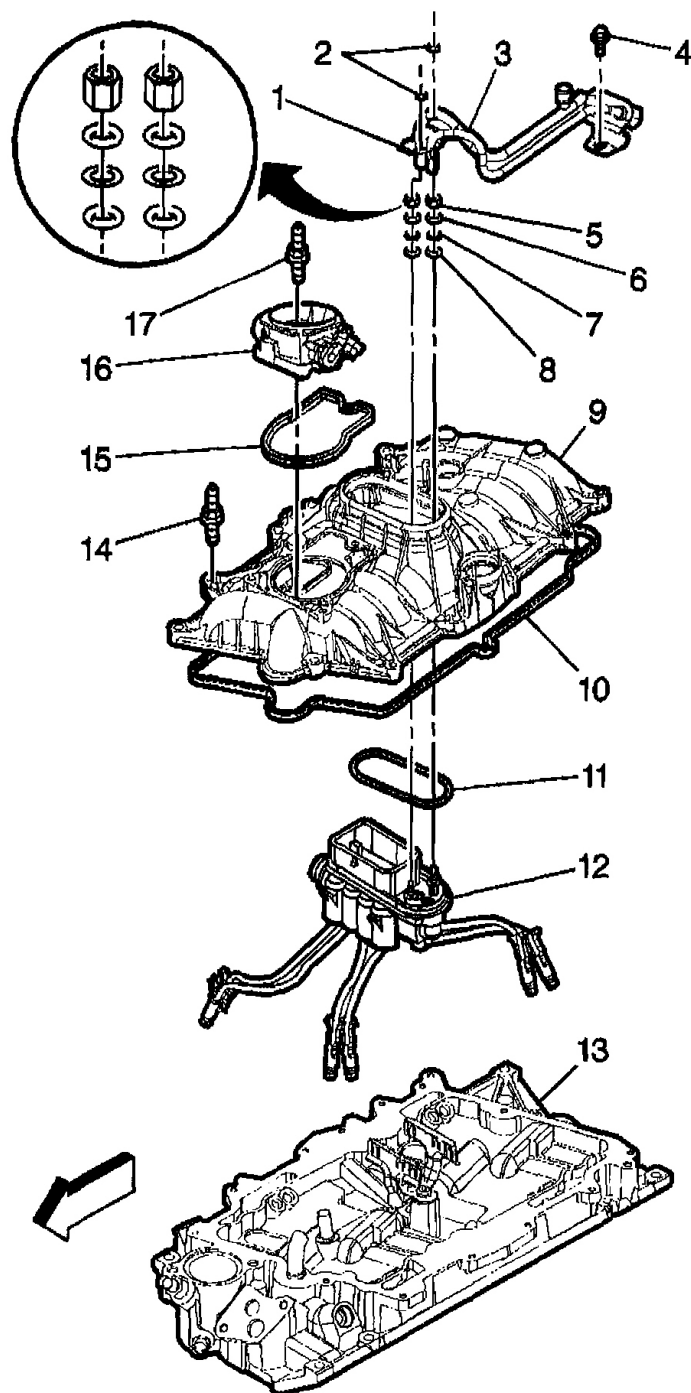
CYLINDER HEAD REPLACEMENT - RIGHT

Tools Required

J36660-A Electronic Torque Angle Meter

Removal Procedure

1. Remove the drive belt. Refer to **Drive Belt Replacement**.
2. Remove the A/C compressor from the power steering pump bracket, if equipped, and set it aside.
3. Remove the lower intake manifold. Refer to **Intake Manifold Replacement - Upper** or **Intake Manifold Replacement - Lower**.
4. Remove the exhaust manifold.
5. Remove the valve rocker arm cover. Refer to **Valve Rocker Arm Cover Replacement - Right**.
6. Remove the valve rocker arms and valve push rods. Refer to **Valve Rocker Arm And Push Rod Replacement**.
7. Remove the power steering pump pulley.
8. Remove the power steering pump mounting bracket.
9. Disconnect the wiring bracket (3) from the rear of the right cylinder head.

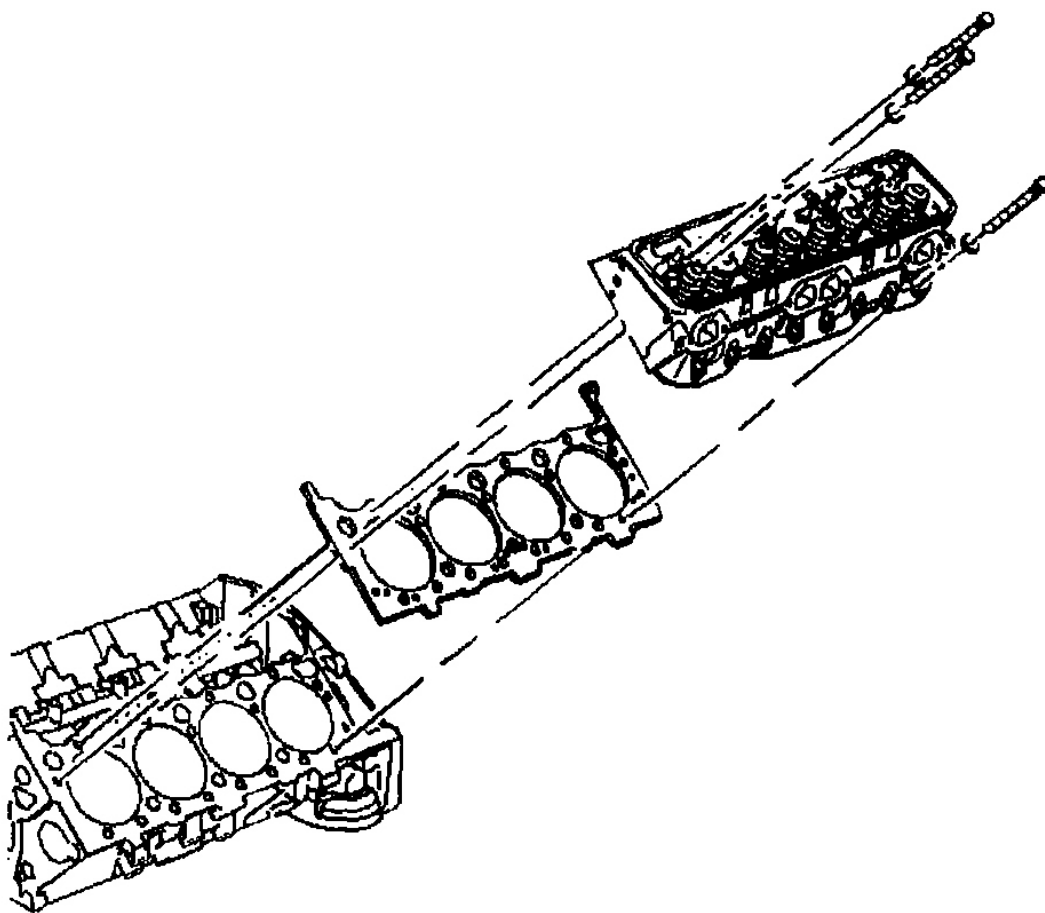


G01688462

Fig. 89: Removing Power Steering Pump Mounting Bracket & Wiring Bracket
Courtesy of GENERAL MOTORS CORP.

10. For the right side cylinder head, remove the following components:

- 10.1. Remove the generator.
- 10.2. Remove the generator and drive belt tensioner mounting bracket.
- 10.3. Remove the oil indicator tube. Refer to
11. Remove the cylinder head and the gasket. Refer to Cylinder Head Replacement - Left and Cylinder Head Replacement - Right.
12. Clean all sealing surfaces.



G01688463

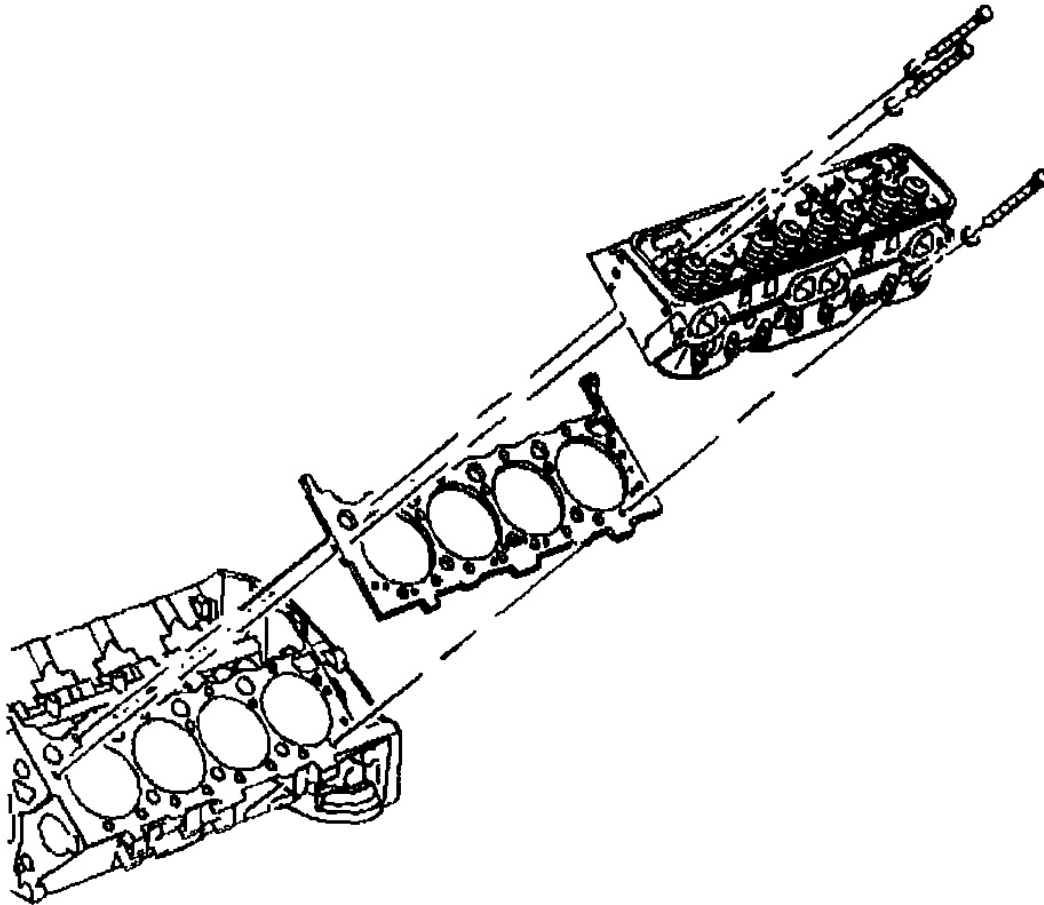
Fig. 90: Removing Generator & Drive Belt Tensioner Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the cylinder head. Refer to Cylinder Head Replacement - Left and Cylinder Head Replacement - Right.
2. Install the valve rocker arms and the valve push rods. Refer to Valve Rocker Arm And Push Rod

Replacement.

3. For the left cylinder head, install the power steering pump mounting bracket.
4. Install the power steering pump pulley.
5. For the right cylinder head, install the generator and drive belt tensioner mounting bracket.
6. Install the exhaust manifold.



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Fig. 91: Installing Generator & Drive Belt Tensioner Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

7. Install Oil Indicator Tube. Refer to **Oil Level Indicator And Tube Replacement**.
8. Install the lower intake manifold. Refer to **Intake Manifold Replacement - Upper** or **Intake Manifold Replacement - Lower**.
9. Install the valve rocker arm covers. Refer to **Valve Rocker Arm Cover Replacement - Right**.
10. Install the A/C compressor, if equipped.

11. Install the drive belt. Refer to **Drive Belt Replacement**.

CRANKSHAFT BALANCER REPLACEMENT

Tools Required

J 23523-F Crankshaft Balancer Remover and Installer

Removal Procedure

1. Disconnect the battery negative cable.
2. Remove the drive belt. Refer to **Drive Belt Replacement**.
3. Remove the fan shroud assembly.
4. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.
5. Clean and inspect all parts.

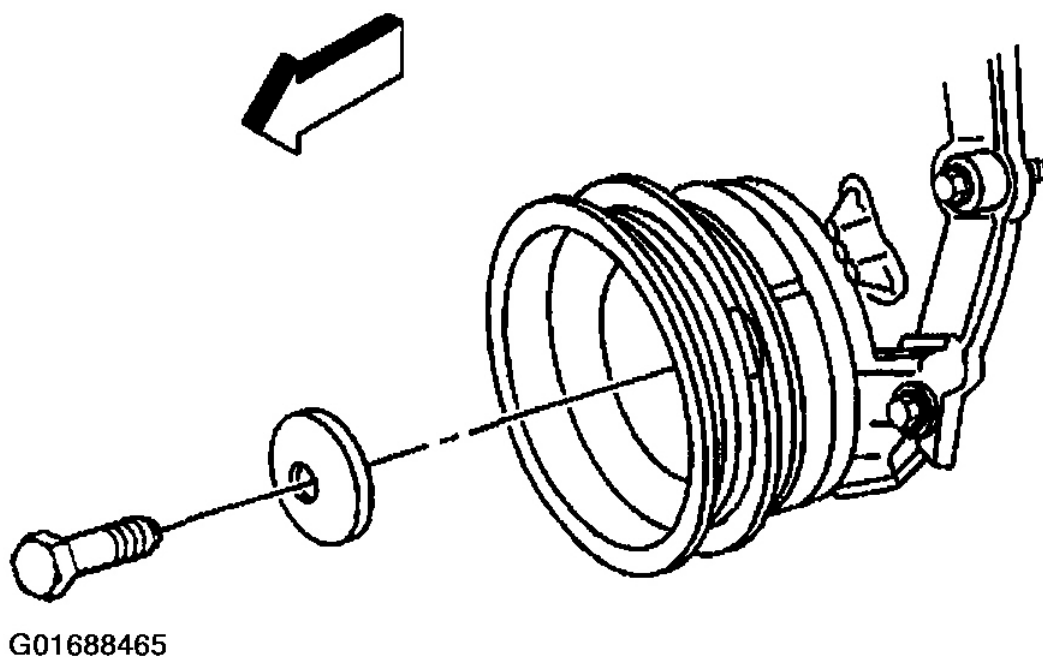
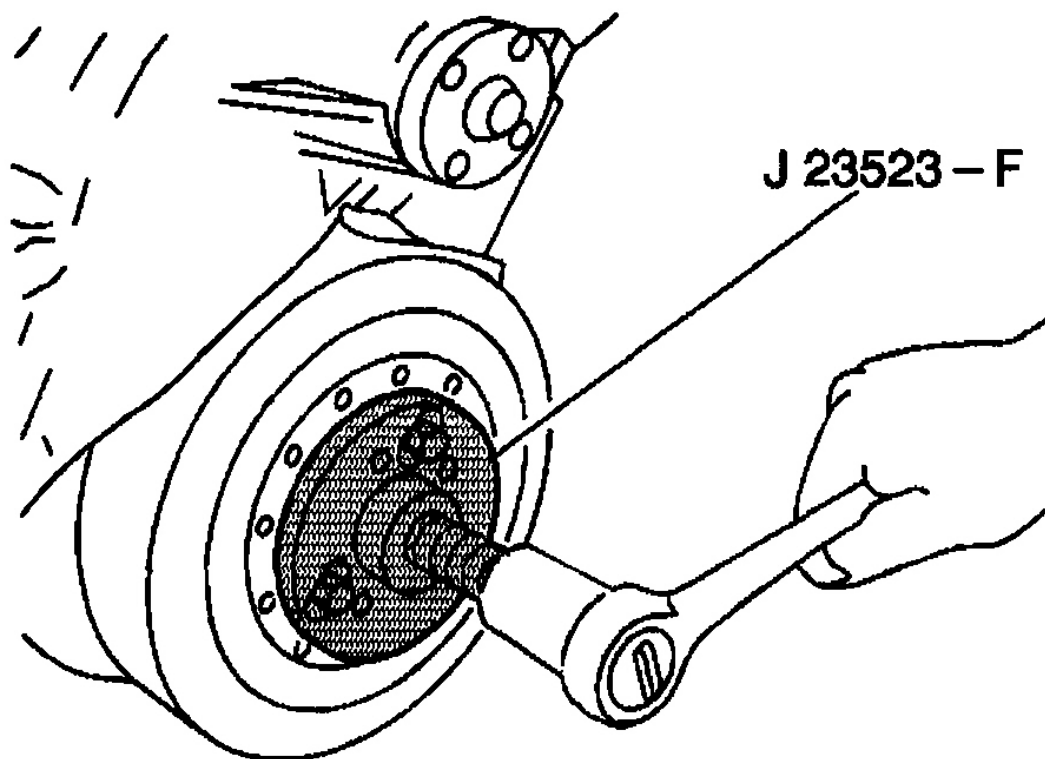


Fig. 92: Removing Crankshaft Balancer
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.
2. Install the drive belt. Refer to **Drive Belt Replacement**.

3. Install the fan shroud assembly.
4. Connect the battery negative cable.



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Fig. 93: Installing Crankshaft Balancer
Courtesy of GENERAL MOTORS CORP.

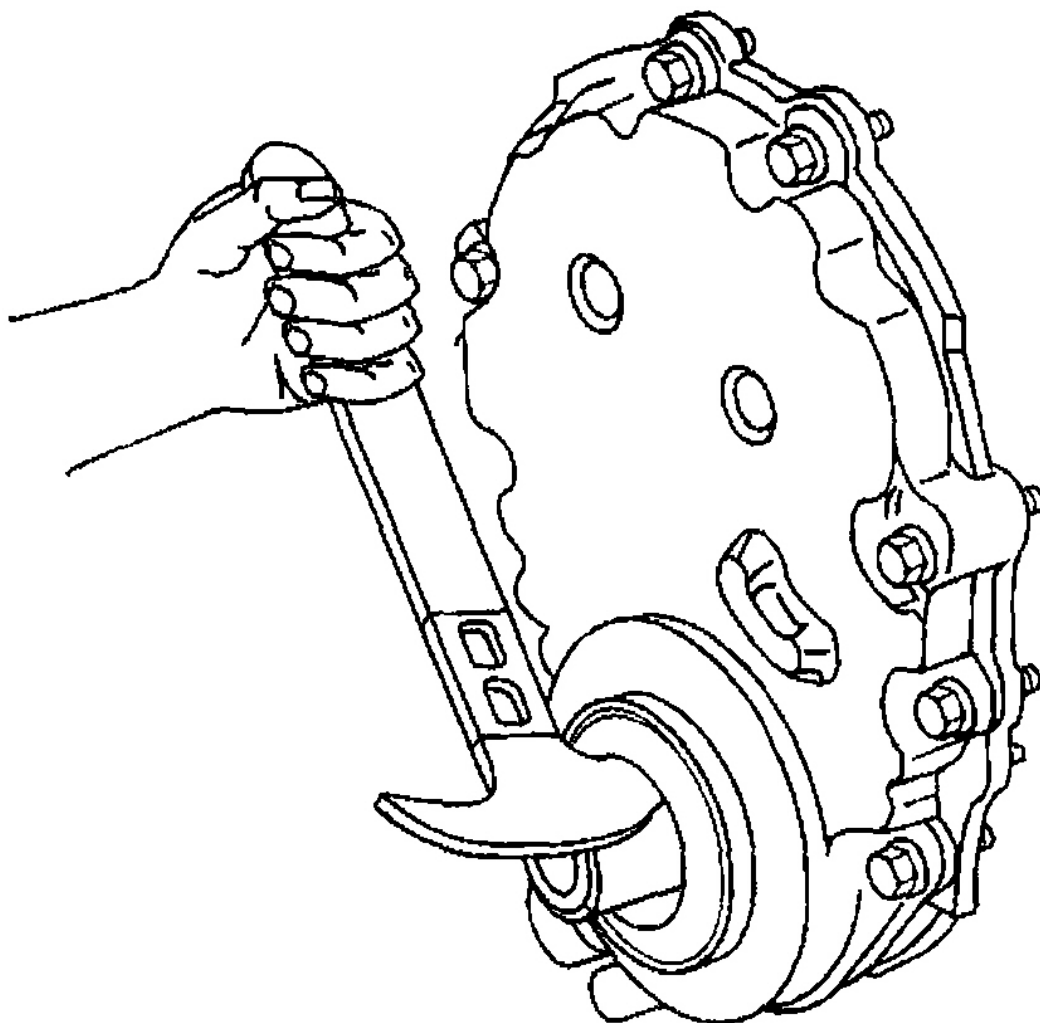
CRANKSHAFT FRONT OIL SEAL REPLACEMENT

Tools Required

J 35468 Cover Aligner Seal Installer

Removal Procedure

1. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.
2. Use a suitable prying tool to remove the crankshaft front oil seal.
3. Inspect the engine front cover seal bore for damage.
4. Inspect the crankshaft balancer sealing surface for damage.



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Fig. 94: Removing Crankshaft Front Oil Seal
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Look to ensure that the pre-applied grease on the crankshaft front oil seal is intact.
2. Use the **J 35468** In order to install the crankshaft front oil seal.
3. Inspect to ensure the crankshaft front seal is flush and square to the engine front cover.
4. Install the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.

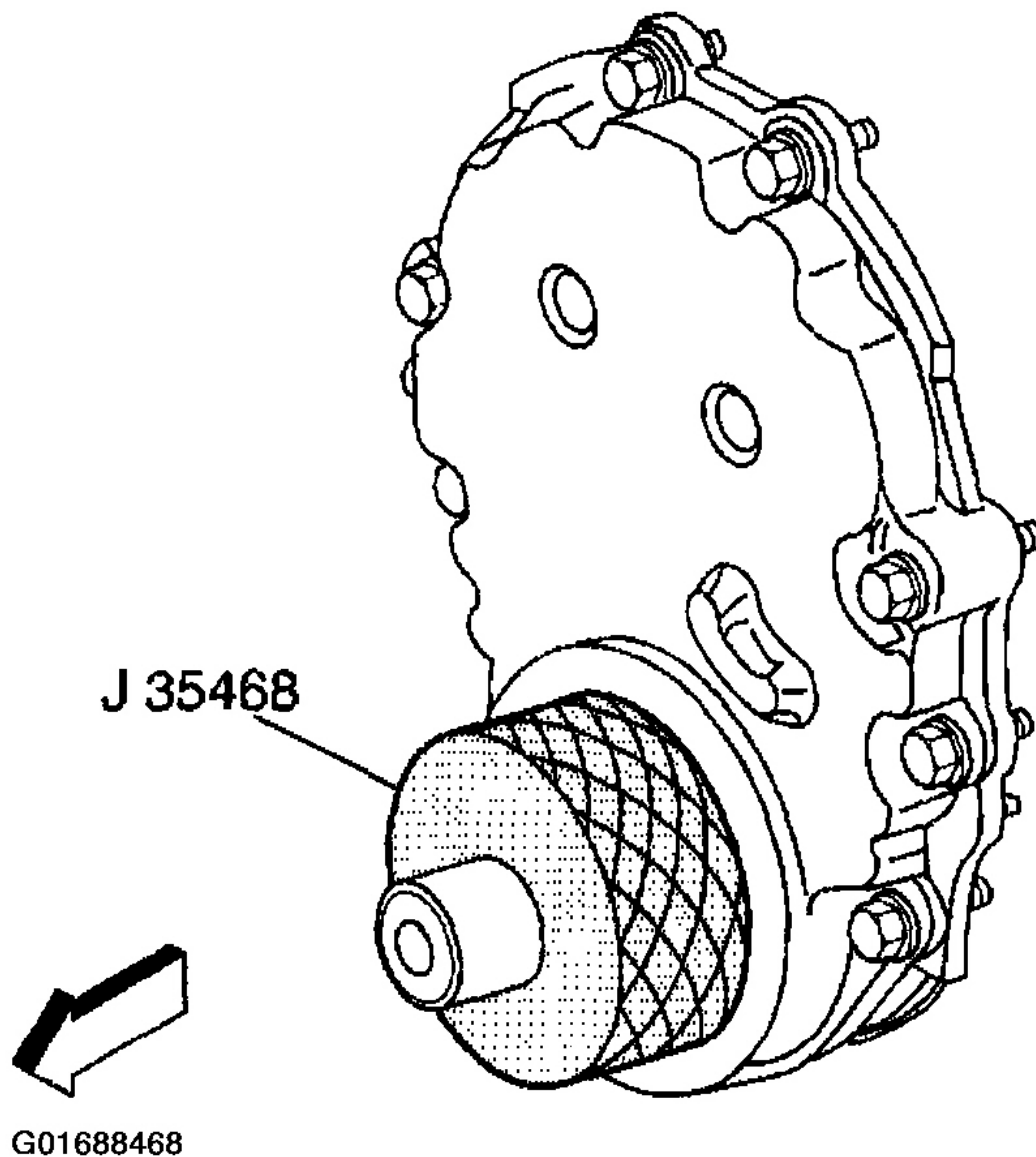


Fig. 95: Installing Crankshaft Front Oil Seal Using J 35468
Courtesy of GENERAL MOTORS CORP.

ENGINE FRONT COVER REPLACEMENT

Removal Procedure

1. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.
2. Remove the water pump.
3. Drain the engine oil. Refer to **Engine Oil and Oil Filter Replacement**.

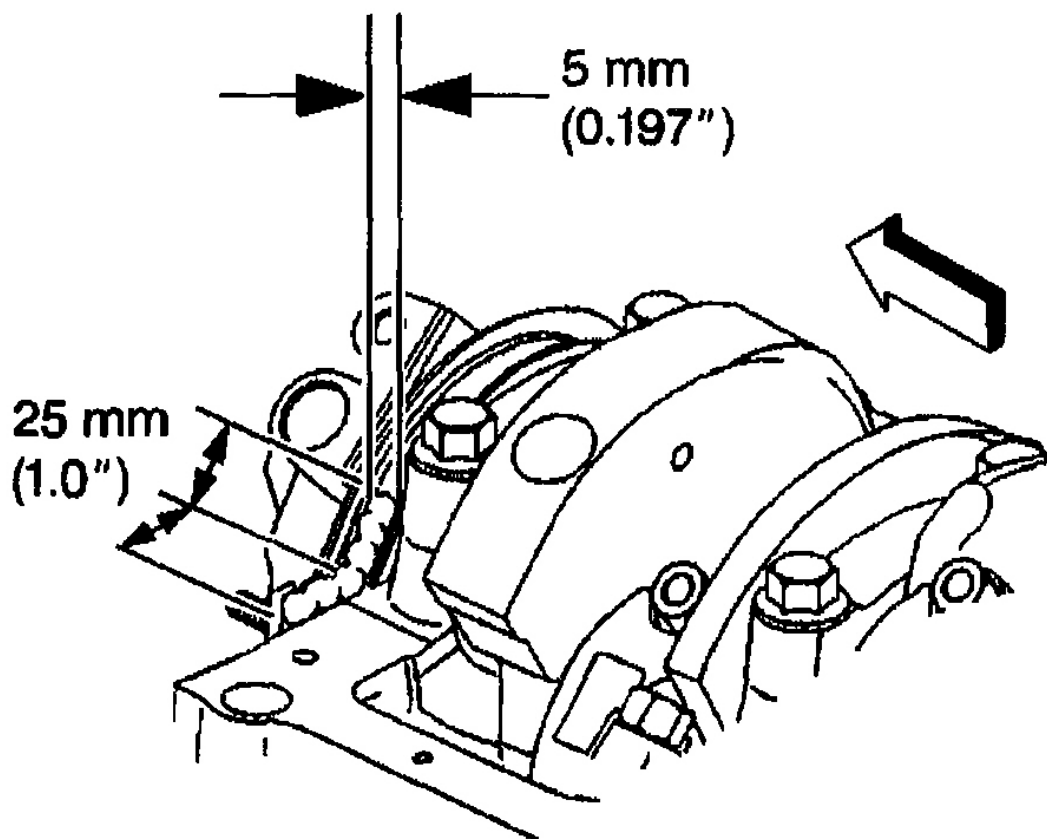
4. Remove all the engine oil pan fasteners except the two nuts at the rear of the engine. Refer to **Oil Pan Replacement**.
5. Carefully separate the engine oil pan from the engine front cover.
6. Disconnect the crankshaft position (CKP) sensor wire.
7. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.

Installation Procedure

1. Install the NEW engine front cover. Refer to **Engine Front Cover Replacement**.
2. Clean all adhesive from the corners of the oil pan gasket where it meets the engine front cover.

Important: The oil gasket and the oil pan must be installed and the fasteners tightened while the adhesive is still wet to the touch.

3. Apply a 5 mm (0.197 in) bead of adhesive, GM P/N 12346141 or equivalent, 25 mm (1.0 in) long to the engine front cover to the engine block junction at the oil pan.
4. Install the engine oil pan. Refer to **Oil Pan Replacement**.
5. Connect the crankshaft position (CKP) sensor wire.



G01688469

Fig. 96: Applying Adhesive At Engine Front Cover To Engine Block Junction
Courtesy of GENERAL MOTORS CORP.

6. Install the water pump.
7. Install the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.

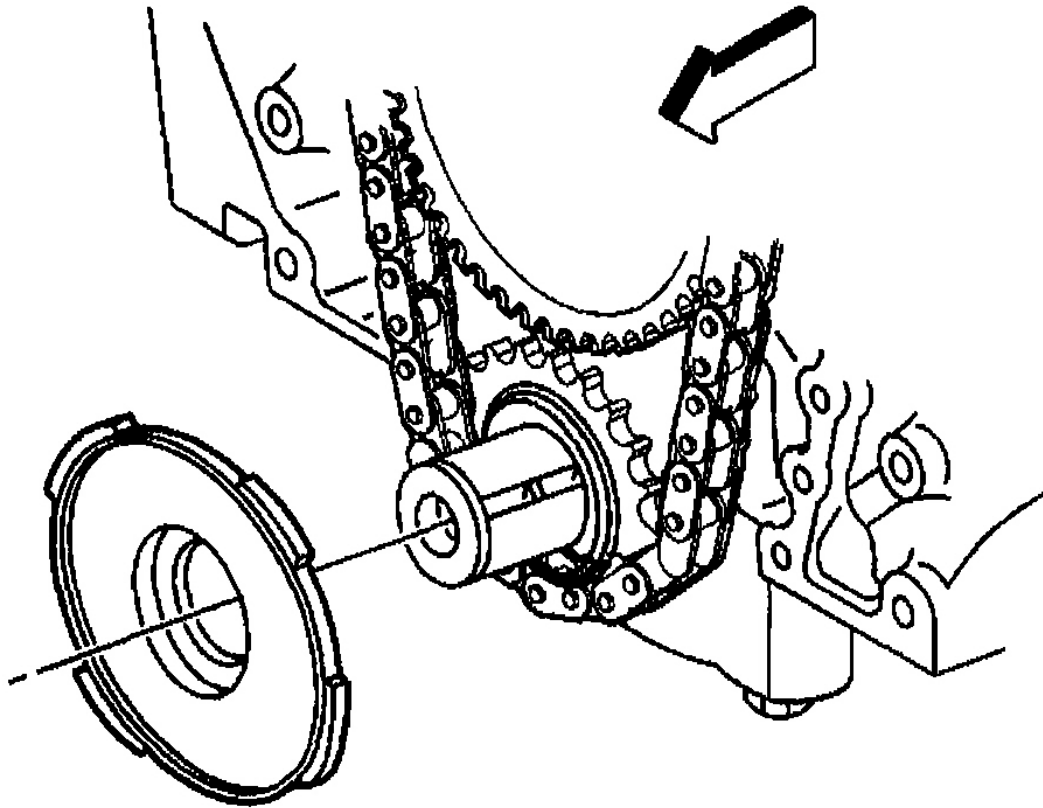
CRANKSHAFT POSITION (CKP) RELUCTOR RING REPLACEMENT

Tools Required

J 5590 Crankshaft Gear Installer

Removal Procedure

1. Disconnect the Battery Negative Terminal.
2. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.
3. Remove the crankshaft position sensor reluctor ring.



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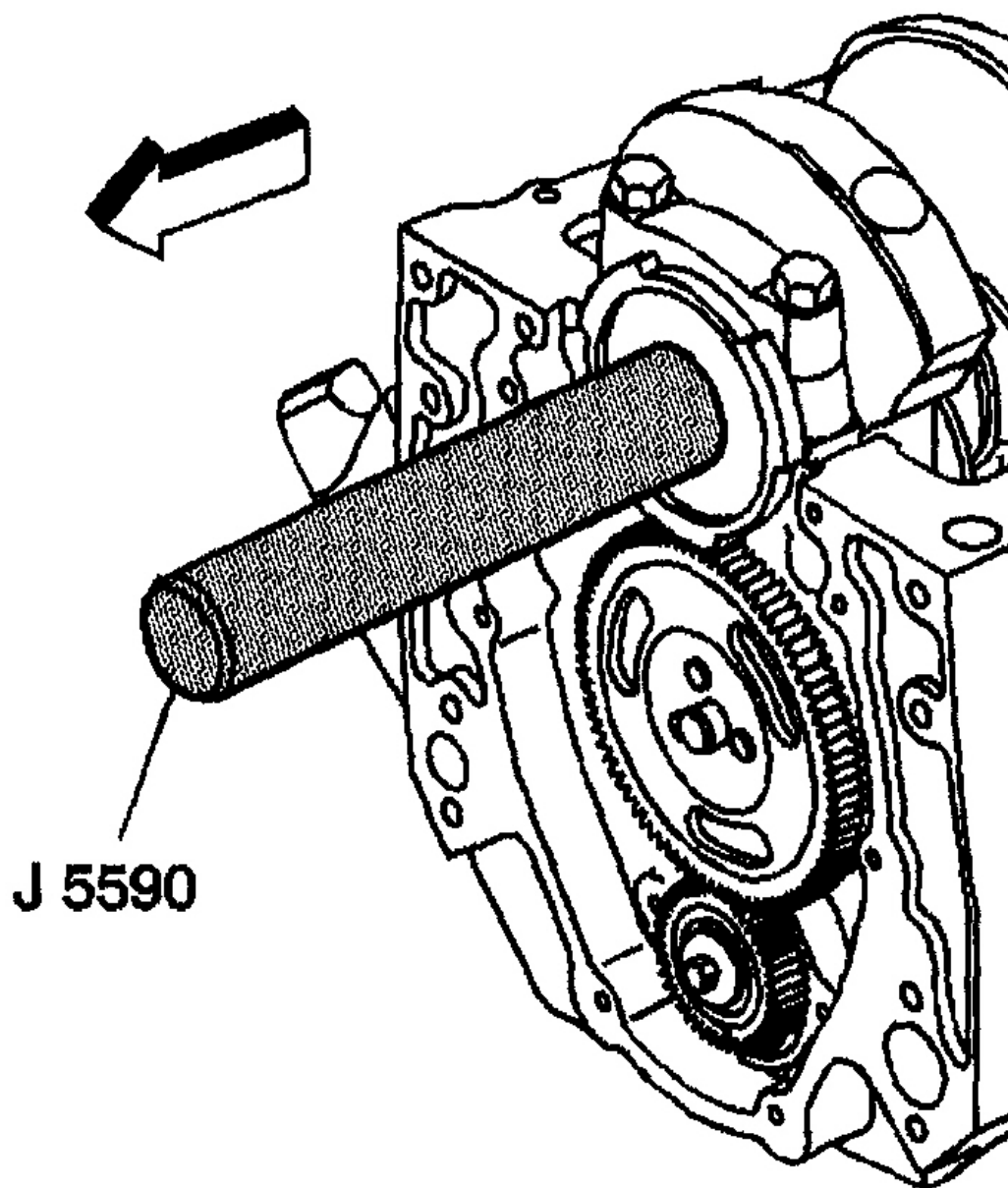
Fig. 97: Removing Crankshaft Position Sensor Reluctor Ring
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

NOTE: Failure to properly align the crankshaft position sensor reluctor ring may result in component damage and effect OBD II system performance.

Important: The crankshaft position sensor reluctor ring is shaped like a dish. The dish must face the engine front cover.

1. Install the crankshaft position sensor reluctor ring. Using **J 5590**.
2. Align the keyway on the crankshaft position sensor reluctor ring with the woodruff key (crankshaft balancer) in the crankshaft.
3. Push the crankshaft position sensor reluctor ring onto the crankshaft until completely seated against the crankshaft sprocket.
4. Install the engine front cover. Refer to **Engine Front Cover Replacement**.



G01688471

Fig. 98: Installing Crankshaft Position Sensor Reluctor Ring Using J 5590
Courtesy of GENERAL MOTORS CORP.

5. Install the Battery Negative Terminal.

TIMING CHAIN AND SPROCKETS REPLACEMENT

Tools Required

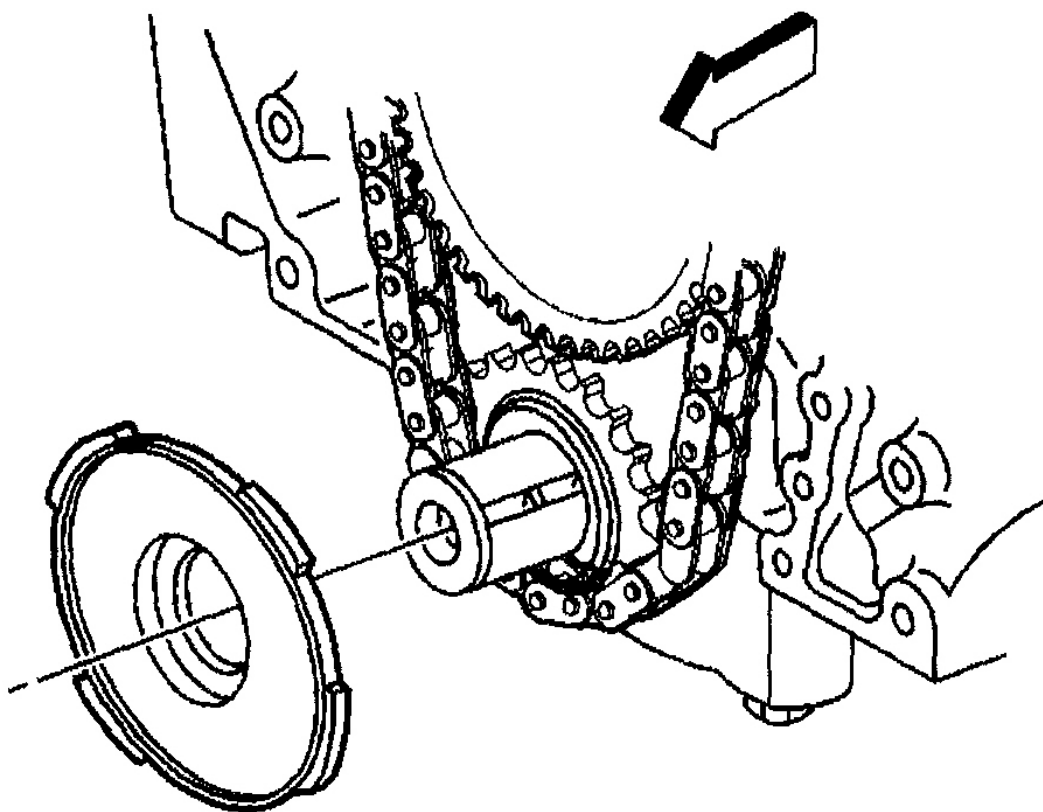
- **J 5825-A** Crankshaft Gear Installer
- **J 5590** Crankshaft Gear Installer

Removal Procedure

1. Remove the engine front cover and the crankshaft position reluctor ring. Refer to **Crankshaft Position (CKP) Reluctor Ring Replacement**.

Important: Once the engine front cover is removed, do not re-install it.

Always install a NEW engine front cover.

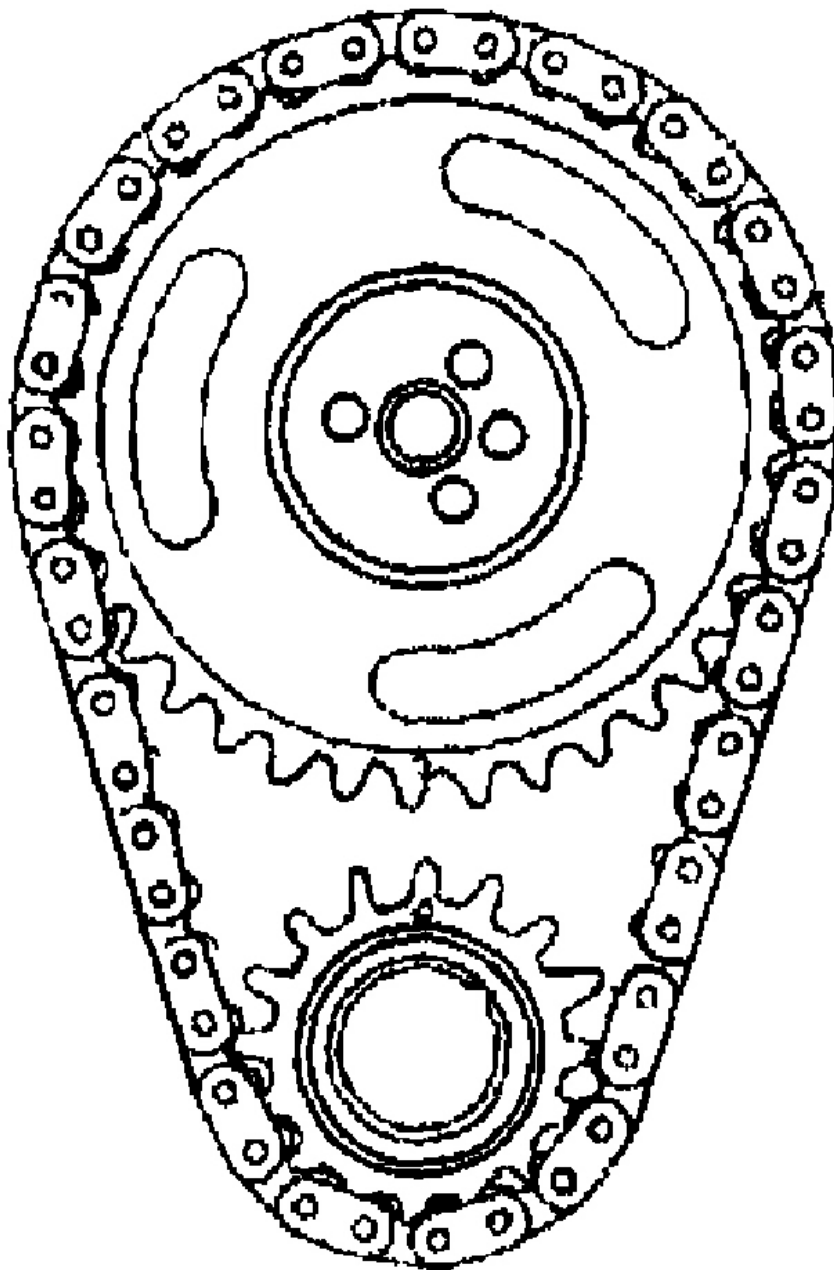


G01688472

Fig. 99: Removing Crankshaft Position Reluctor Ring
Courtesy of GENERAL MOTORS CORP.

2. Rotate the crankshaft until:

- The number one cylinder is at top dead center (TDC) of the compression stroke
- The timing marks on both sprockets line up

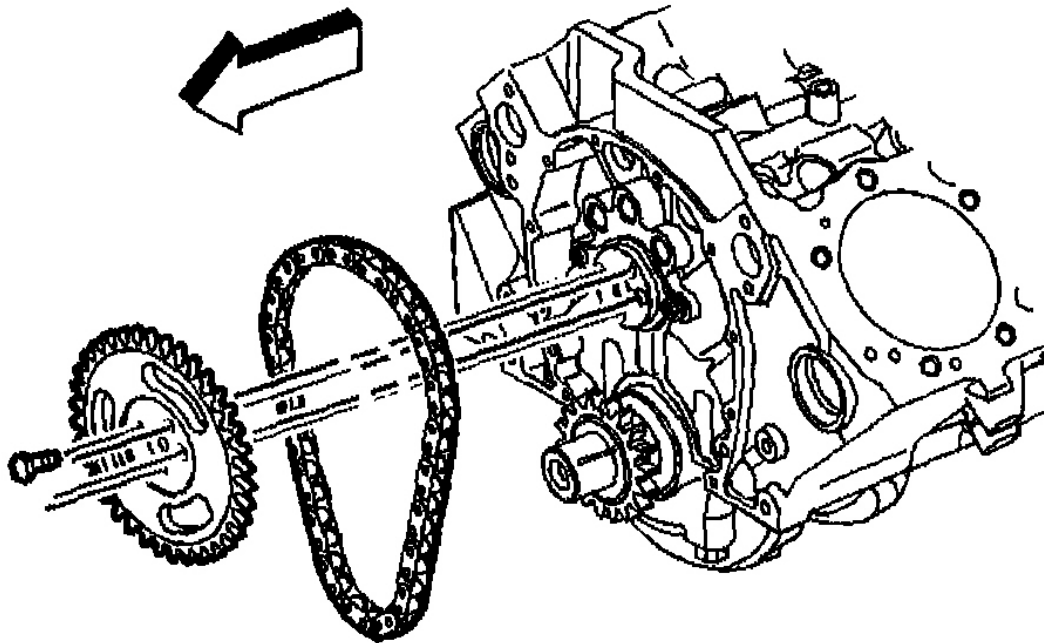


G01688473

Fig. 100: Aligning Timing Marks On Sprockets

Courtesy of GENERAL MOTORS CORP.

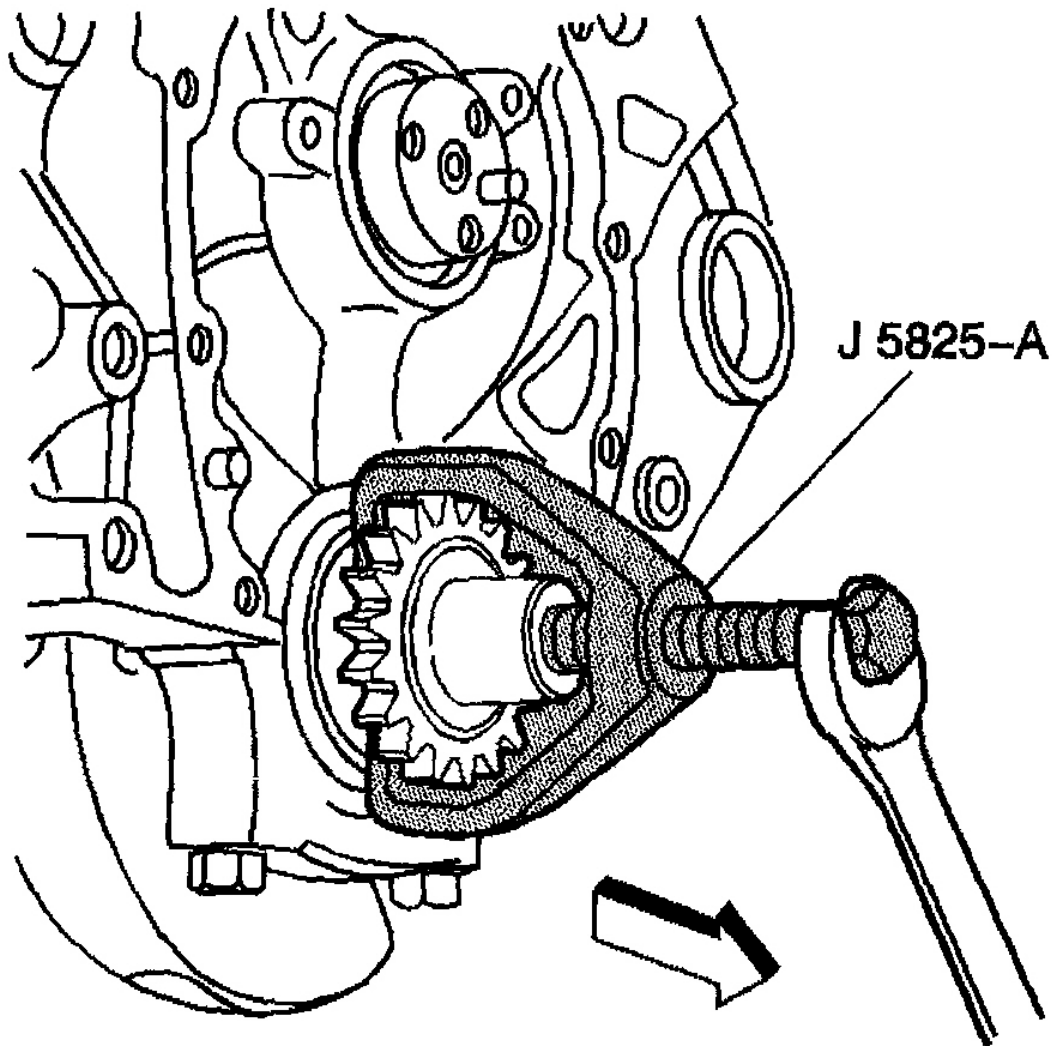
3. Remove the camshaft sprocket bolts.
4. Remove the camshaft sprocket and the camshaft timing chain.



G01688474

Fig. 101: Removing Camshaft Sprocket, Timing Chain & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Use the **J 5825-A** in order to remove the crankshaft sprocket.
6. Remove the woodruff key (crankshaft balancer) if necessary.

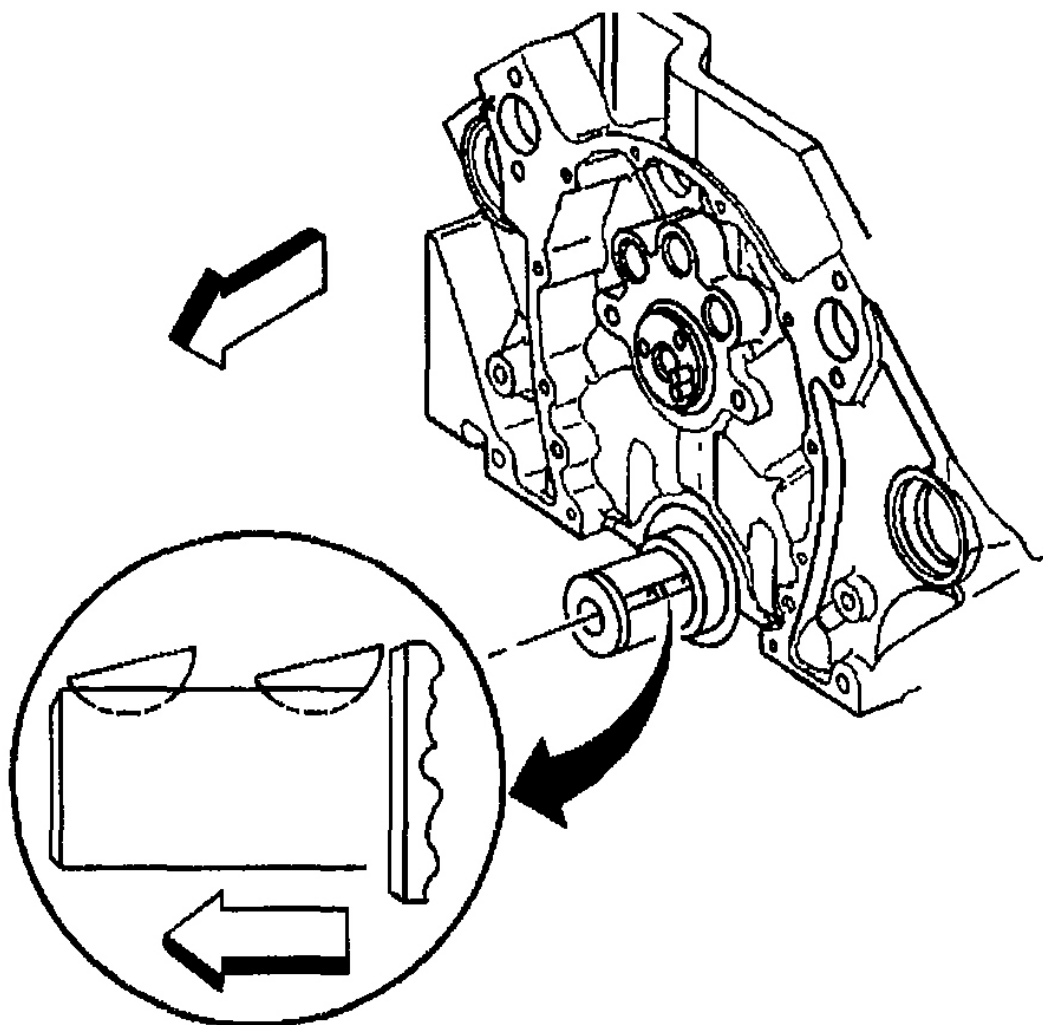


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Fig. 102: Removing Crankshaft Sprocket Using J 5825-A
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

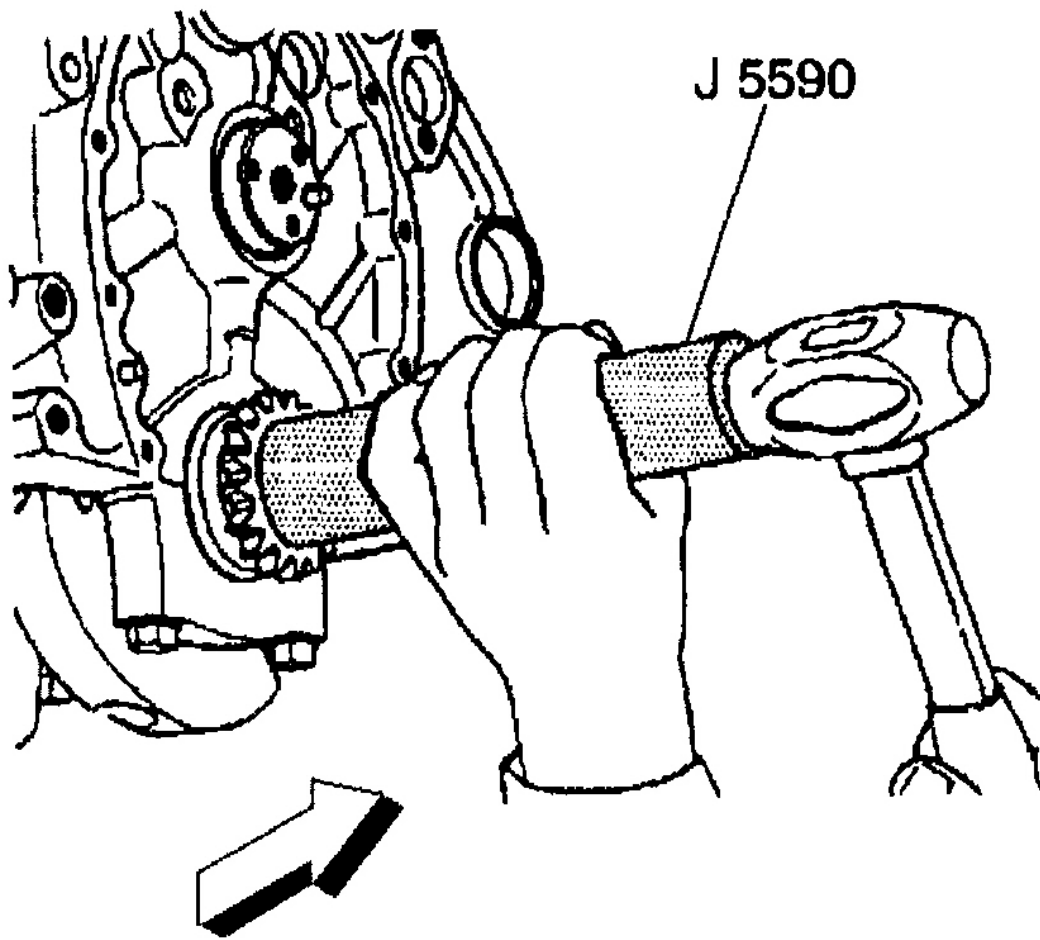
1. Install the woodruff key (crankshaft balancer) into the crankshaft, if removed.



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Fig. 103: Installing Woodruff Key Into Crankshaft
Courtesy of GENERAL MOTORS CORP.

2. Align the keyway of the crankshaft sprocket with the woodruff key (crankshaft balancer).
3. Use the **J 5590** and a hammer in order to install the crankshaft sprocket.
4. Make sure that the number 1 piston is still at TDC of the compression stroke.
5. Align the timing marks on both sprockets. Look to ensure that the crankshaft sprocket alignment mark is in the 12 o'clock position.



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Fig. 104: Installing Crankshaft Sprocket Using J 5590
Courtesy of GENERAL MOTORS CORP.

6. Install the camshaft sprocket and the timing chain.

The camshaft sprocket alignment mark must be in the 6 o'clock position.

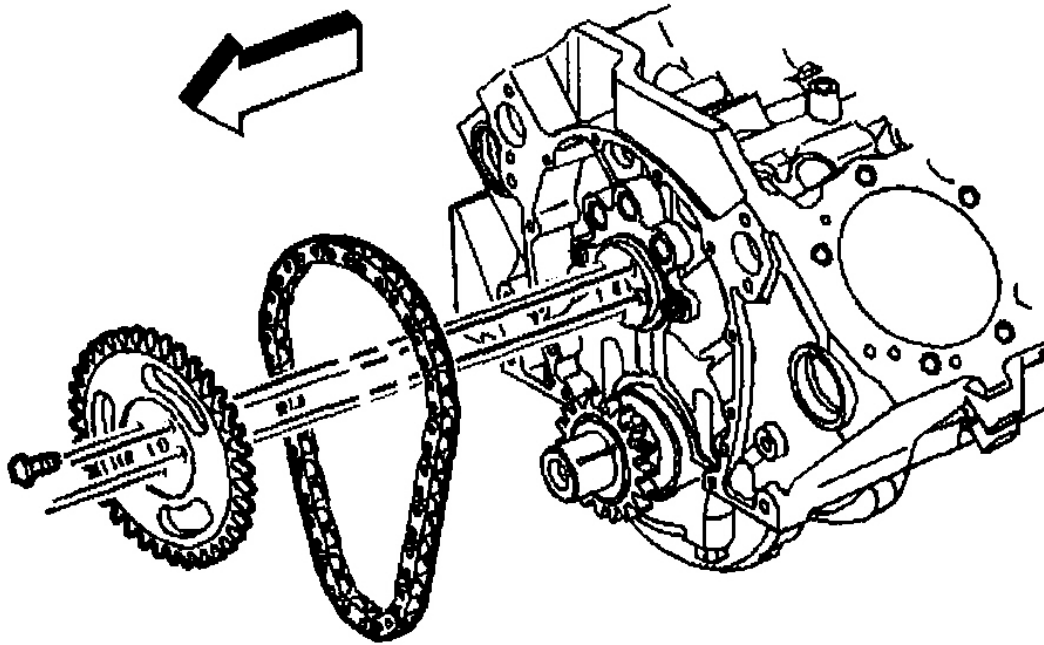
7. Install the camshaft sprocket bolts.

Tighten

Tighten the bolts to 25 N.m (18 lb ft).

8. Be sure to align the camshaft and the crankshaft sprocket alignment marks.

9. Install the crankshaft position sensor reluctor ring and the engine front cover. Refer to **Crankshaft Position (CKP) Reluctor Ring Replacement**.



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Fig. 105: Installing Camshaft Sprocket, Timing Chain & Bolts
Courtesy of GENERAL MOTORS CORP.

CAMSHAFT REPLACEMENT

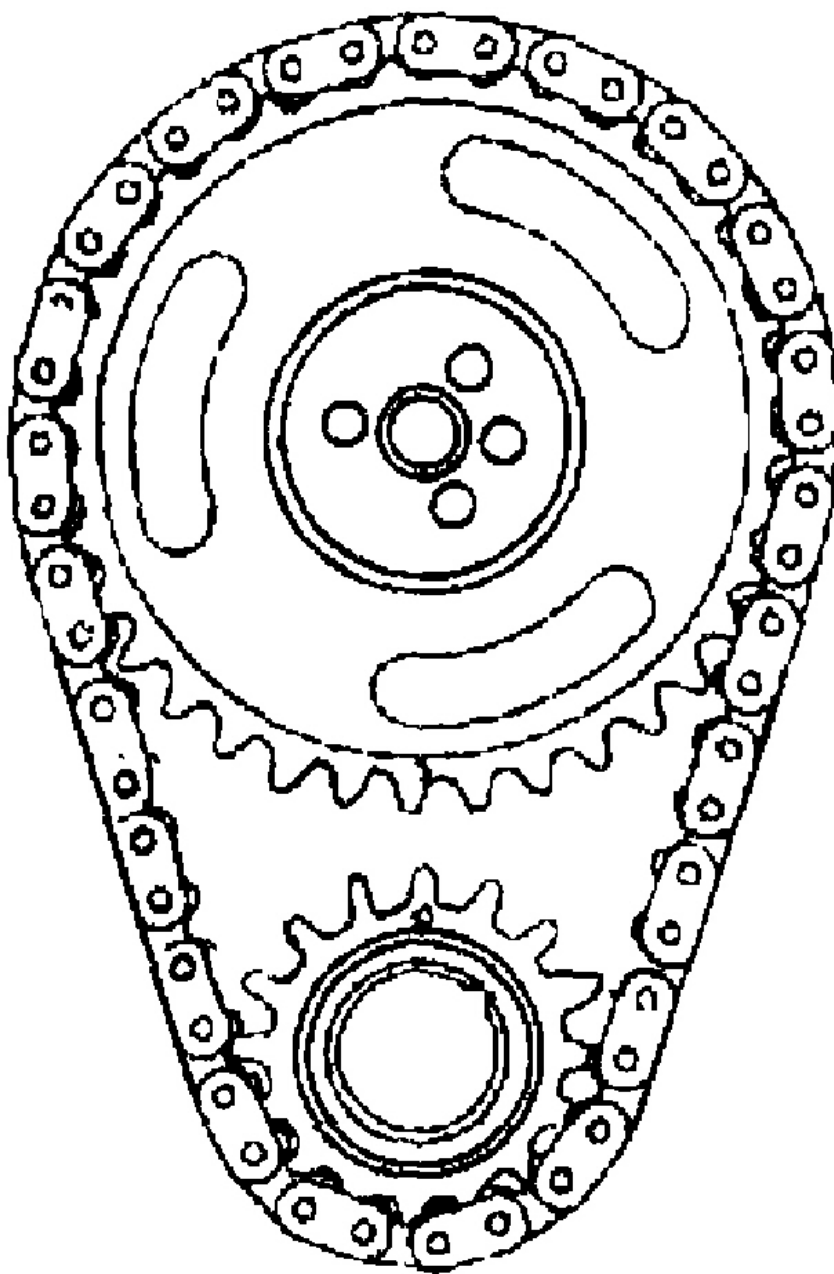
Tools Required

J 23523-F Balancer Remover and Installer

Removal Procedure

1. Evacuate the air conditioning system, if equipped.
2. Disconnect the battery negative cable.
3. Drain the engine oil. Refer to **Engine Oil and Oil Filter Replacement**.
4. Remove the valve lifters. Refer to **Valve Lifter Replacement**.
5. Remove the engine cooling fan and the fan shroud.
6. Remove the radiator grille.
7. Remove the hood latch bracket.

8. Remove the radiator
9. Remove the A/C condenser, if equipped.
10. Remove the water pump.
11. Remove the three crankshaft pulley bolts and the crankshaft pulley. Refer to **Crankshaft Balancer Replacement**.
12. Raise the vehicle.
13. Remove the oil pan. Refer to **Oil Pan Replacement**.
14. Lower the vehicle.
15. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.
16. Remove the crankshaft position sensor reluctor ring. Refer to **Crankshaft Position (CKP) Reluctor Ring Replacement**.
17. Rotate the number one piston to Top Dead Center (TDC).
18. Align the timing marks on the camshaft and the crankshaft sprockets.

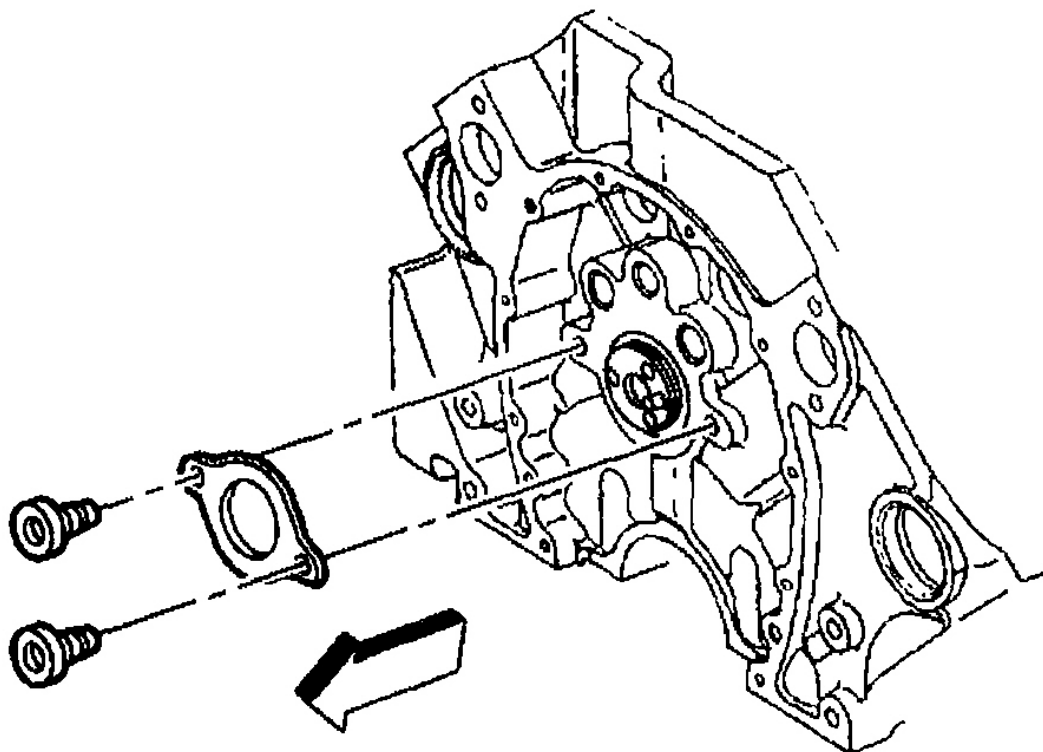


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Fig. 106: Aligning Timing Marks On Camshaft
Courtesy of GENERAL MOTORS CORP.

19. Remove the camshaft sprocket bolts.

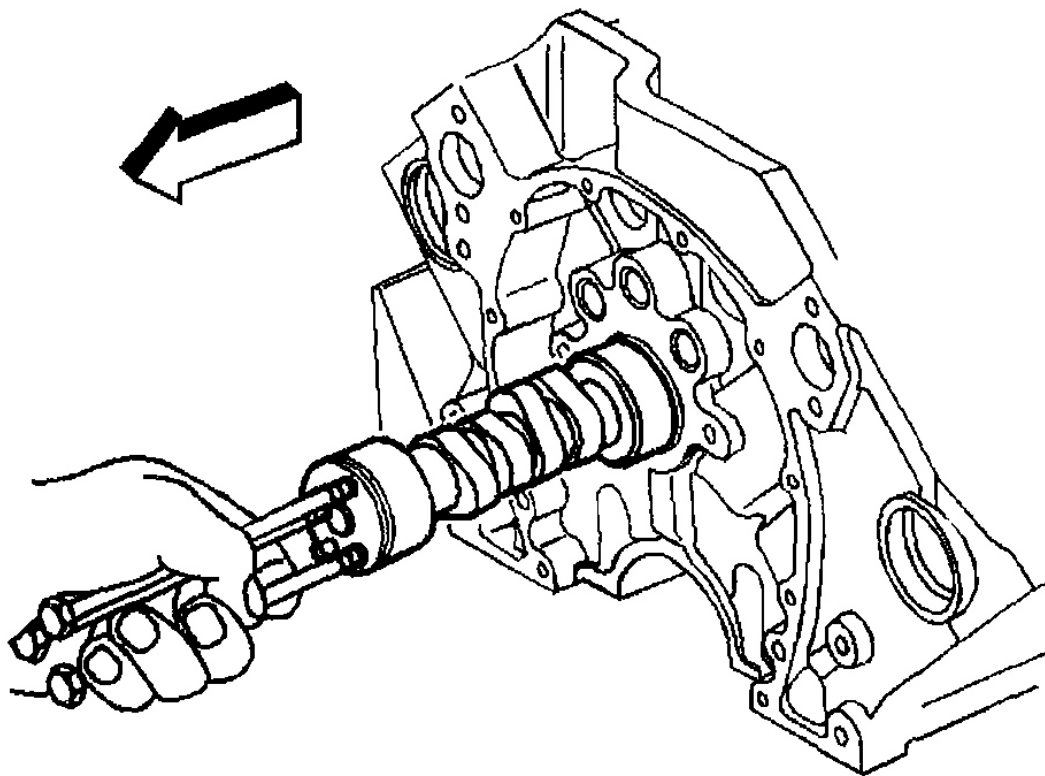
20. Remove the camshaft sprocket and the camshaft timing chain. Refer to **Timing Chain and Sprockets Replacement**.
21. Remove the camshaft retainer plate and bolts using a T-30 TORX® socket.



G01688480

Fig. 107: Removing Camshaft Retainer Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

22. Remove the camshaft. Refer to **Camshaft Replacement**.
23. Clean all sealing surfaces.
24. Inspect all parts for wear.

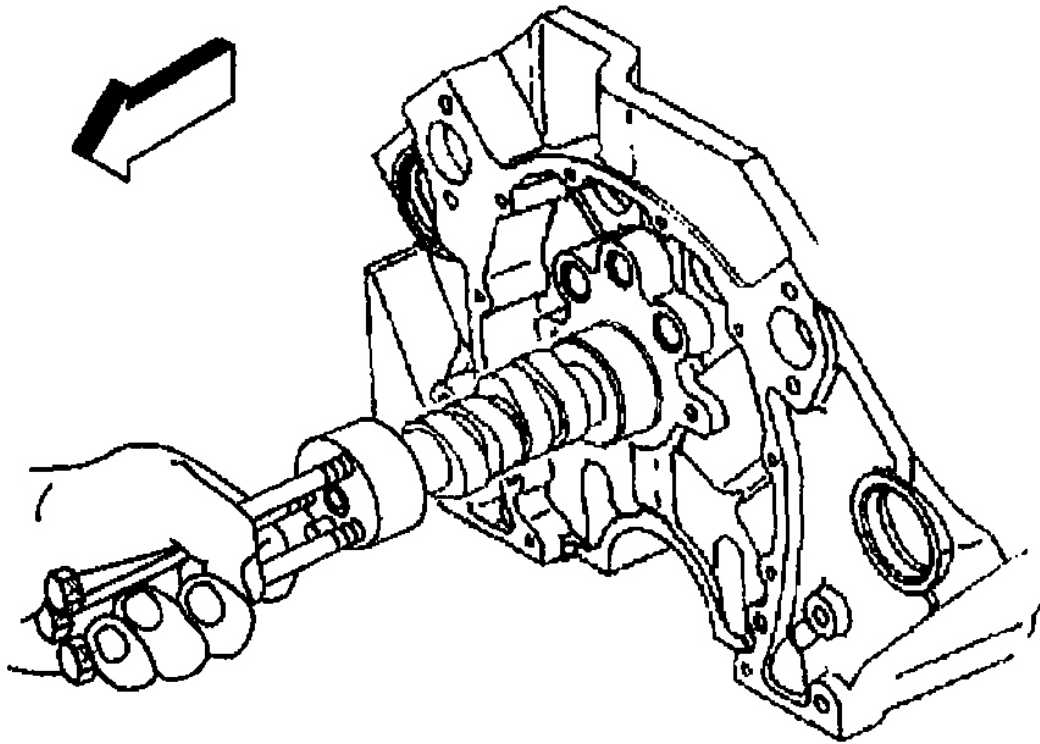


G01688481

Fig. 108: Removing Camshaft
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the camshaft. Refer to **Camshaft Replacement**.
2. Install the components removed from the front of the engine. Refer to **Timing Chain and Sprockets Replacement**.
3. Raise the vehicle.
4. Install the fasteners to the oil pan. Refer to **Oil Pan Replacement**.
5. Lower the vehicle.



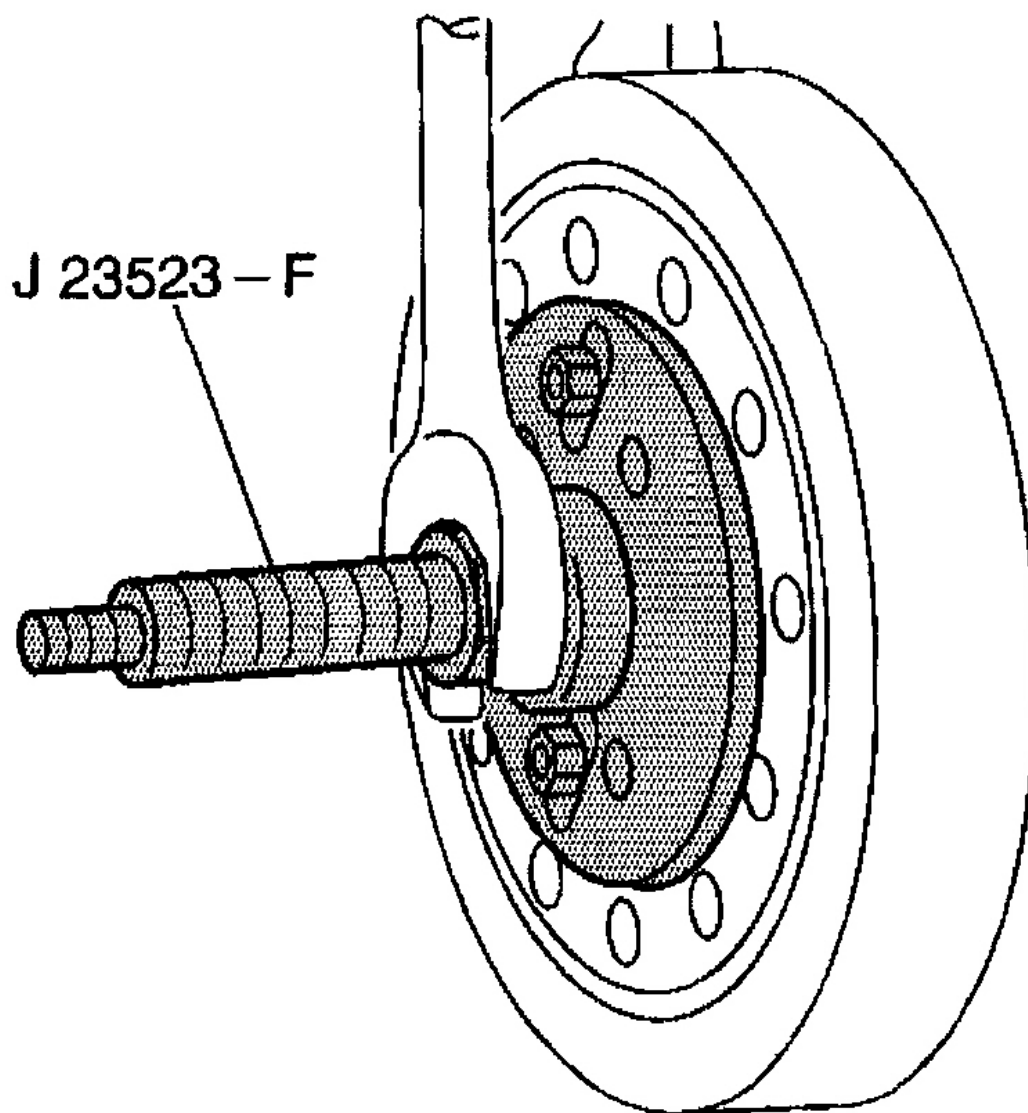
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Fig. 109: Installing Camshaft
Courtesy of GENERAL MOTORS CORP.

6. Use the **J 23523-F** in order to install the crankshaft balancer.

Refer to **Crankshaft Balancer Replacement**.

7. Install the water pump.
8. Install the A/C condenser, if equipped.
9. Install the radiator
10. Install the hood latch bracket.
11. Install the radiator grille.



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Fig. 110: Installing Crankshaft Balancer Using J 23523-F
Courtesy of GENERAL MOTORS CORP.

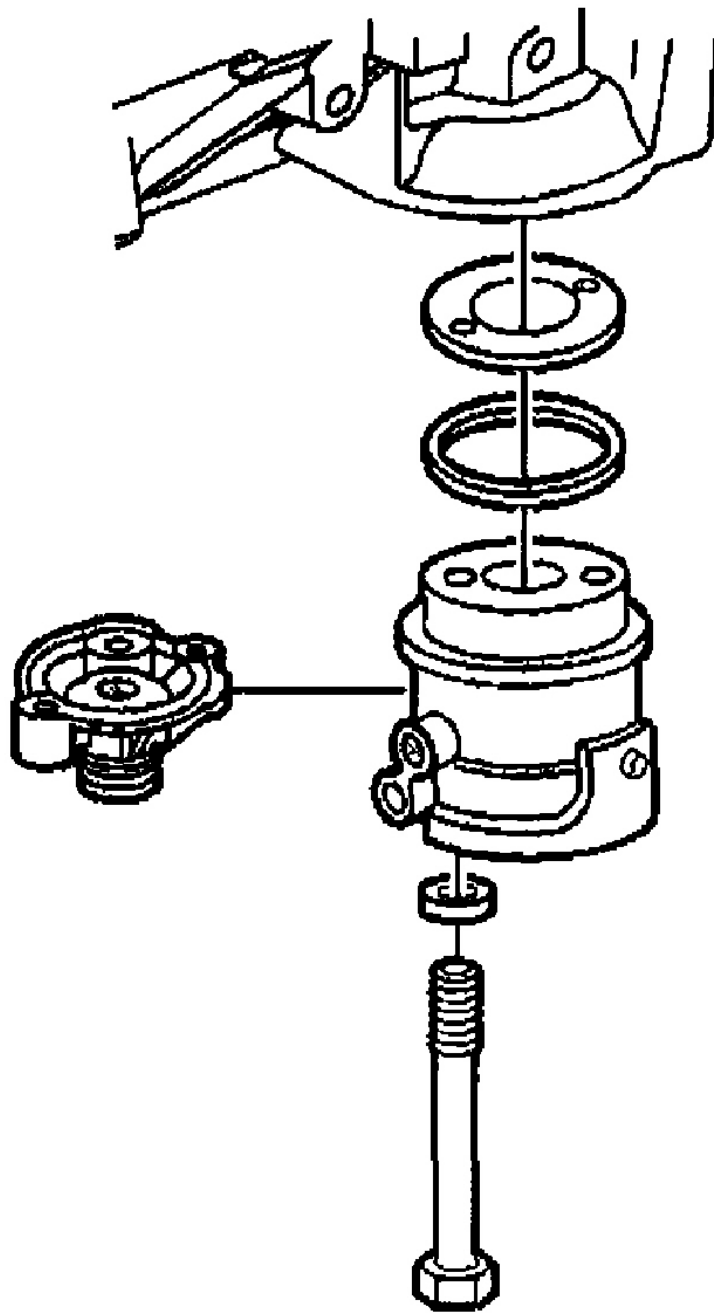
12. Install the engine cooling fan and the upper fan shroud.
13. Install the valve lifters. Refer to **Valve Rocker Arm And Push Rod Replacement**.
14. Install the lower intake manifold. Refer to **Intake Manifold Replacement - Lower**.
15. Install the valve rocker arms and push valve rods. Refer to **Valve Rocker Arm And Push Rod Replacement**.

16. Connect the battery negative cable.
17. Replace the engine oil filter. Refer to **Engine Oil and Oil Filter Replacement**.

OIL FILTER ADAPTER REPLACEMENT

Removal Procedure

1. Remove the oil filter. Refer to **Engine Oil and Oil Filter Replacement**.
2. Remove the oil cooler pipes.
3. Remove the oil filter adapter.
4. Clean all sealing surfaces.

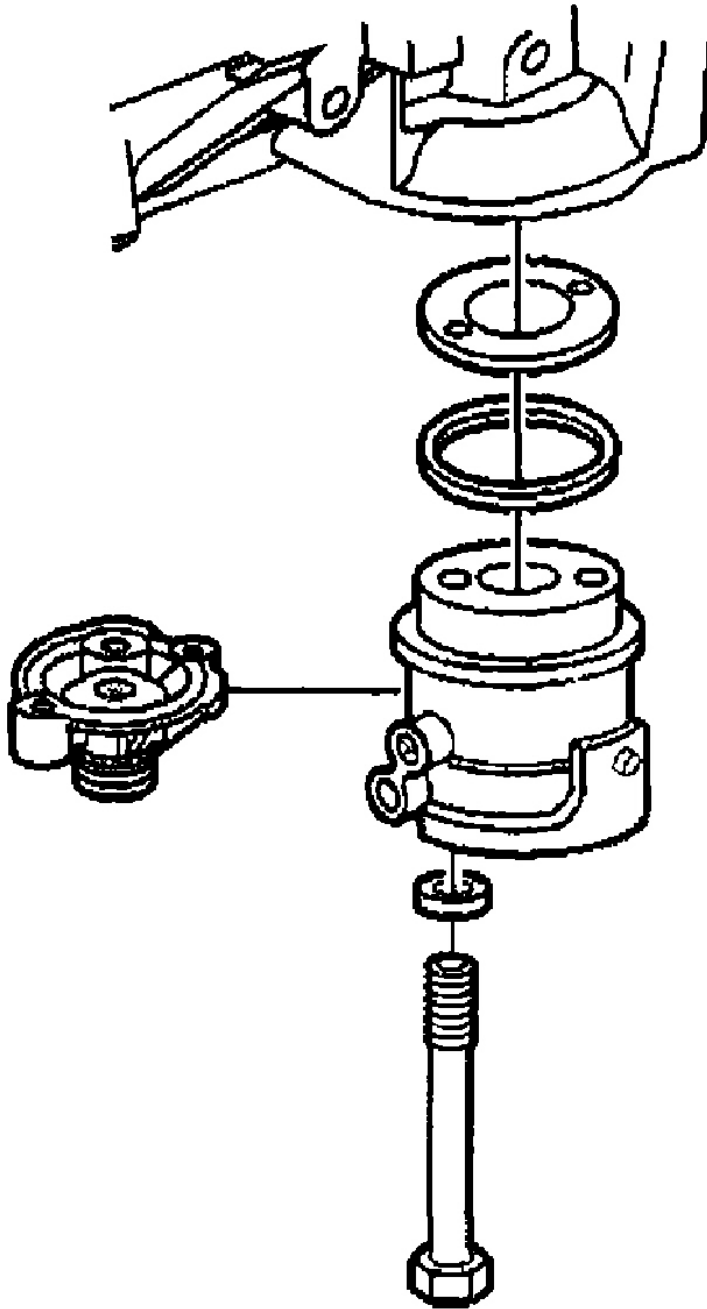


G01688484

Fig. 111: Removing Oil Filter Adapter
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the oil filter adapter. Refer to **OIL FILTER ADAPTER INSTALLATION** .
2. Install the oil cooler pipes.
3. Install the engine oil and the oil filter. Refer to **Engine Oil and Oil Filter Replacement**.



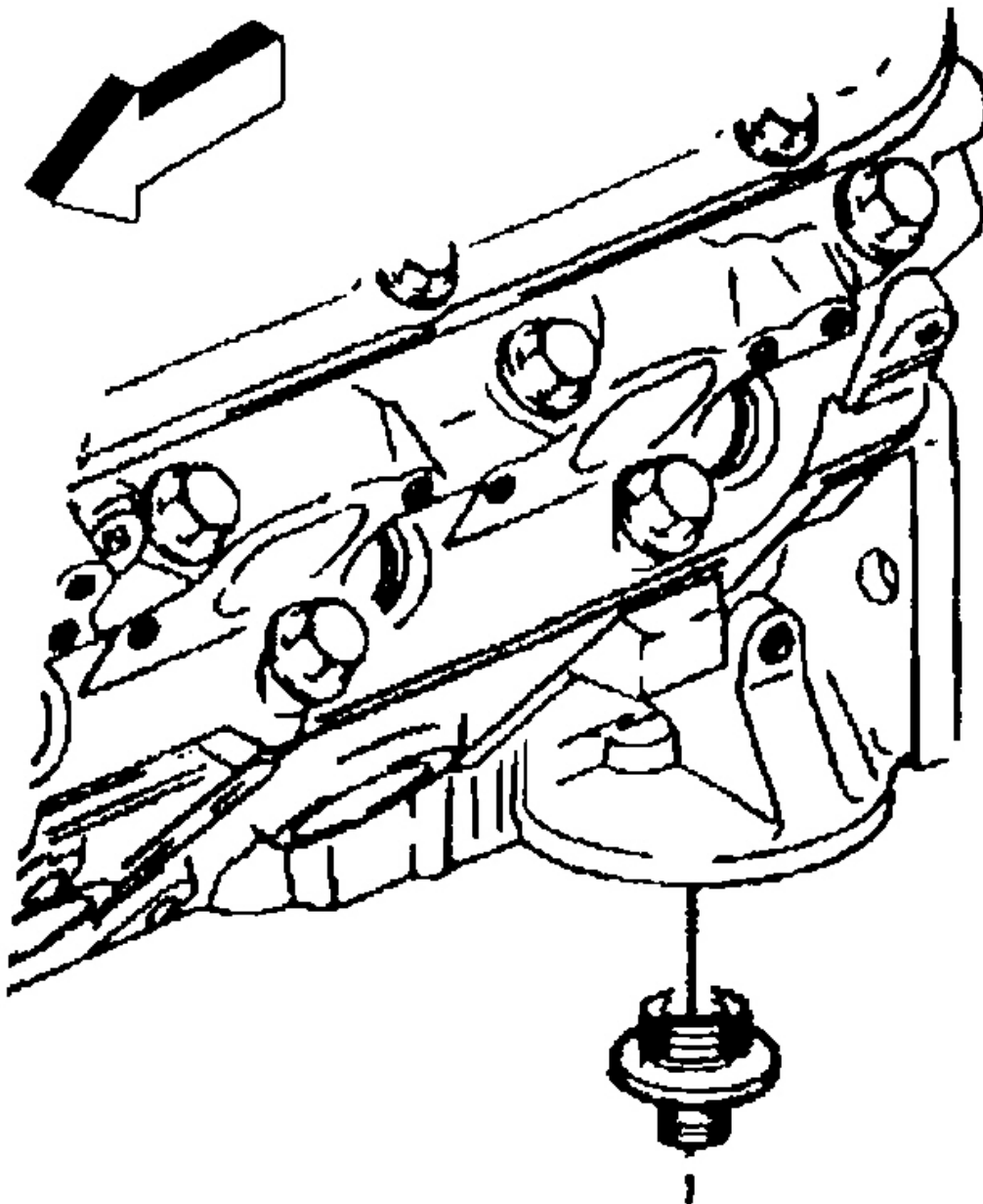
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Fig. 112: Installing Oil Filter Adapter
Courtesy of GENERAL MOTORS CORP.

OIL FILTER BYPASS VALVE REPLACEMENT

Removal Procedure

1. Remove the oil filter. Refer to **Engine Oil and Oil Filter Replacement**.
2. Remove the oil filter bypass valve. Insert Allen wrench and remove bypass valve.

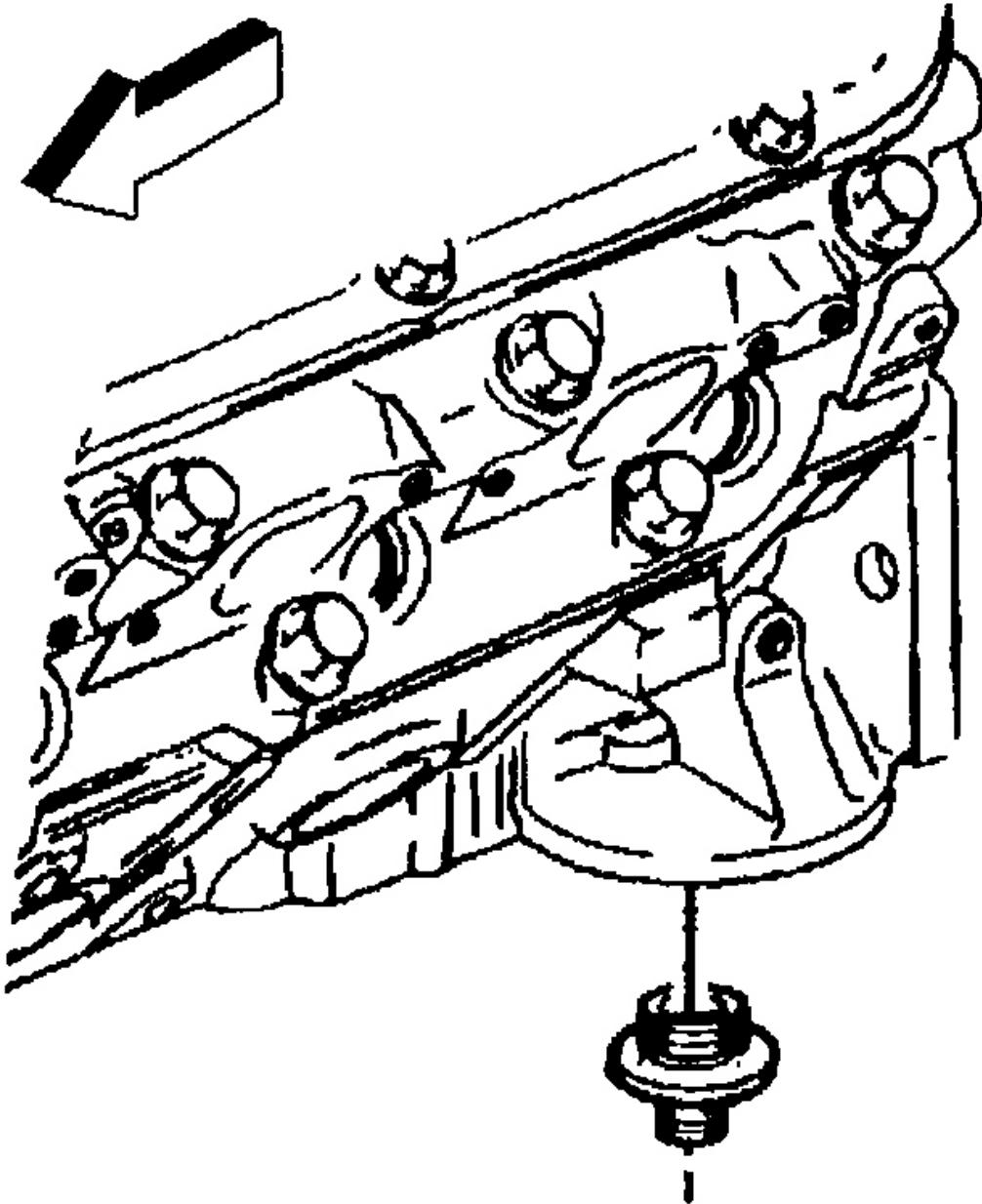


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Fig. 113: Removing Oil Filter Bypass Valve
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the oil filter bypass valve and a new gasket. Tighten bypass valve with an Allen wrench.
2. Install the engine oil and the oil filter. Refer to Engine Oil and Oil Filter Replacement.



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Fig. 114: Installing Oil Filter Bypass Valve

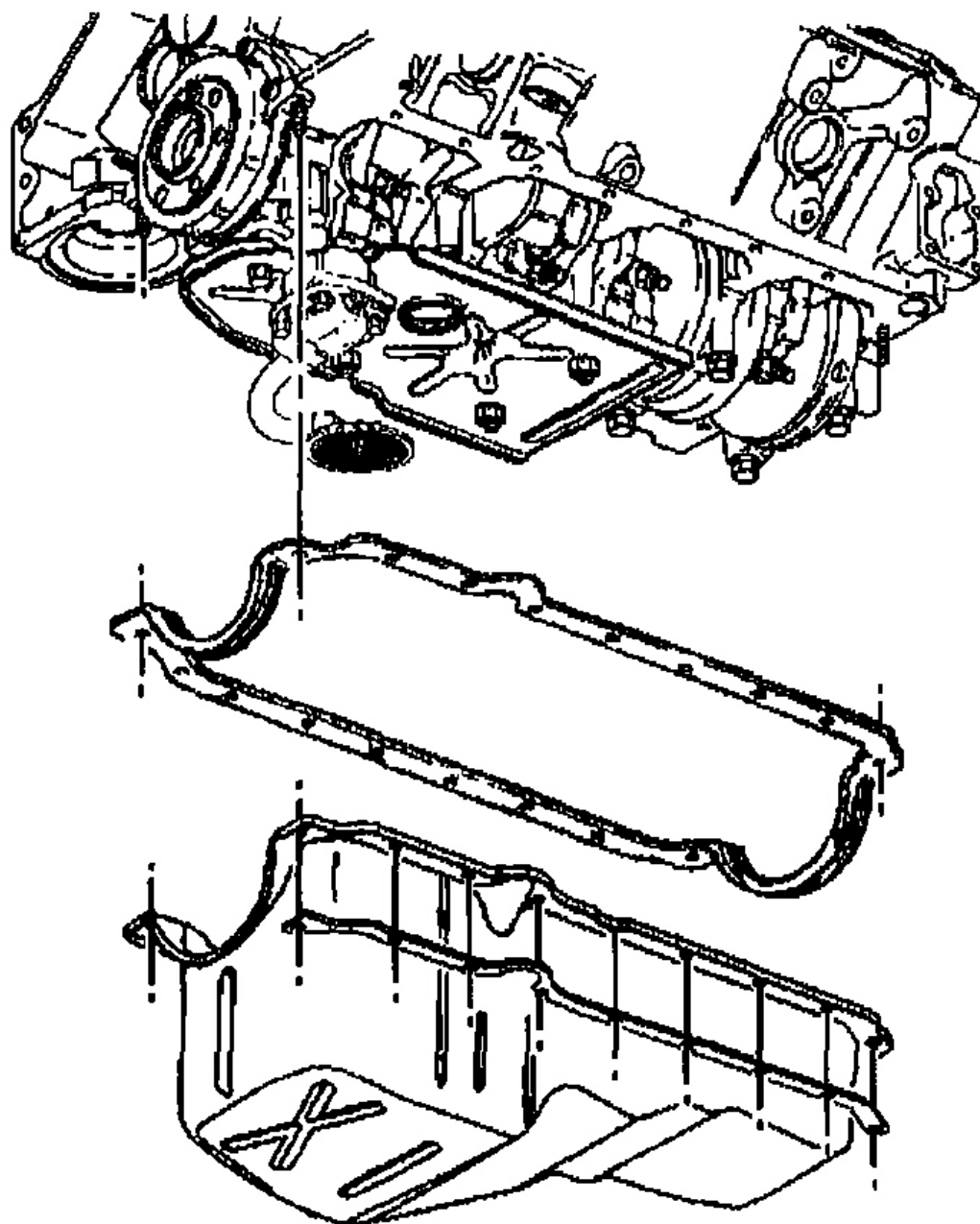
Courtesy of GENERAL MOTORS CORP.

OIL PAN REPLACEMENT

Removal Procedure

1. Remove the exhaust pipe from the exhaust manifold.
2. Remove the engine oil and the engine oil filter. Refer to **Engine Oil and Oil Filter Replacement**.
3. Remove the oil level indicator and tube. Refer to **Oil Level Indicator and Tube Replacement**.
4. Remove the oil filter adapter. Refer to **Oil Filter Adapter Replacement**.
5. Remove the oil cooler pipes and the retainer from the side of the engine.
6. Remove the starter motor.
7. Remove the engine mount through bolts. Refer to **Engine Mount Replacement - Left** or **Engine Mount Replacement - Right**.
8. Remove the oil pan nuts and bolts.
9. Note the location of any studs to assist reassembly.
10. Remove the engine oil pan and the oil pan gasket.

Clean all sealing surfaces.

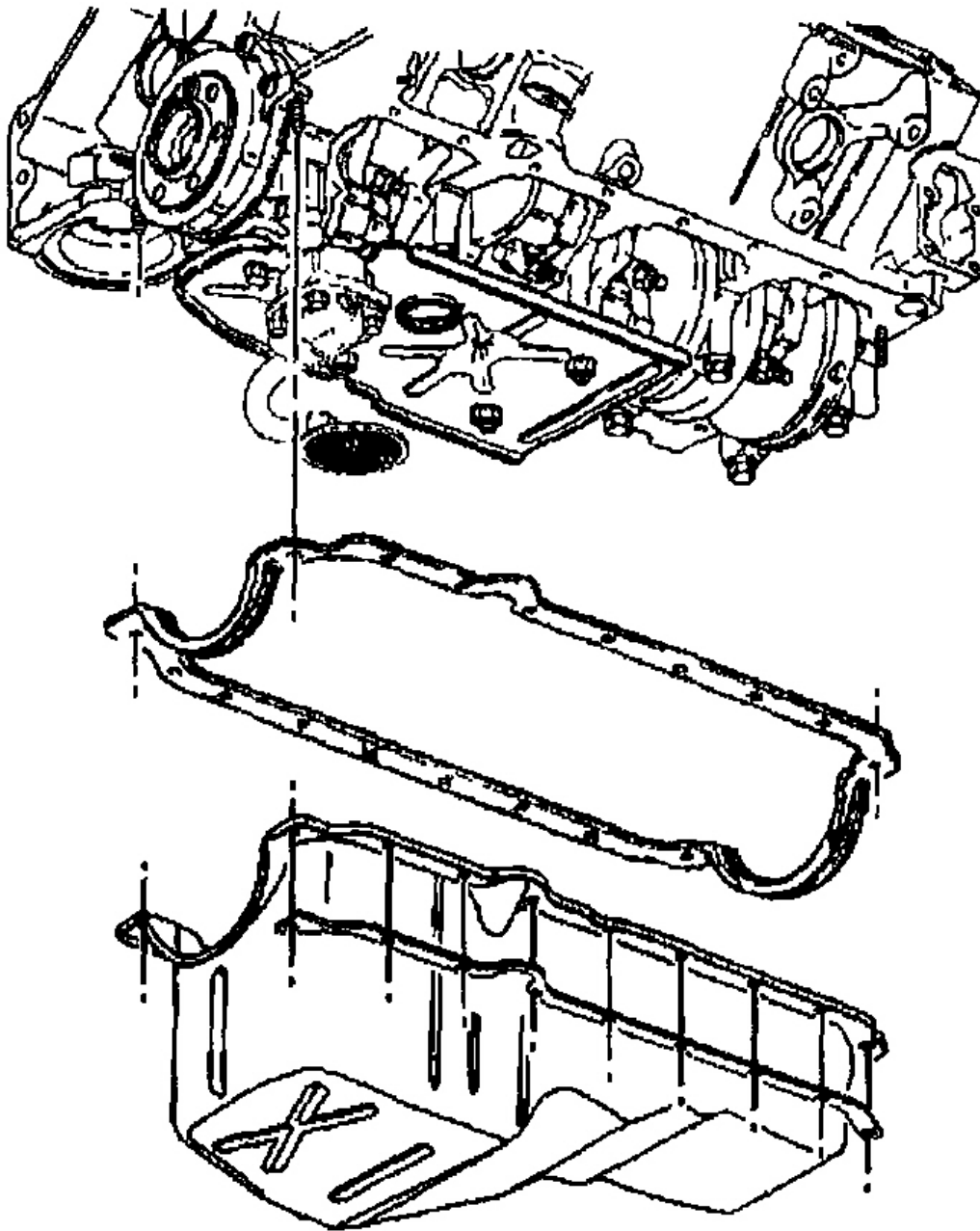


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Fig. 115: Removing Oil Pan & Gasket
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the engine oil pan and a NEW oil pan gasket. Refer to **Oil Pan Replacement**.
2. Lower the engine onto the mounts.
3. Install the engine mount through-bolts. Refer to **Engine Mount Replacement - Left** or **Engine Mount Replacement - Right**.
4. Install the starter motor.
5. Install the oil filter adapter. Refer to **Oil Filter Adapter Replacement**.
6. Install oil level indicator and tube. Refer to **Oil Level Indicator and Tube Replacement**.
7. Install the engine oil filter and the engine oil. Refer to **Engine Oil and Oil Filter Replacement**.
8. Lower the vehicle.
9. Install the exhaust pipe to the exhaust manifold.



G01688489

Fig. 116: Installing Engine Oil Pan & Gasket
Courtesy of GENERAL MOTORS CORP.

ENGINE OIL PRESSURE SENSOR AND/OR SWITCH REPLACEMENT (5.0L)

Tools Required**J 41712** Oil Pressure Switch Socket**Removal Procedure**

1. Remove the engine cover.
2. Remove the air cleaner assembly.
3. Disconnect the electrical connector from the engine oil pressure gauge sensor.
4. Hold the engine oil pressure gauge sensor fitting with a wrench.

Important: Note the alignment of the engine oil pressure gauge sensor fitting prior to removal.

5. Remove the engine oil pressure gauge sensor using **J 41712** .

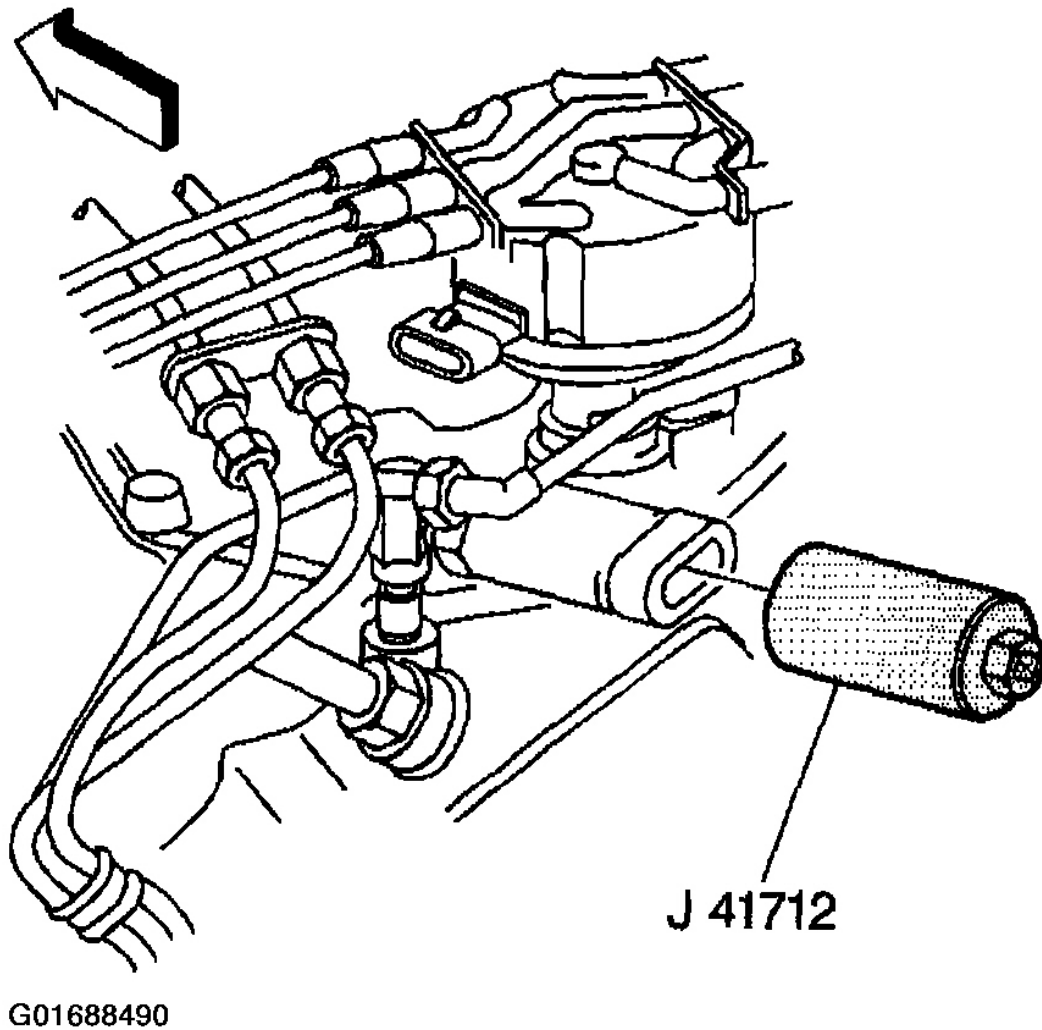
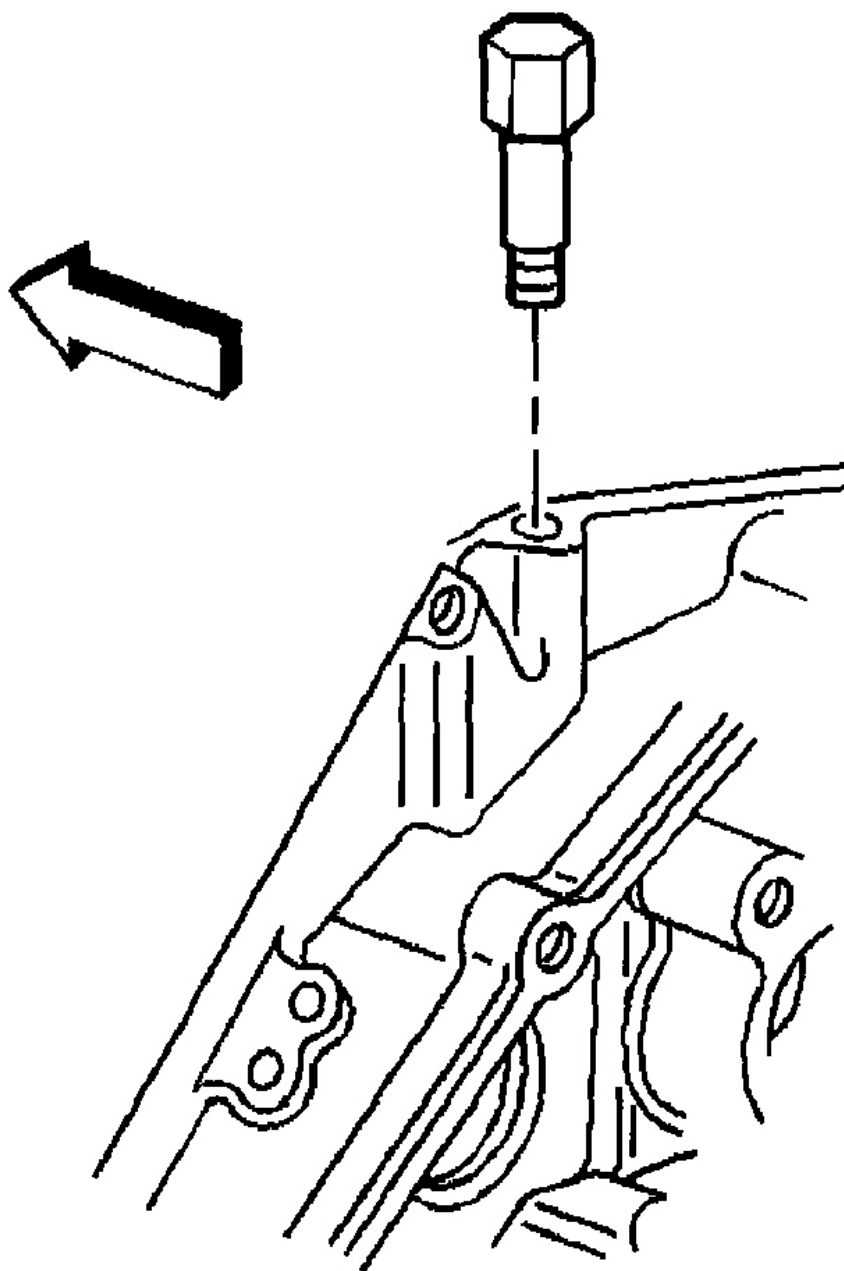


Fig. 117: Removing Engine Oil Pressure Gauge Sensor Using J 41712
Courtesy of GENERAL MOTORS CORP.

6. Remove the engine oil pressure sensor fitting, if necessary.



G01688491

Fig. 118: Removing Engine Oil Pressure Sensor Fitting
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Apply sealant GM P/N 12346004 (Canadian P/N 10953480) or equivalent to the threads of the engine oil pressure sensor fitting.

Important: Do not loosen the oil pressure sensor fitting after the initial torque has been obtained.

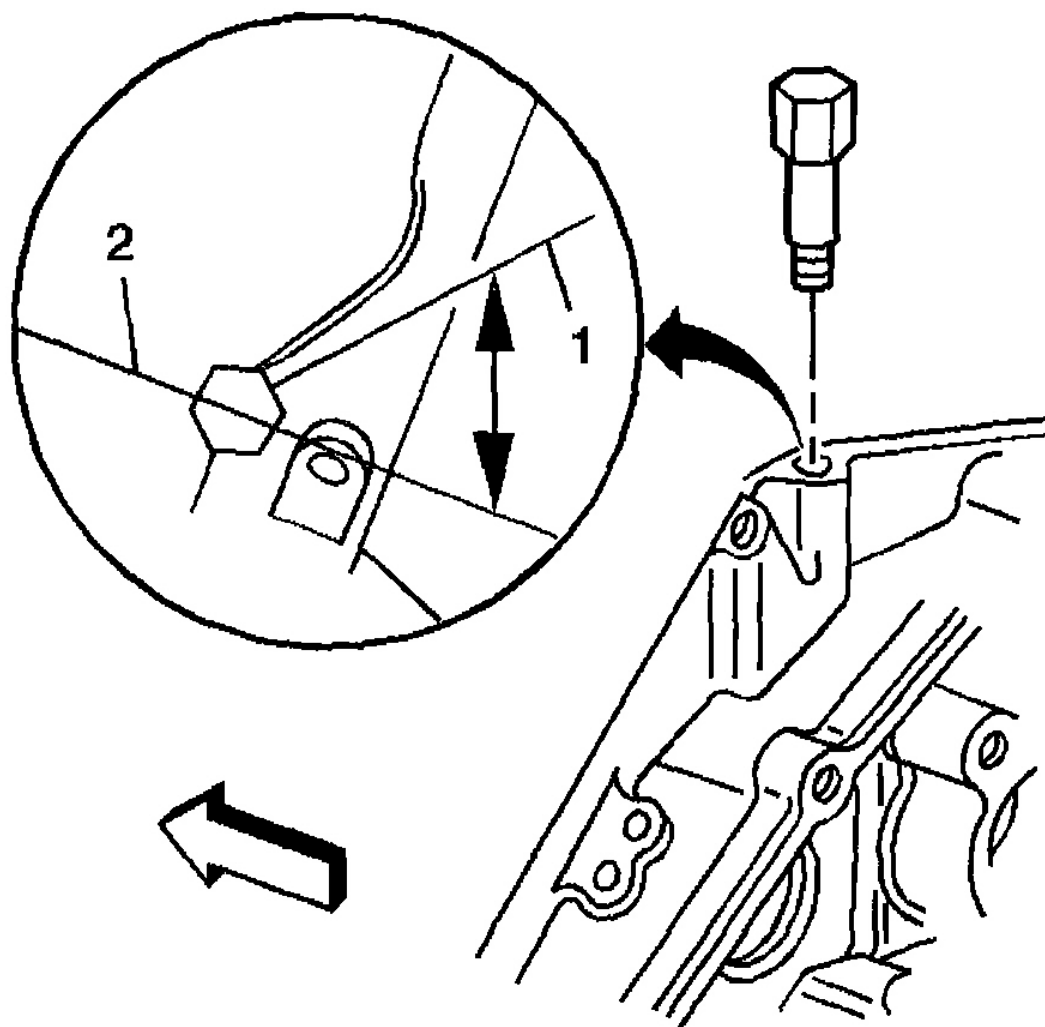
2. Install the engine oil pressure gage sensor fitting.

Tighten

Tighten the engine oil pressure gage sensor fitting to 15 N.m (15 lb in).

Important: Do not rotate the engine oil pressure sensor fitting more than 359 degrees after the initial torque has been obtained.

3. Rotate the engine oil pressure sensor fitting clockwise to the proper position (1), 50 degrees from the centerline (2).



G01688492

Fig. 119: Ensuring Engine Oil Pressure Sensor Fitting Proper Installation Position
Courtesy of GENERAL MOTORS CORP.

4. Install the oil pressure sensor.
5. Hold the oil pressure sensor fitting with a wrench to prevent from turning.

Tighten

Using **J 41712** tighten the oil pressure sensor to 30 N.m (22 lb ft).

6. Install the electrical connector.
7. Install the engine cover.

8. Install the air cleaner assembly.

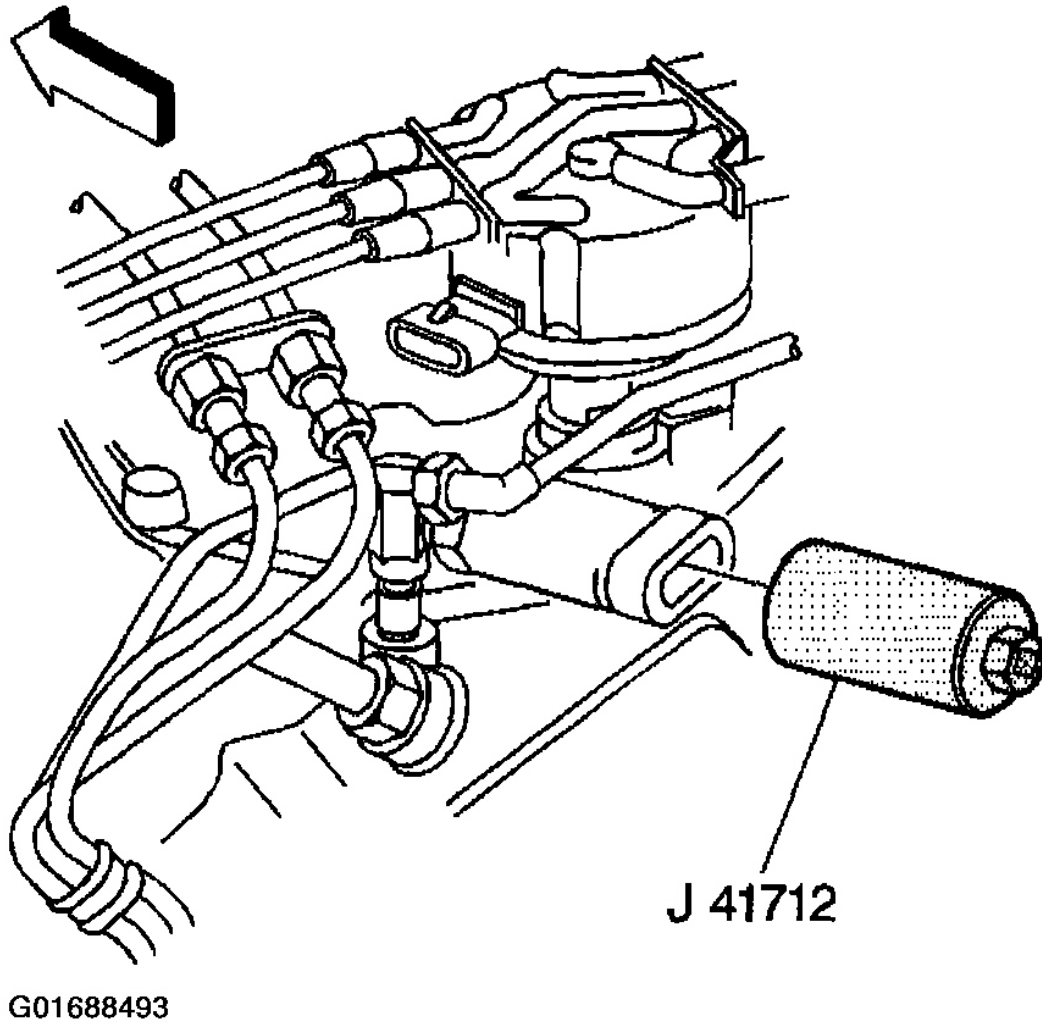


Fig. 120: Installing Oil Pressure Sensor Using J 41712
Courtesy of GENERAL MOTORS CORP.

ENGINE OIL PRESSURE SENSOR AND/OR SWITCH REPLACEMENT (5.7L)

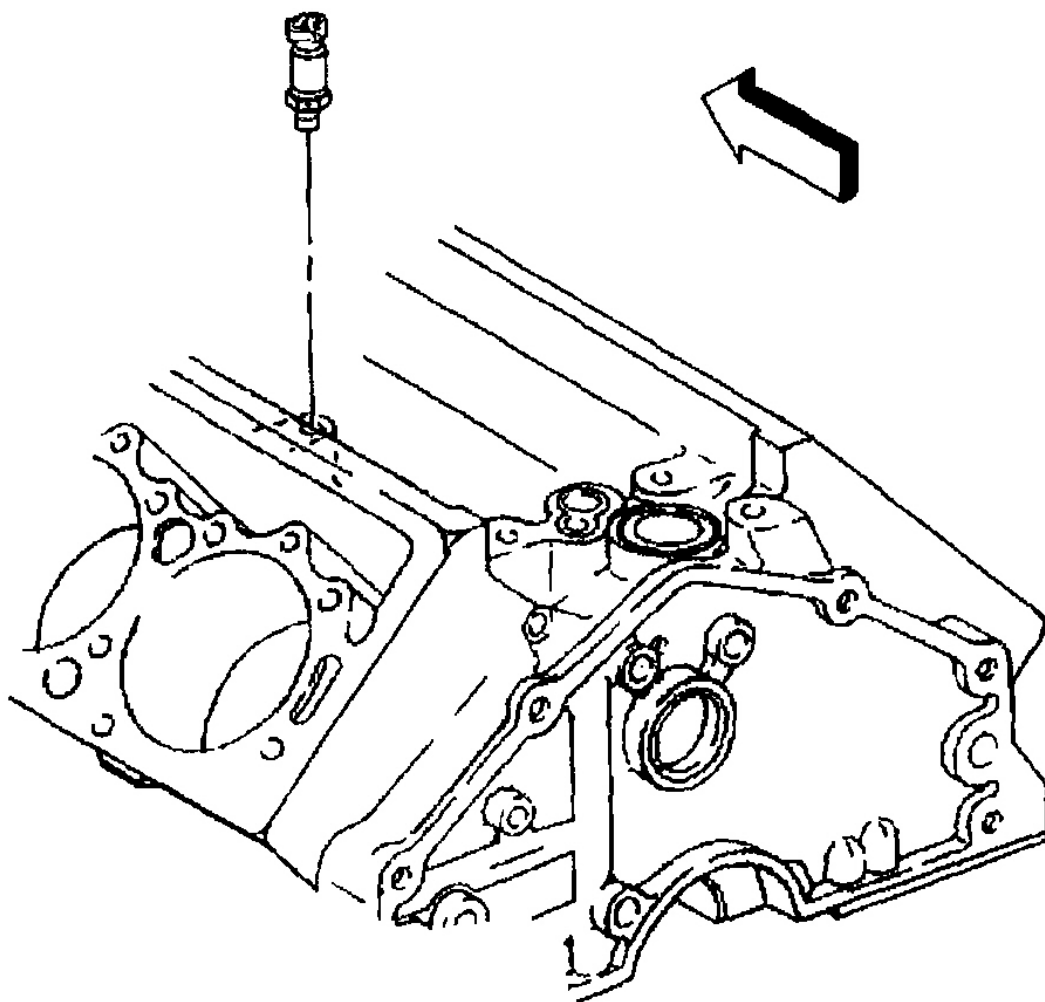
Tools Required

J 41712 Oil Pressure Sending Unit Socket

Removal Procedure

1. Remove the engine cover from the vehicle.

2. Remove the electrical connector from the oil pressure sending unit.
3. Use the **J 41712** to remove the oil pressure sending unit from the engine block.



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Fig. 121: Removing Oil Pressure Sending Unit Using J 41712
Courtesy of GENERAL MOTORS CORP.

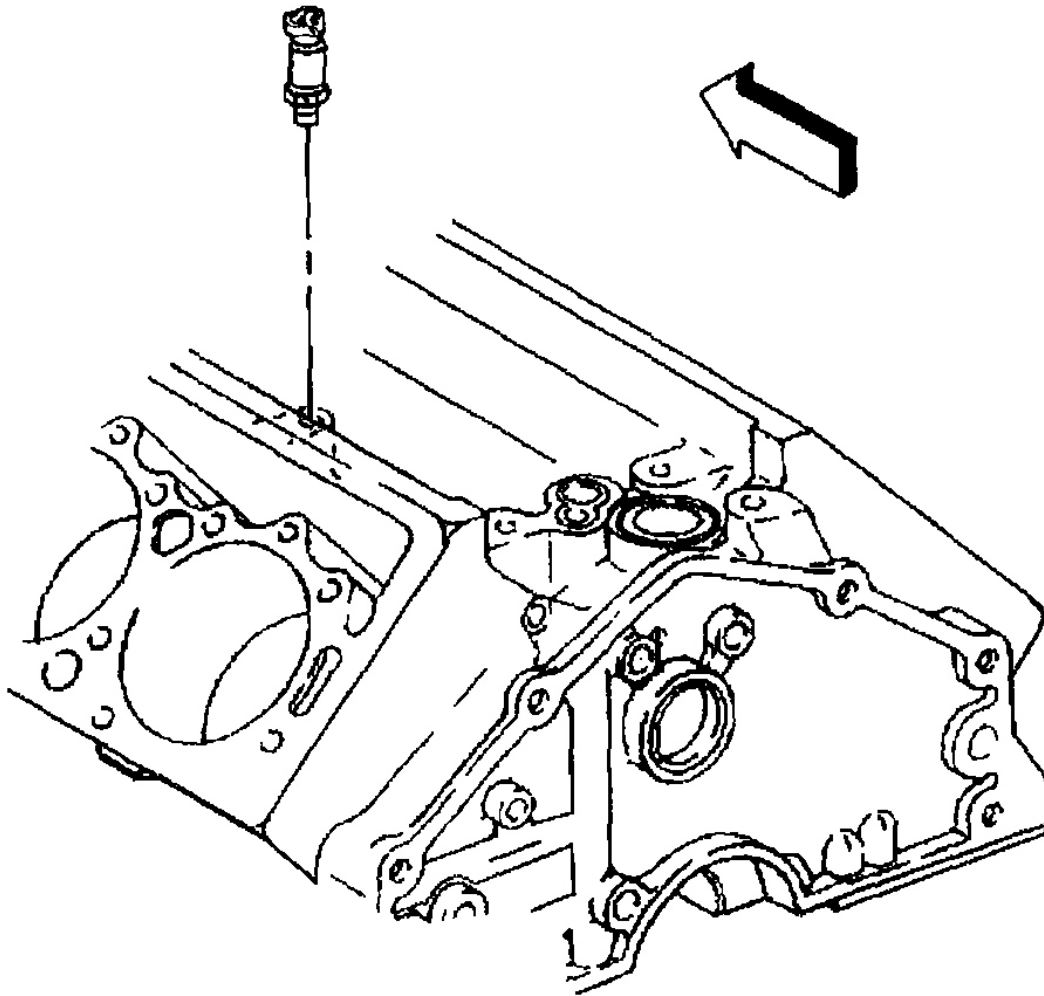
Installation Procedure

1. Use the **J 41712** to install the oil pressure sending unit to the engine block.

Tighten

Tighten the oil sending unit to 12 N.m (9 lb ft).

2. Install the electrical connector to the oil pressure sending unit.
3. Install the engine cover in the vehicle.



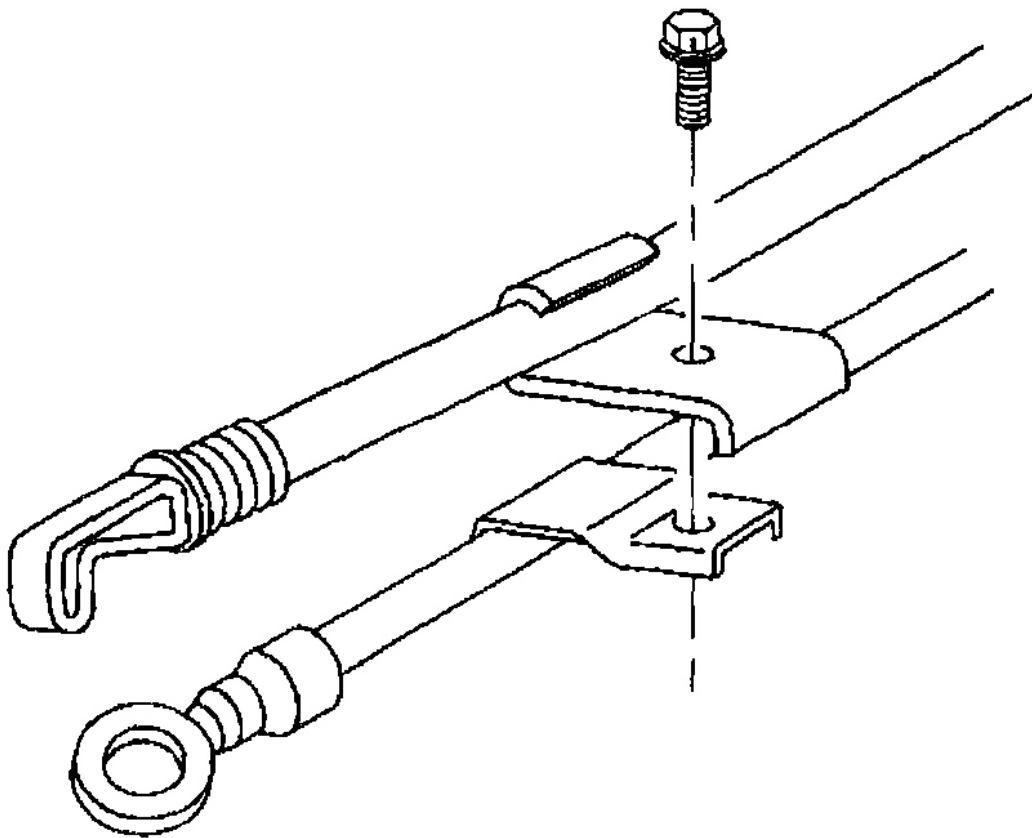
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Fig. 122: Installing Oil Pressure Sending Unit Using J 41712
Courtesy of GENERAL MOTORS CORP.

OIL LEVEL INDICATOR AND TUBE REPLACEMENT

Removal Procedure

1. Remove the air cleaner assembly.
2. Remove the engine cover.
3. Remove the bolt holding both oil level indicator tubes together.



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Fig. 123: Removing Bolt Holding Oil Level Indicator Tubes Together
Courtesy of GENERAL MOTORS CORP.

4. Remove the top half of the oil level indicator tube from the bottom half.
5. Clean the old sealer from the tube.
6. Remove the spark plug for the number 4 cylinder.

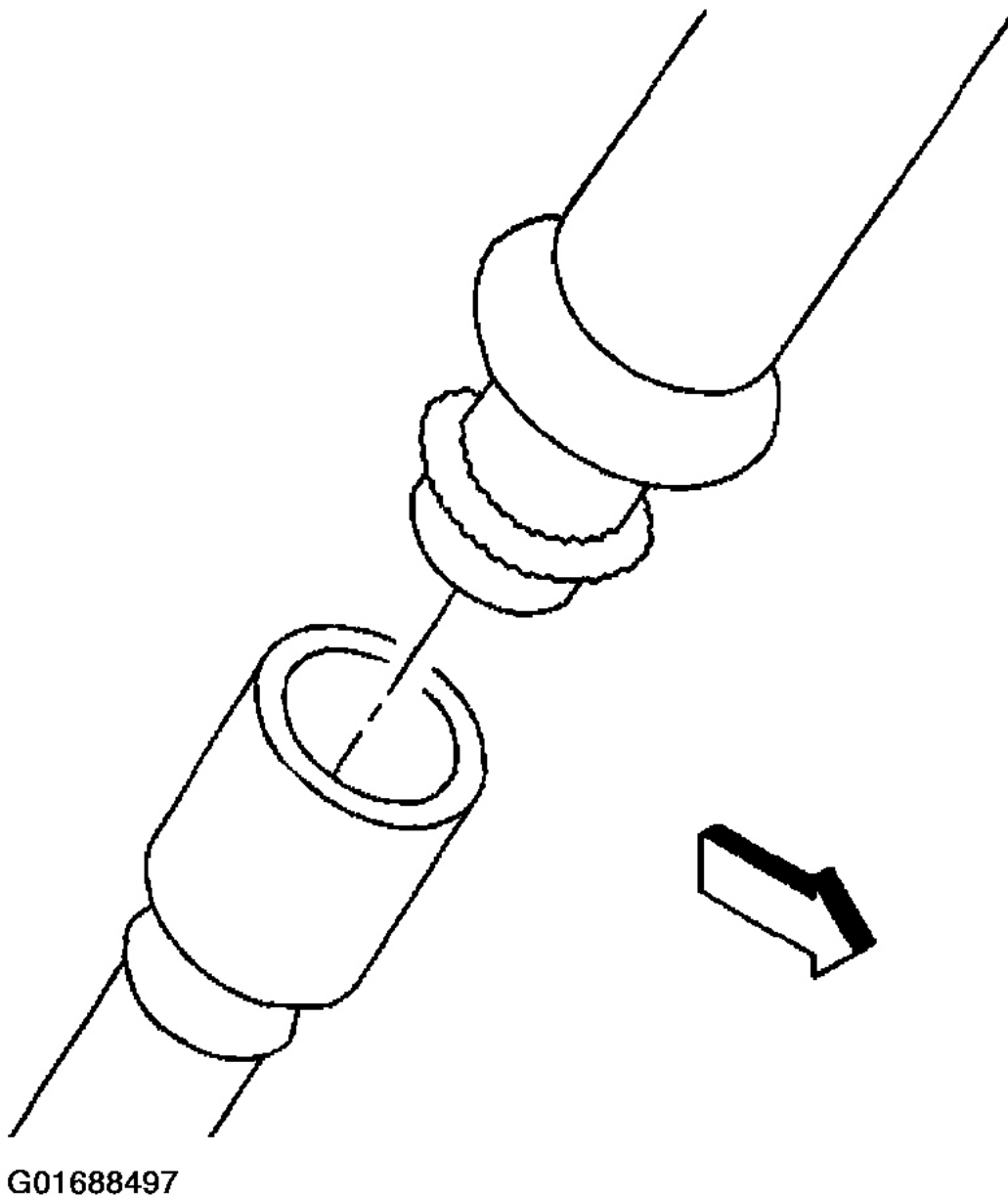
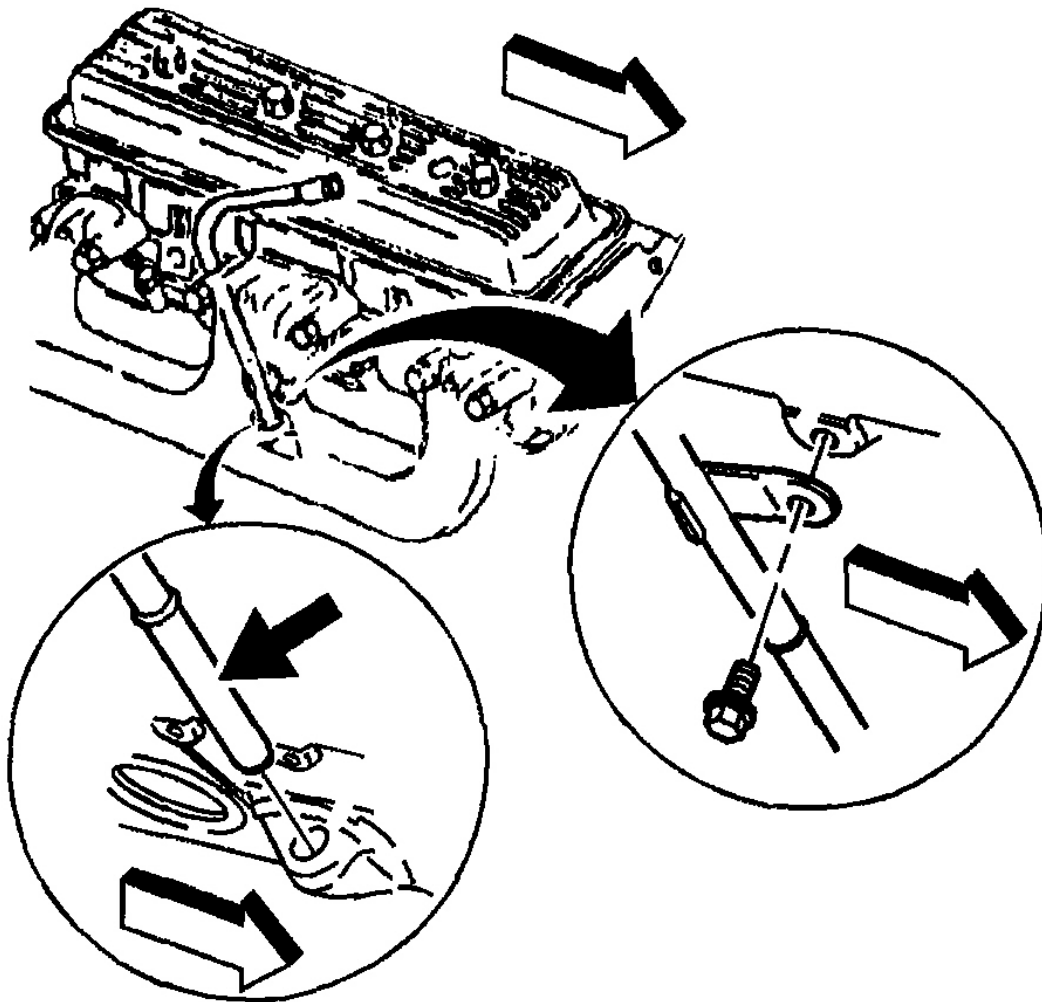


Fig. 124: Removing Top Half Of Oil Level Indicator Tube From Bottom Half
Courtesy of GENERAL MOTORS CORP.

7. Remove the oil level indicator tube bolt.
8. Remove the oil level indicator tube from the engine using a twisting motion.
9. Clean the old sealer from the oil level indicator tube and the engine block.

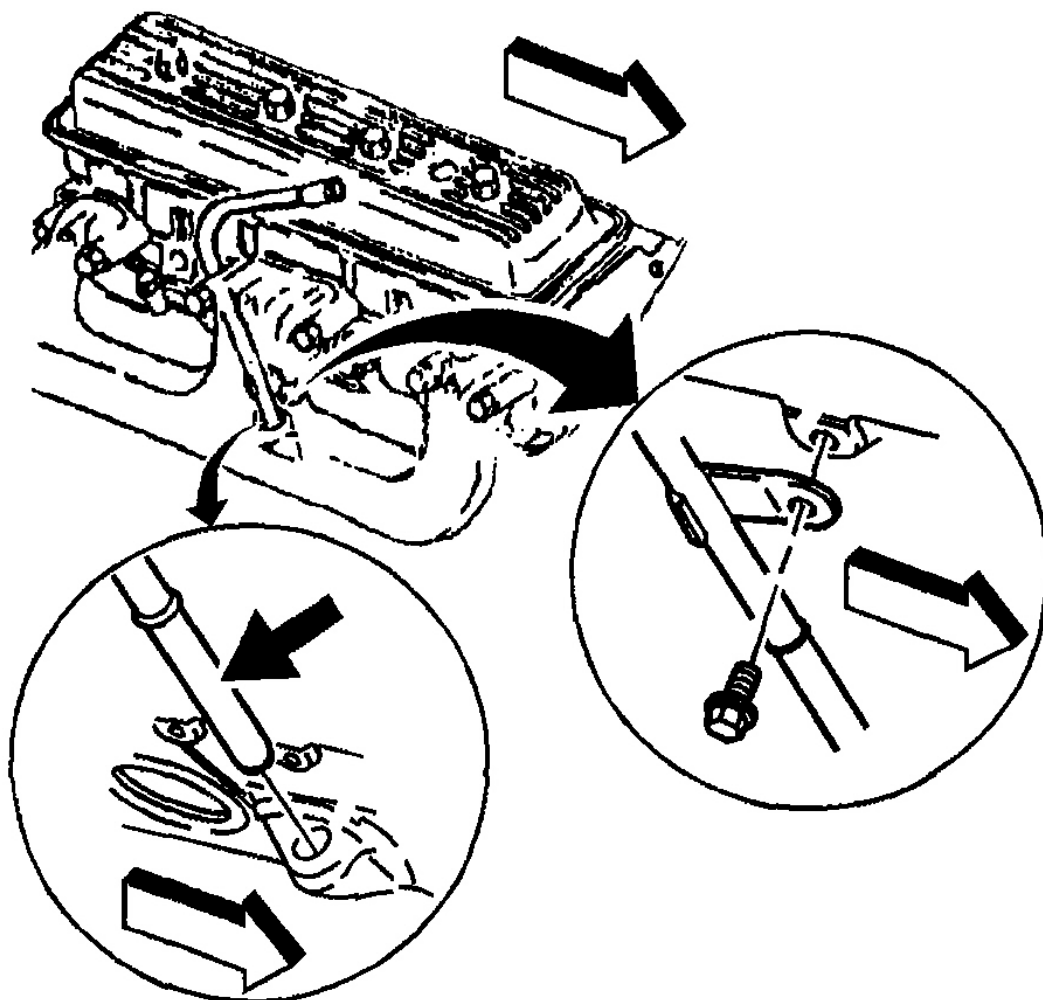


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Fig. 125: Removing Oil Level Indicator Tube & Bolt
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the oil level indicator tube to the engine block.
2. Install the spark plug for the number 4 cylinder.



G01688499

Fig. 126: Installing Oil Level Indicator Tube
Courtesy of GENERAL MOTORS CORP.

3. Apply sealant, GM P/N 12346004 (Canadian P/N 10954380) or equivalent, to the end of the oil level indicator tube top half.
4. Install the oil level indicator tube top half to the bottom half.

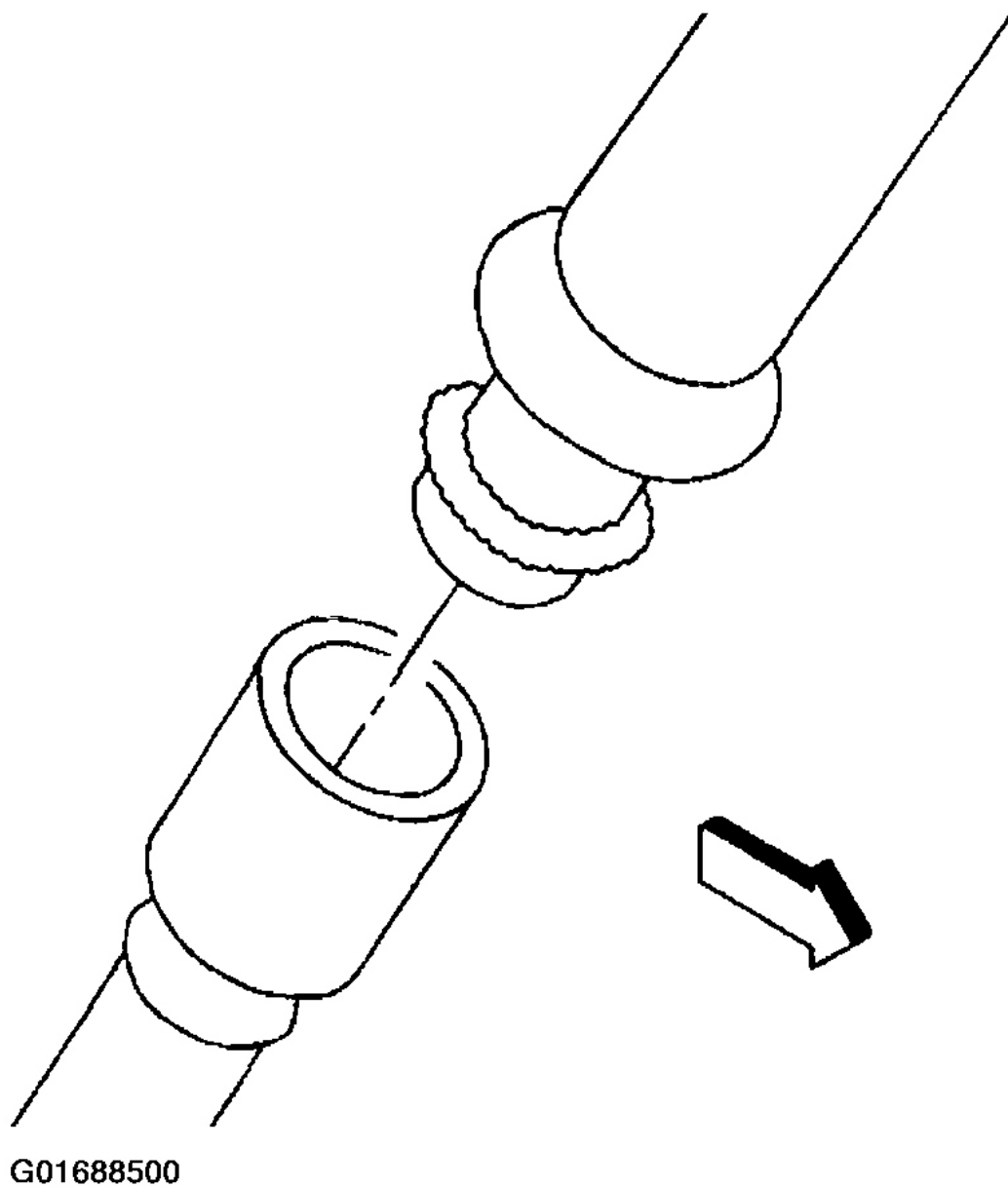


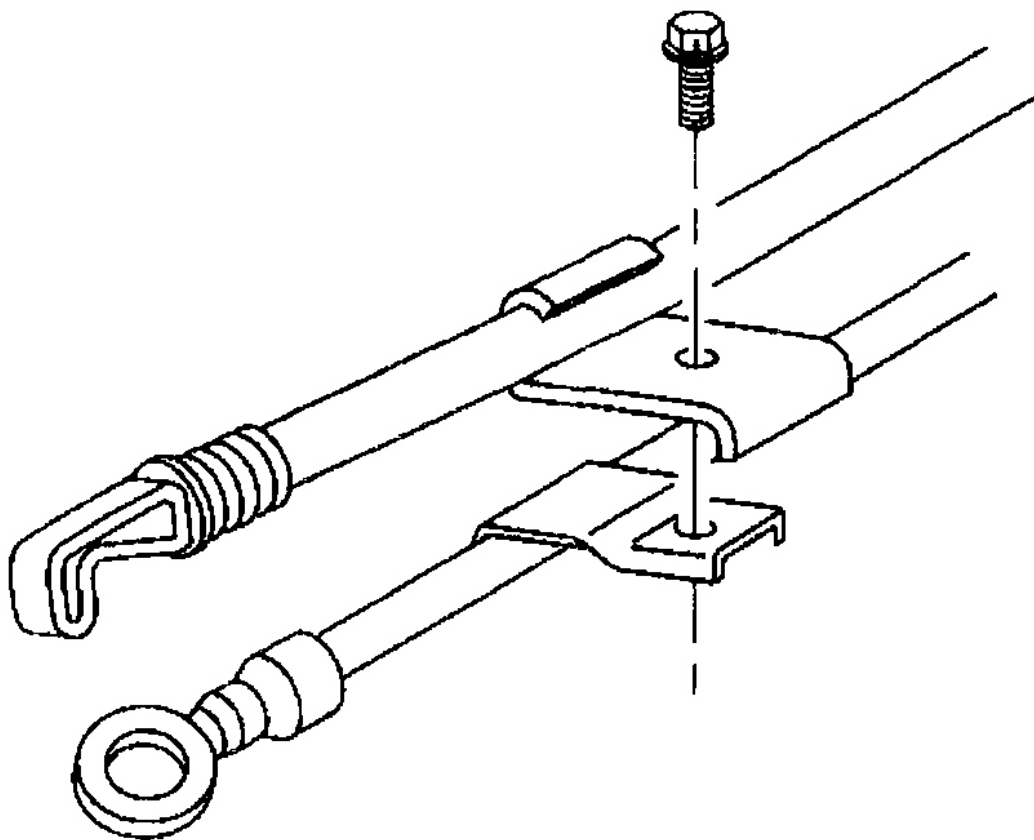
Fig. 127: Installing Oil Level Indicator Tube Half To Bottom Half
Courtesy of GENERAL MOTORS CORP.

5. Secure the engine oil level indicator tube to the transmission oil level indicator tube with the bolt.

Tighten

Tighten the bolt to 13 N.m (106 lb in).

6. Install the engine cover.
7. Install the air cleaner assembly.



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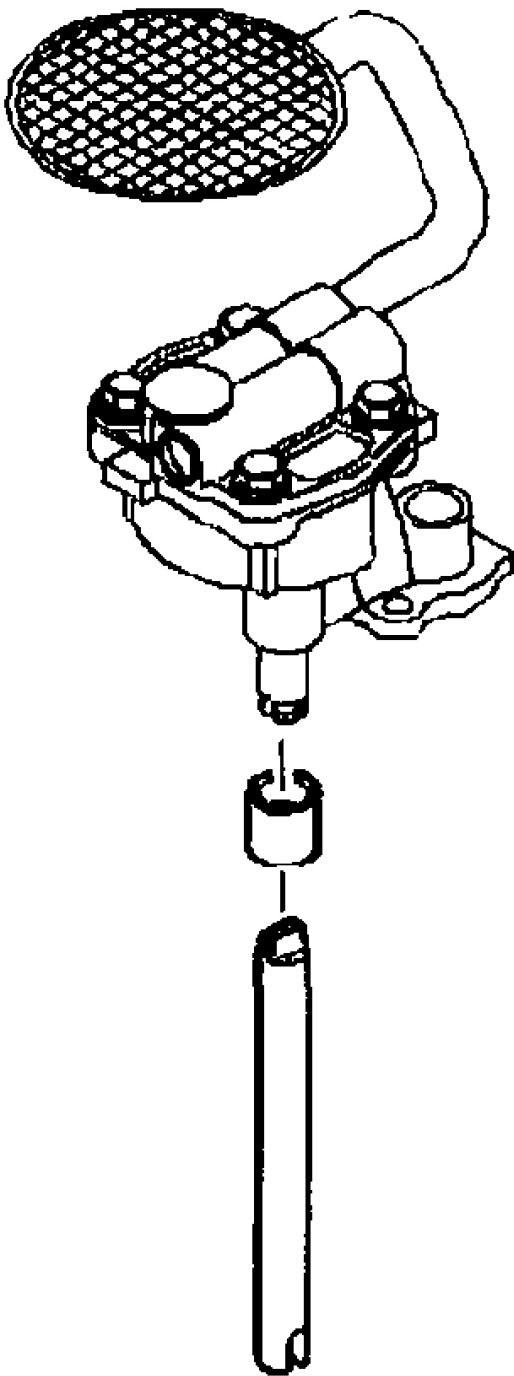
Fig. 128: Installing Oil Level Indicator Tube & Bolt
Courtesy of GENERAL MOTORS CORP.

OIL PUMP, PUMP SCREEN AND DEFLECTOR REPLACEMENT

Removal Procedure

1. Remove the engine oil pan. Refer to **Oil Pan Replacement**.
2. Remove the oil pump. Refer to **Oil Pump, Pump Screen and Deflector Replacement**.
3. A loose oil pump screen or pipe assembly can result in an air leak and loss of oil pressure.

If the tube is loose in the oil pump body, replace the oil pump screen.

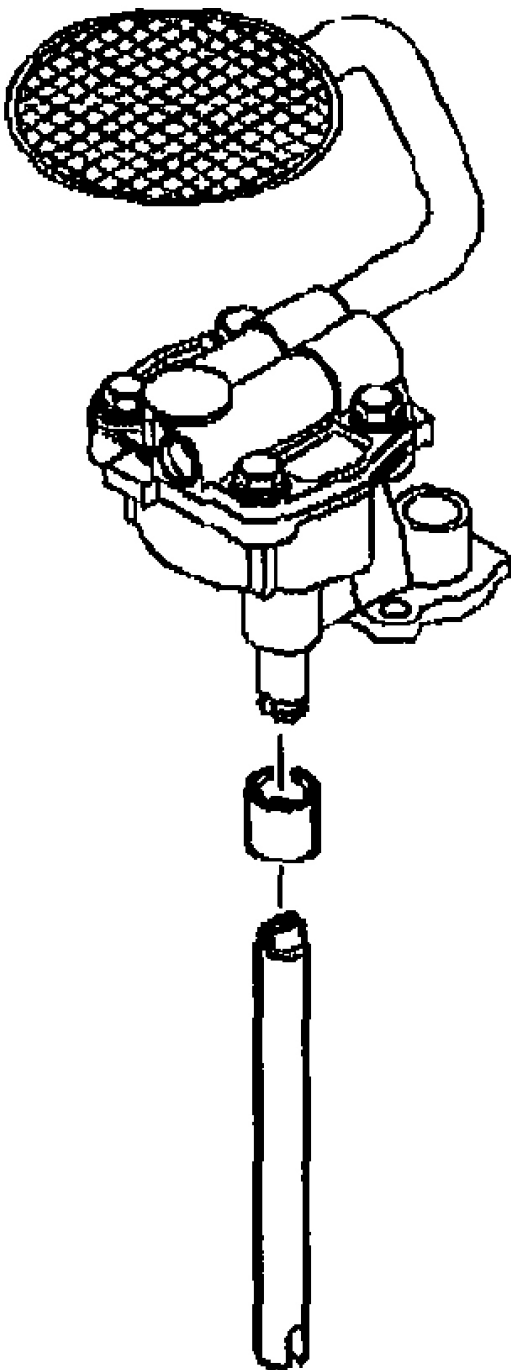


G01688502

Fig. 129: Removing Oil Pump, Pump Screen & Deflector Replacement
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the oil pump and the crankshaft oil deflector. Refer to **Oil Pump, Pump Screen and Deflector Replacement**.
2. Install the engine oil pan. Refer to **Oil Pan Replacement**.



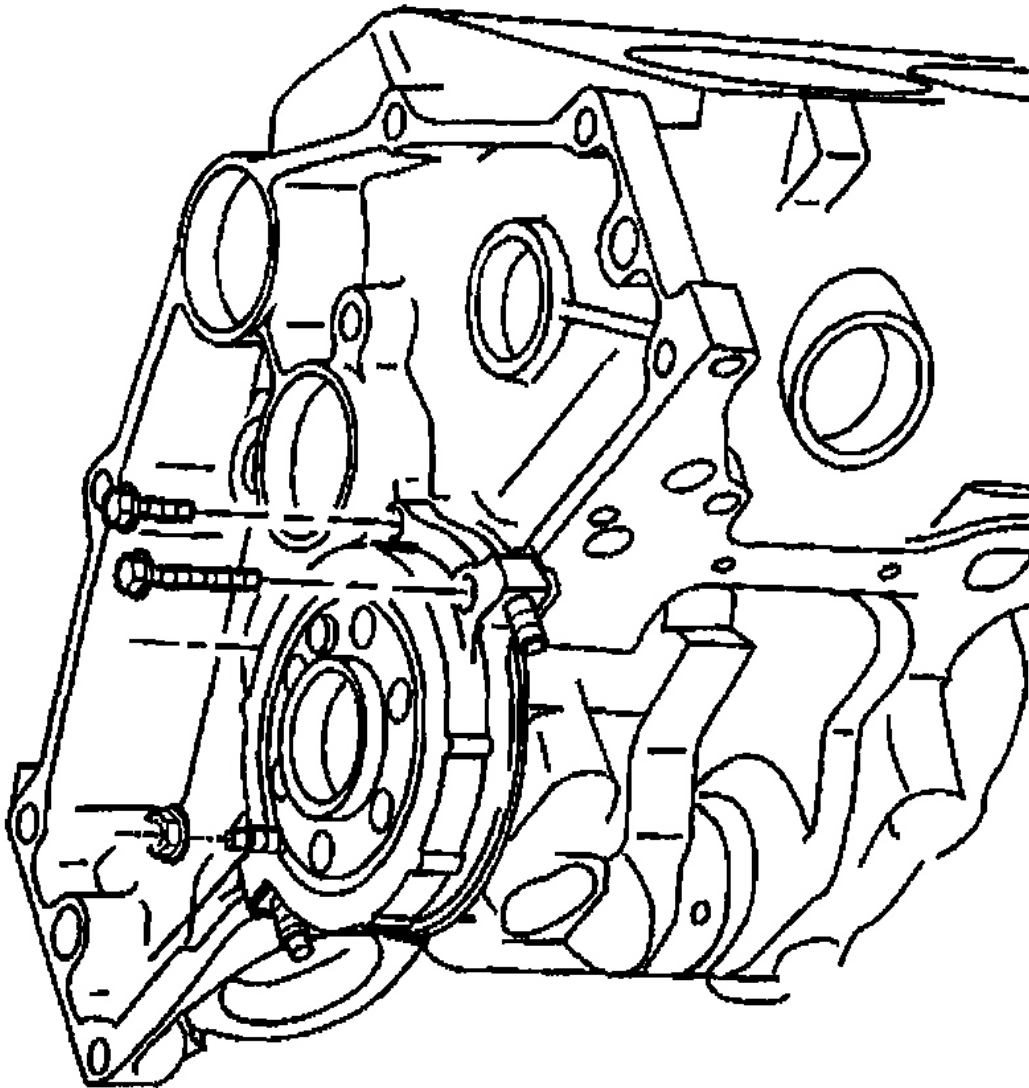
G01688503

Fig. 130: Installing Oil Pump & Crankshaft Oil Deflector
Courtesy of GENERAL MOTORS CORP.

CRANKSHAFT REAR OIL SEAL AND HOUSING REPLACEMENT

Removal Procedure

1. Remove the transmission assembly
2. Remove the flywheel. Refer to **Engine Flywheel Replacement**.
3. Loosen and lower the oil pan. Refer to **Oil Pan Replacement**.
4. Remove the crankshaft rear oil seal housing. Refer to **Crankshaft Rear Oil Seal and Housing Replacement**.

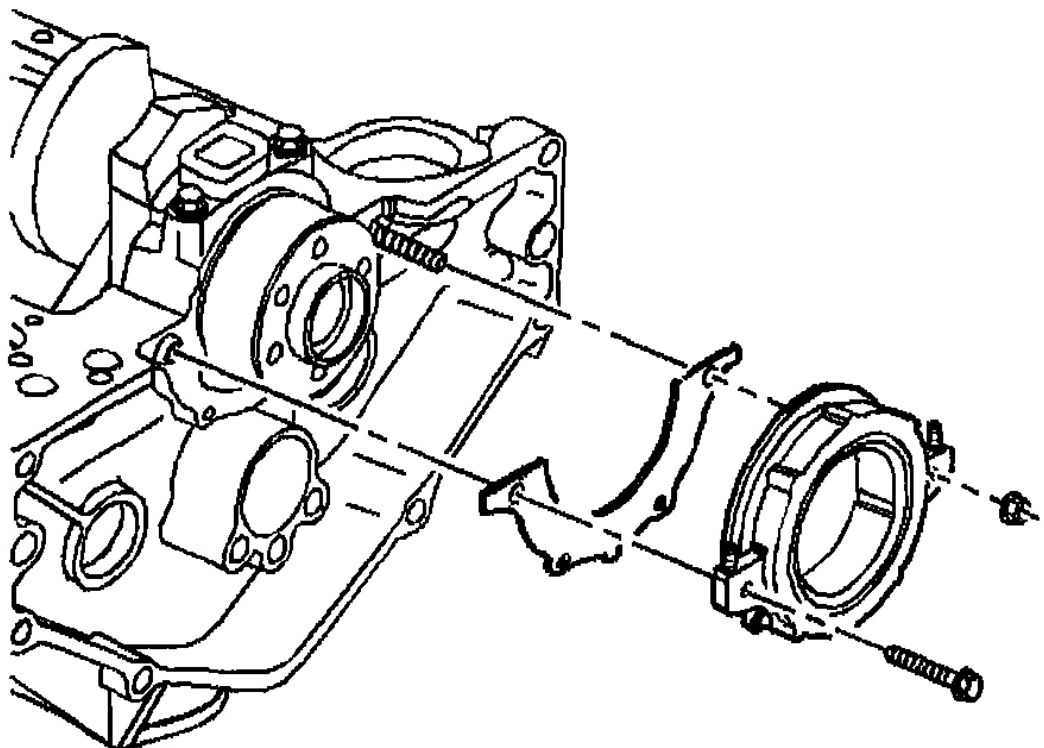


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Fig. 131: Removing Crankshaft Rear Oil Seal & Housing
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the oil seal housing. Refer to **Crankshaft Rear Oil Seal and Housing Replacement**.
2. Install the flywheel. Refer to **Engine Flywheel Replacement**.
3. Install the transmission assembly.



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Fig. 132: Installing Crankshaft Rear Oil Seal & Housing
Courtesy of GENERAL MOTORS CORP.

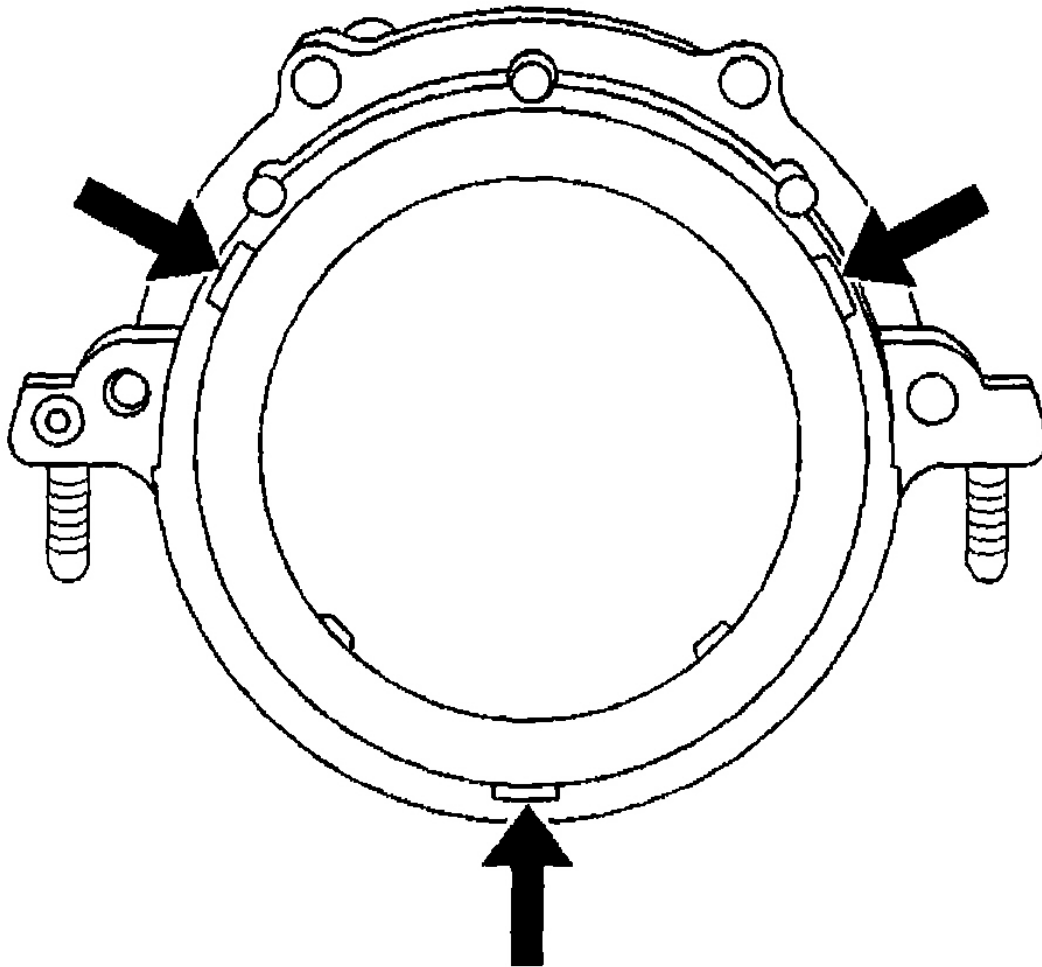
CRANKSHAFT REAR OIL SEAL REPLACEMENT

Tools Required

J 35621-B Crankshaft Rear Oil Seal Installer

Removal Procedure

1. Remove the transmission assembly.
2. Remove the flywheel. Refer to **Engine Flywheel Replacement**.
3. Loosen the oil pan. Refer to **Oil Pan Replacement**.
4. Remove the crankshaft rear oil seal from the crankshaft rear oil seal housing. Refer to **Crankshaft Rear Oil Seal and Housing Replacement**.

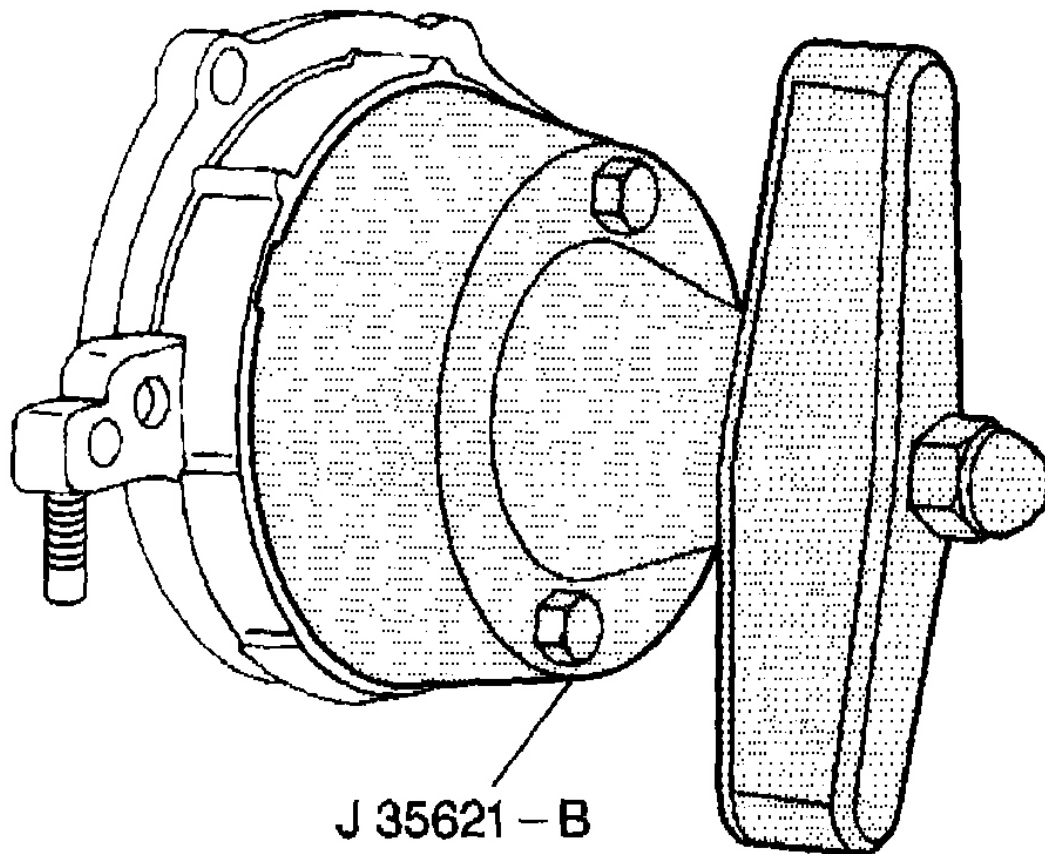


G01688506

Fig. 133: Removing Crankshaft Rear Oil Seal
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the crankshaft rear oil seal using **J 35621-B** . Refer to **Crankshaft Rear Oil Seal and Housing Replacement**.
2. Tighten the oil pan. Refer to **Oil Pan Replacement**.
3. Install the flywheel. Refer to **Engine Flywheel Replacement**.
4. Install the transmission assembly.



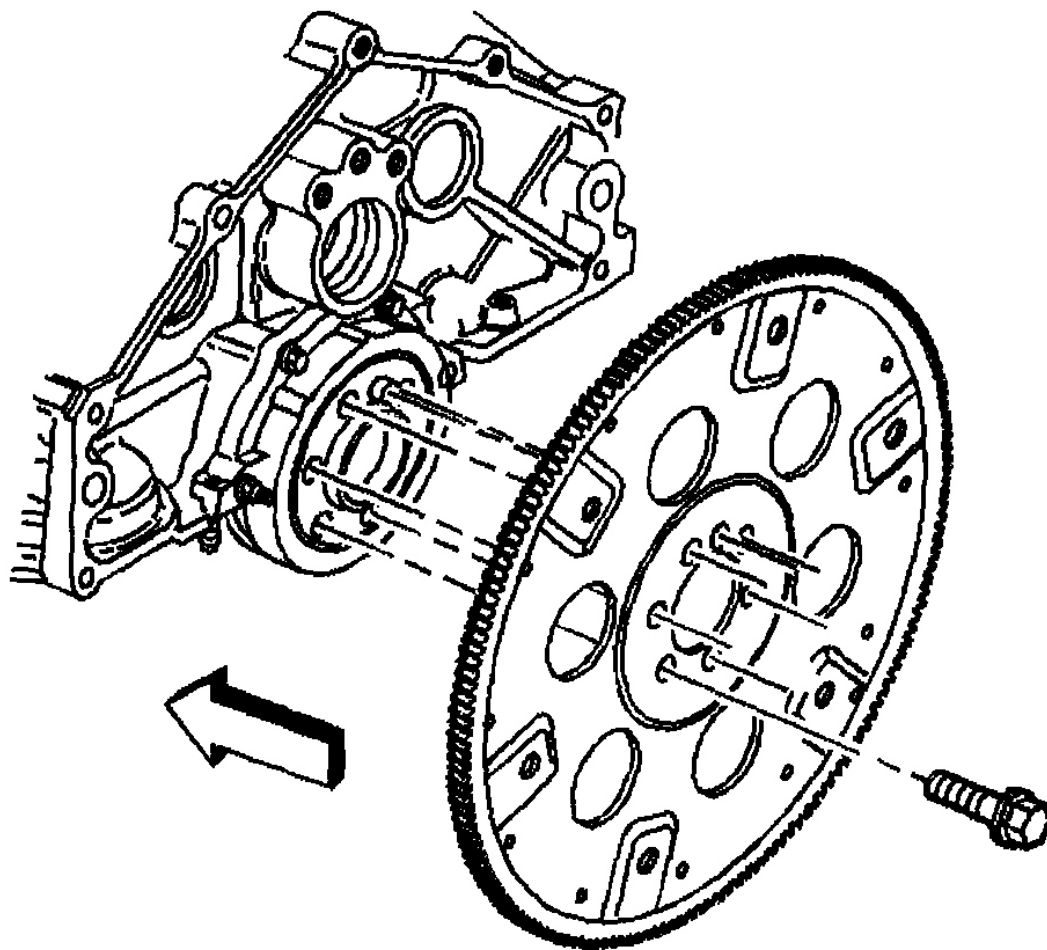
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Fig. 134: Installing Crankshaft Rear Oil Seal Using J 35621-B
Courtesy of GENERAL MOTORS CORP.

ENGINE FLYWHEEL REPLACEMENT

Removal Procedure

1. Remove the transmission.
2. Remove the engine flywheel.
3. Clean and inspect all parts. Refer to **Engine Flywheel Replacement**.

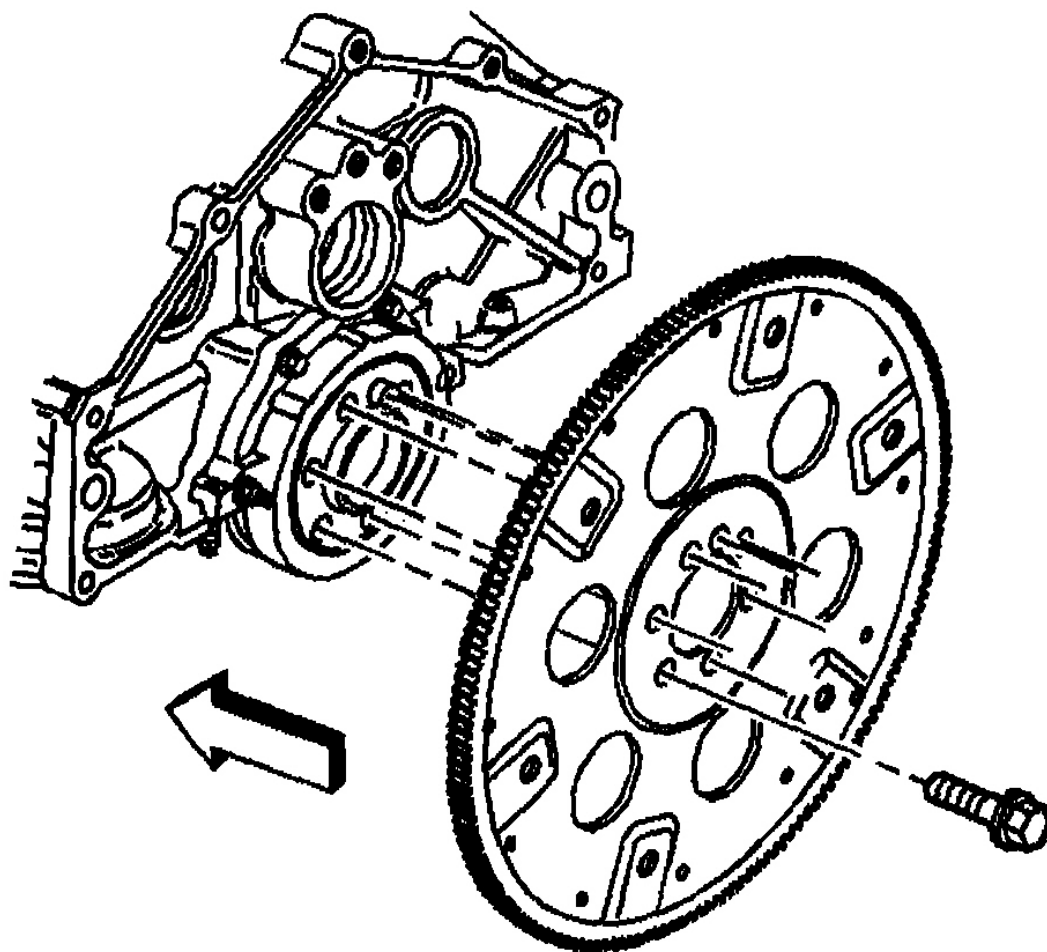


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Fig. 135: Removing Engine Flywheel
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the engine flywheel.
2. Install the transmission.



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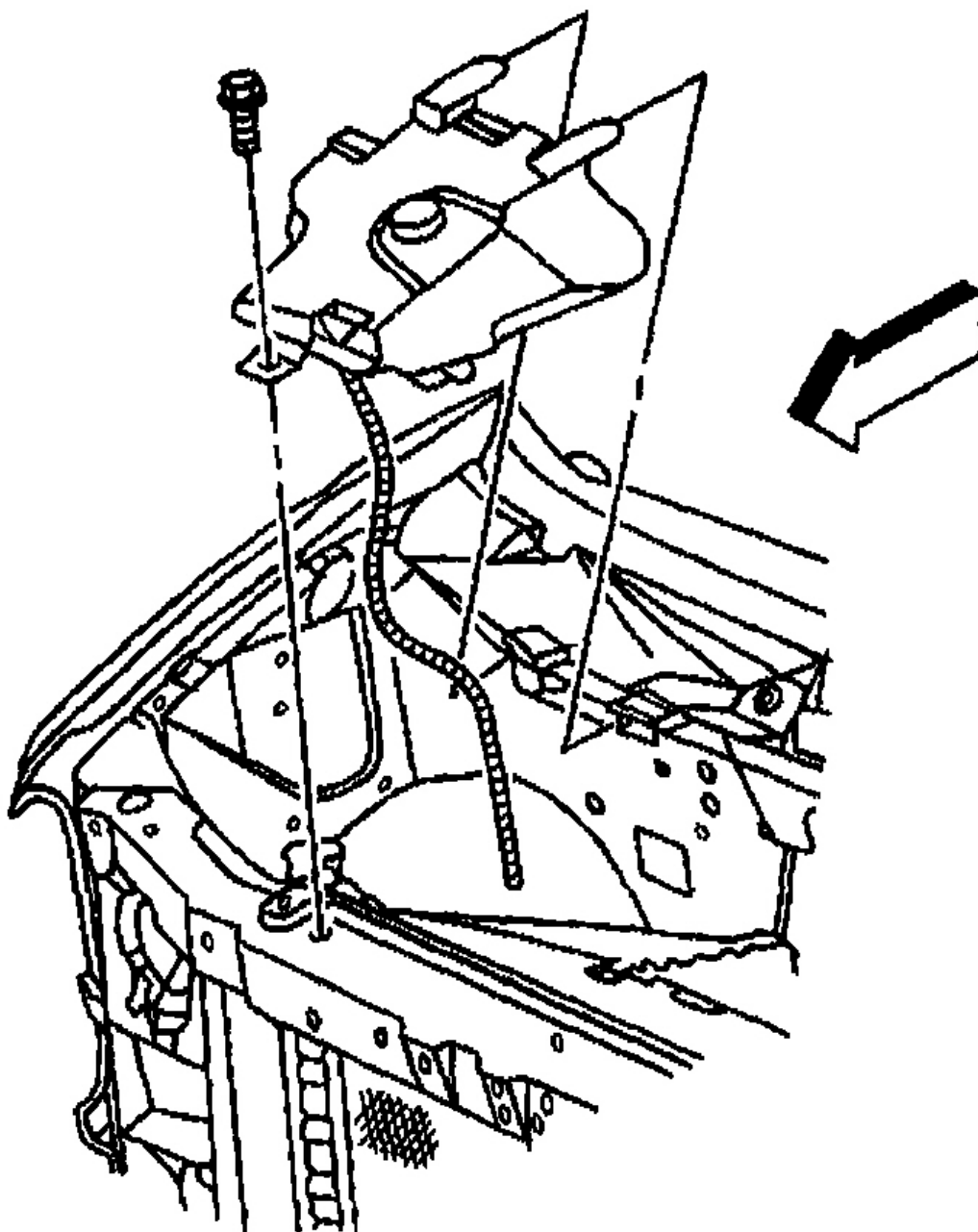
Fig. 136: Installing Engine Flywheel
Courtesy of GENERAL MOTORS CORP.

ENGINE REPLACEMENT

Removal Procedure

1. Remove the engine cover.
2. Remove the coolant recovery reservoir.
3. Disconnect the battery negative cable from the battery.
4. Remove the engine cover.
5. Remove the air cleaner assembly.
6. Remove the front bumper.

7. Remove the radiator grille assembly.
8. Remove the radiator support.



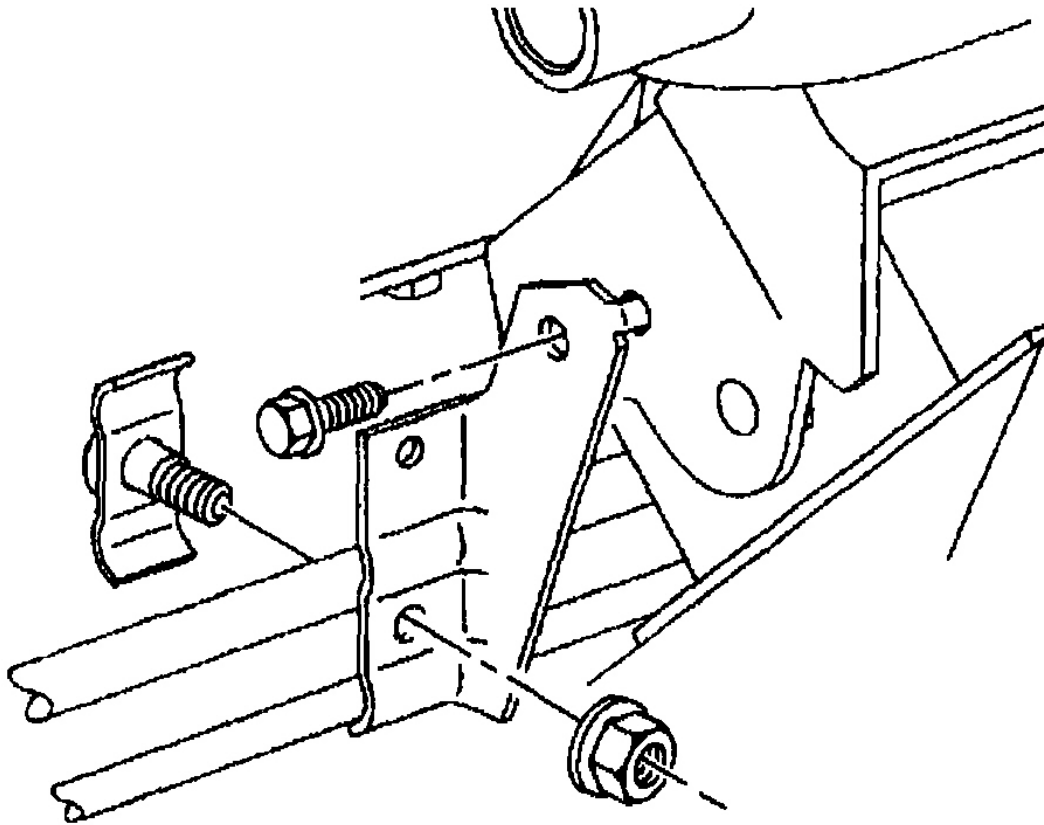
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Fig. 137: Removing Radiator Support
Courtesy of GENERAL MOTORS CORP.

9. Remove the A/C condenser.
10. Remove the radiator.
11. Remove the ground straps.
12. Remove the fan clutch from the water pump.
13. Remove the heater hoses from the engine.

CAUTION: In order to avoid possible injury or vehicle damage, always replace the accelerator control cable with a **NEW** cable whenever you remove the engine from the vehicle.
In order to avoid cruise control cable damage, position the cable out of the way while you remove or install the engine. Do not pry or lean against the cruise control cable and do not kink the cable. You must replace a damaged cable.

14. Remove the accelerator control cable and the cruise control cable, if equipped.
15. Remove the generator from the generator and drive belt tensioner bracket.

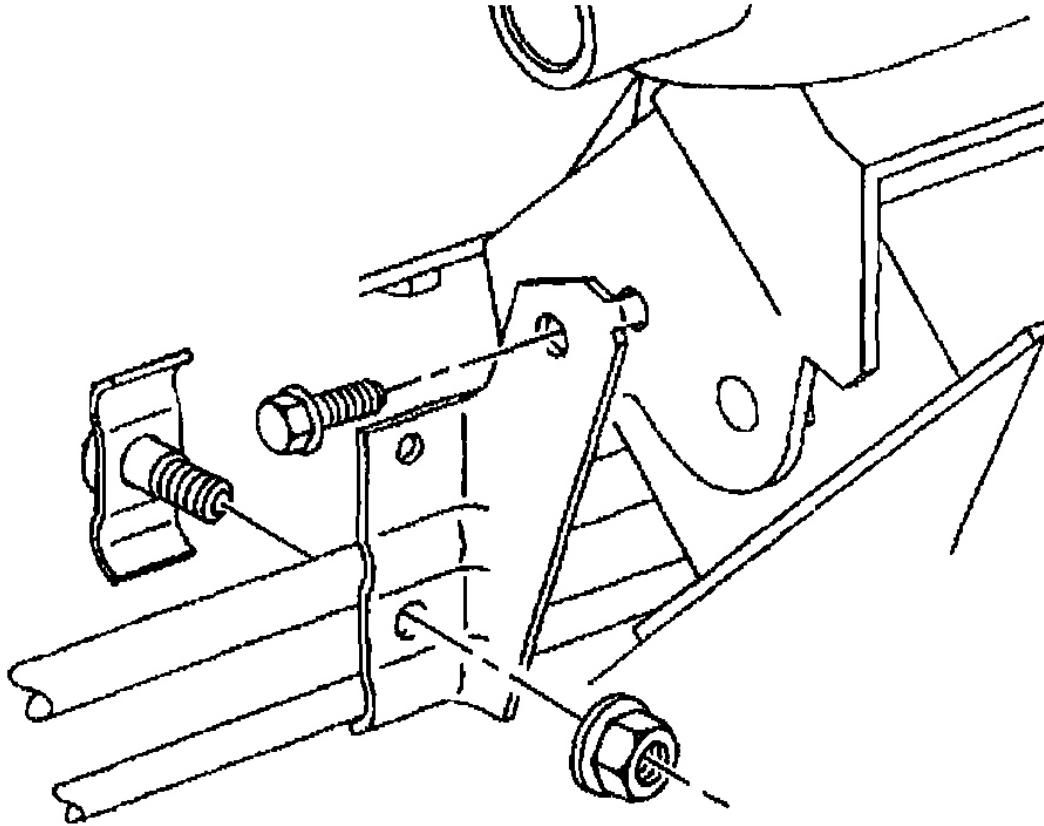


G01688511

Fig. 138: Removing Engine Oil Cooler Lines & Bracket
Courtesy of GENERAL MOTORS CORP.

16. Remove the generator and drive belt brackets.
17. Remove the A/C compressor from the mounting bracket.
18. Remove the power steering pump from the power steering pump bracket.
19. Remove the power steering pump mounting bracket.
20. In order to allow access for the lifting device, remove the upper intake manifold. Refer to **Intake Manifold Replacement - Upper**.
21. Remove the transmission oil level indicator and tube.
22. Remove the engine oil fill tube.
23. Remove the transmission shift cable connector.
24. Raise the vehicle and support with safety stands.
25. Drain the engine oil. Refer to **Engine Oil and Oil Filter Replacement**.
26. Remove the exhaust pipes from the exhaust manifolds.
27. Remove the engine oil cooler lines from the retaining brackets.

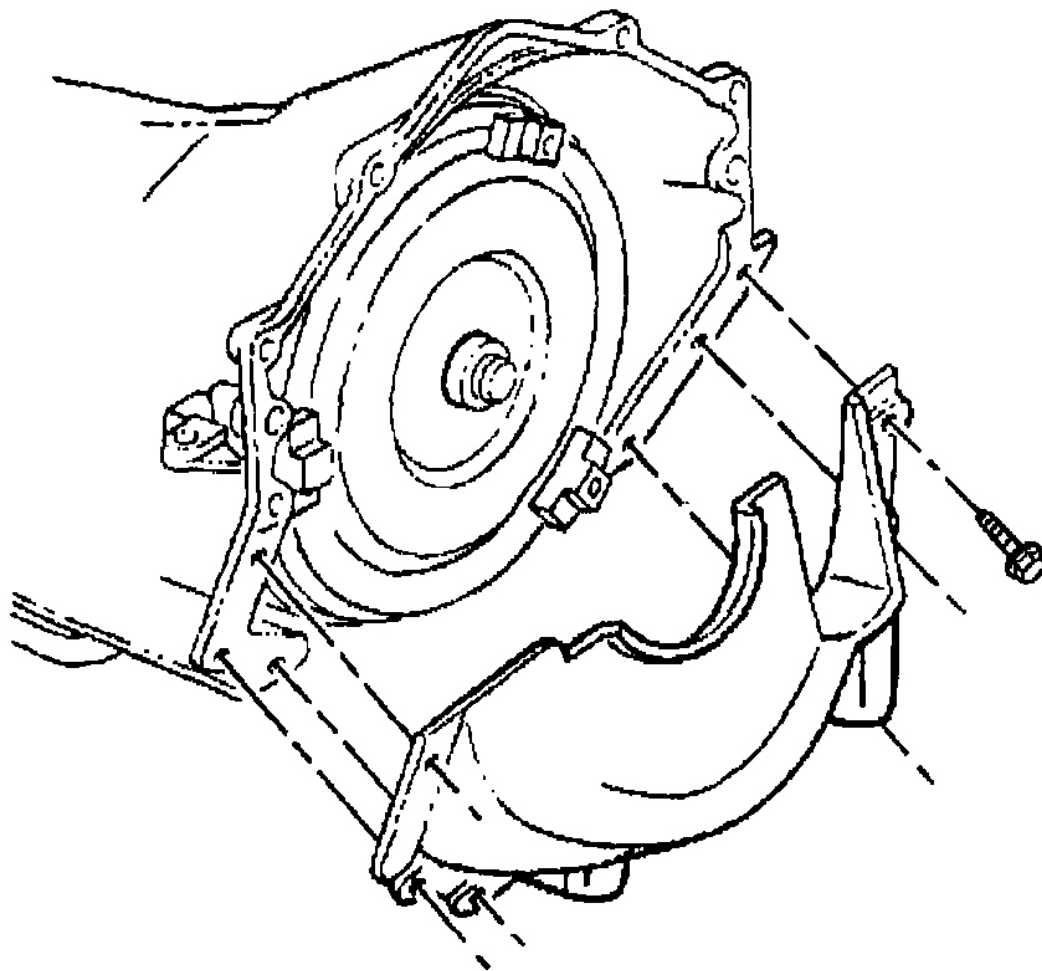
28. Remove the engine oil cooler lines from the engine.



G01688512

Fig. 139: Removing Engine Oil Cooler Lines & Bracket
Courtesy of GENERAL MOTORS CORP.

29. Remove the flywheel cover.
30. Remove the starter motor.
31. Remove the torque converter bolts from the engine flywheel.
32. Remove the engine oil cooler lines from the engine.
33. Remove the bolts holding the transmission to the engine.
34. Remove the safety stands and lower the vehicle.



G01688513

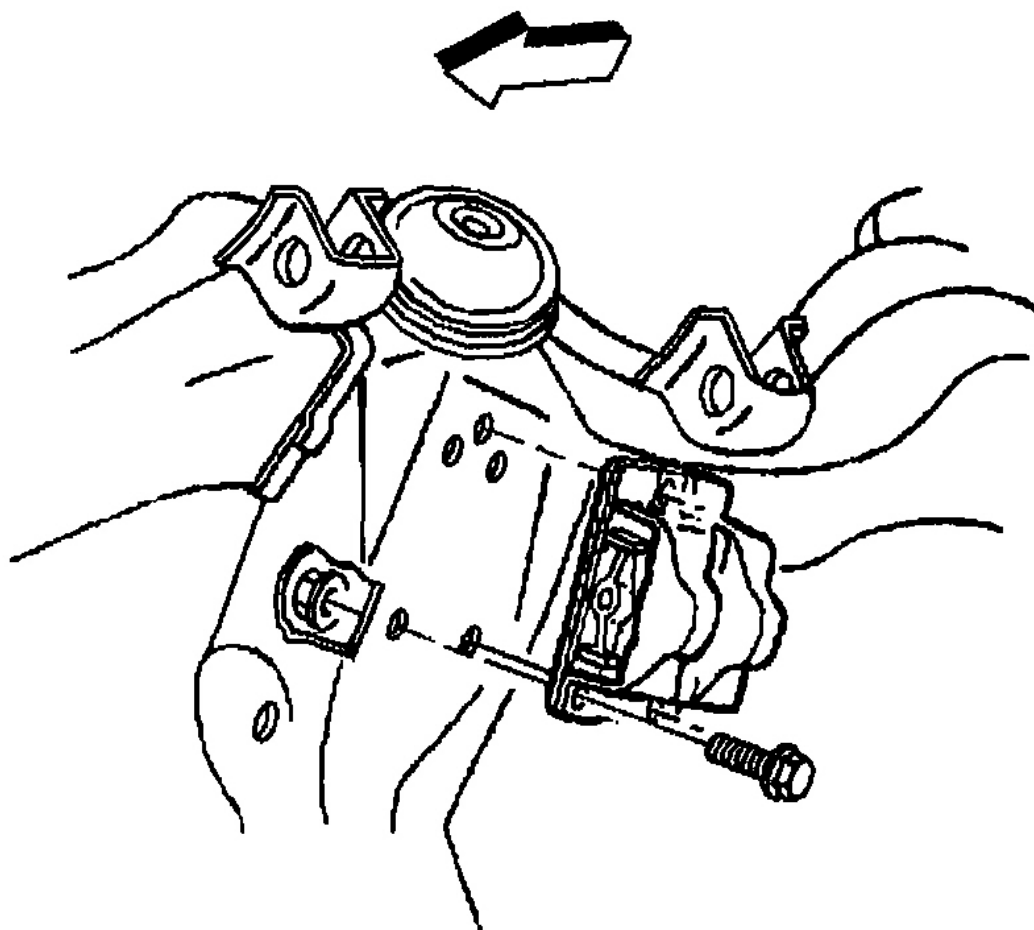
Fig. 140: Removing Flywheel Cover & Torque Converter Bolts
Courtesy of GENERAL MOTORS CORP.

35. Install a length of chain, using GM P/N 23503910 attaching bolt to the rear of the left cylinder head.
36. Support the transmission using a suitable lifting device.
37. Attach a suitable lifting device to the chain.
38. Remove the engine mounts from the frame. Refer to **Engine Mount Replacement - Left** or to **Engine Mount Replacement - Right**.
39. Remove the engine assembly from the vehicle.

Installation Procedure

1. Install the engine assembly to the vehicle.

2. Install the engine mounts to the frame. Refer to [Engine Mount Replacement - Left](#) or to [Engine Mount Replacement - Right](#).
3. Install the engine mount through bolts. Refer to [Engine Mount Replacement - Left](#) or to [Engine Mount Replacement - Right](#).
4. Remove the lifting device from the chain.
5. Support the transmission with a strap between the frame rails.
6. Raise the vehicle and support with safety stands.



G01688514

Fig. 141: Installing Engine Assembly
Courtesy of GENERAL MOTORS CORP.

7. Install the bolts from the transmission to the engine.
8. Install the transmission cooler lines to the engine block.

9. Install the torque converter bolts to the engine flywheel.

Tighten

Tighten the bolts to 62 N.m (46 lb ft).

10. Install the starter motor.
11. Install the engine oil cooler lines to the retaining brackets.
12. Install the exhaust pipes to the exhaust manifolds.
13. Remove the safety stands and lower the vehicle.
14. Install the transmission shift cable connector.
15. Install the transmission oil level indicator and the tube.
16. Install the fuel pipes to the rear of the engine.
17. Install the upper intake manifold to the engine. Refer to **Intake Manifold Replacement - Upper**.
18. Install the A/C compressor to the accessory mounting bracket.
19. Install the generator and drive belt tensioner bracket.
20. Install the generator to the generator and drive belt tensioner bracket.

CAUTION: In order to avoid possible injury or vehicle damage, always replace the accelerator control cable with a NEW cable whenever you remove the engine from the vehicle.
In order to avoid cruise control cable damage, position the cable out of the way while you remove or install the engine. Do not pry or lean against the cruise control cable and do not kink the cable. You must replace a damaged cable.

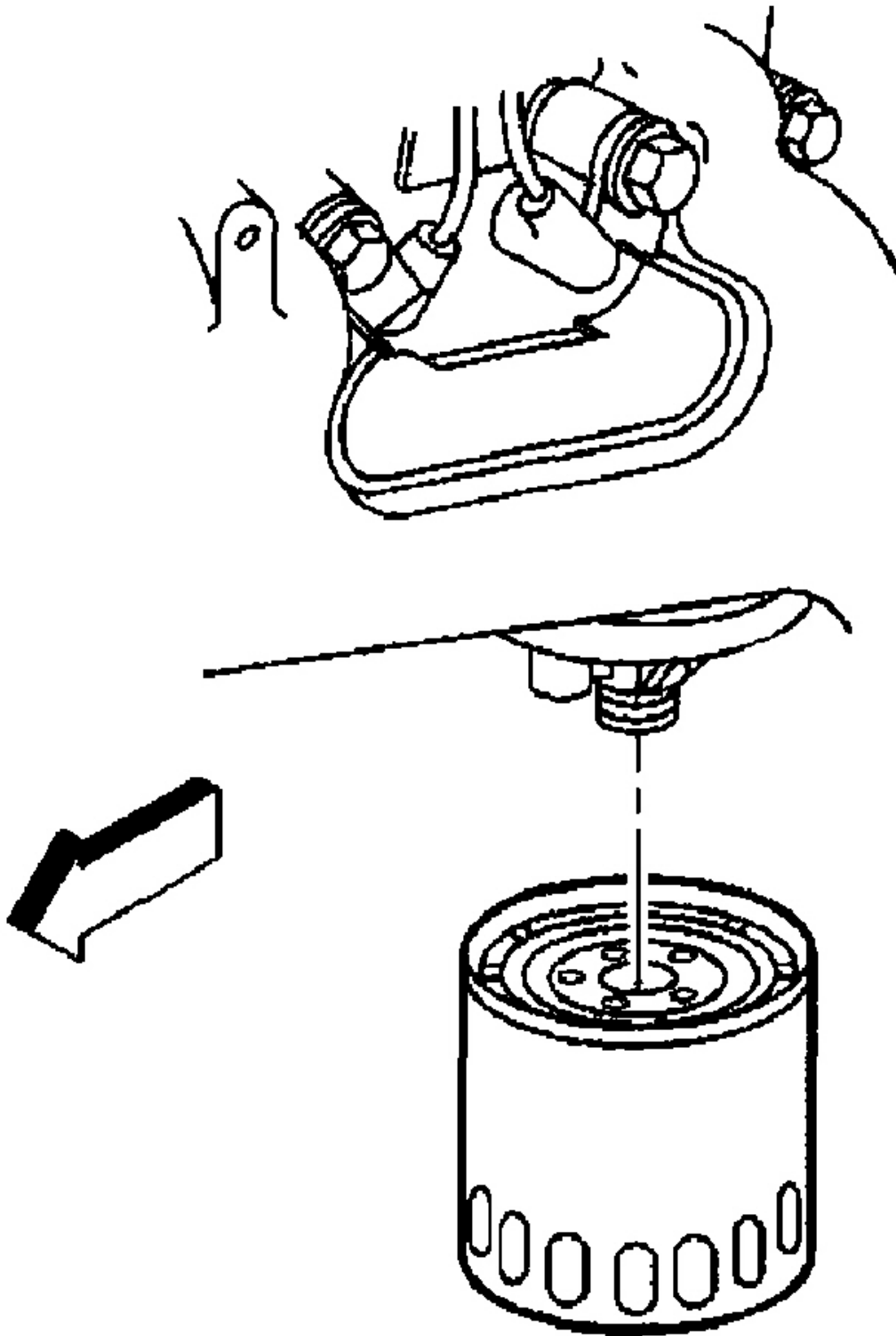
21. Install the NEW accelerator control cable and the cruise control cable, if equipped.
22. Install the heater hoses to the engine block.
23. Install the fan clutch to the water pump.
24. Install the ground straps.
25. Install the radiator.
26. Install the A/C condenser.
27. Install the radiator support.
28. Install the radiator grille assembly.
29. Install the front bumper.
30. Install the air cleaner assembly.
31. Install the coolant recovery reservoir.
32. Install the engine cover.
33. Connect the battery negative cable to the battery.
34. Fill the engine with the proper quantity and grade of engine oil. Refer to **Engine Oil and Oil Filter Replacement**.

35. Fill the cooling system with the proper quantity and type of coolant.
36. The final step is to perform the CKP System Variation Learn procedure.

ENGINE OIL AND OIL FILTER REPLACEMENT

Removal Procedure

1. Raise the vehicle.
2. Remove the oil filter from the engine block. Clean the sealing surface.



G01688515

Fig. 142: Removing Oil Filter From Engine Block
Courtesy of GENERAL MOTORS CORP.

3. Remove the oil pan drain plug and drain the engine oil into a suitable container.

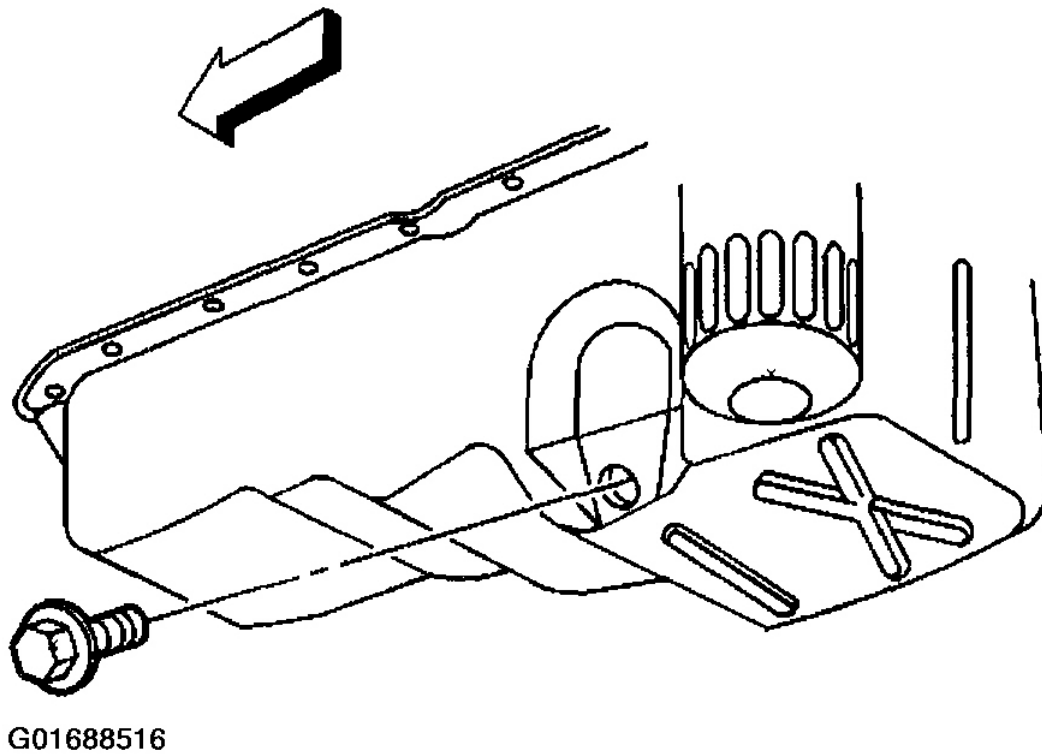
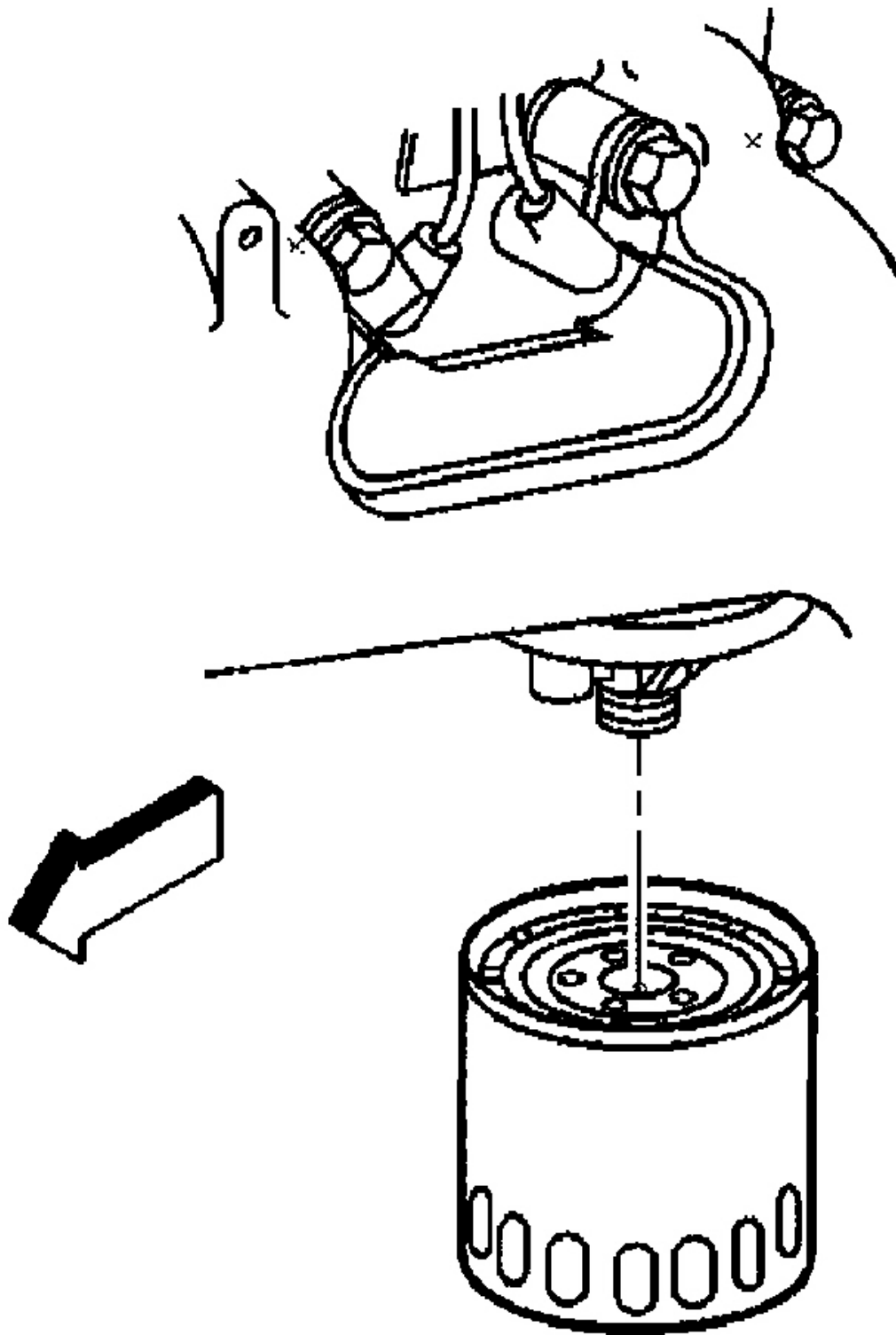


Fig. 143: Removing Oil Pan Drain Plug
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the oil filter to the engine block. Tighten the oil filter to the oil filter manufacturer's specifications listed on the oil filter box.



G01688517

Fig. 144: Installing Oil Filter To Engine Block
Courtesy of GENERAL MOTORS CORP.

2. Install the drain plug to the oil pan.

Tighten

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

3. Lower the vehicle.
4. Fill the crankcase with oil.

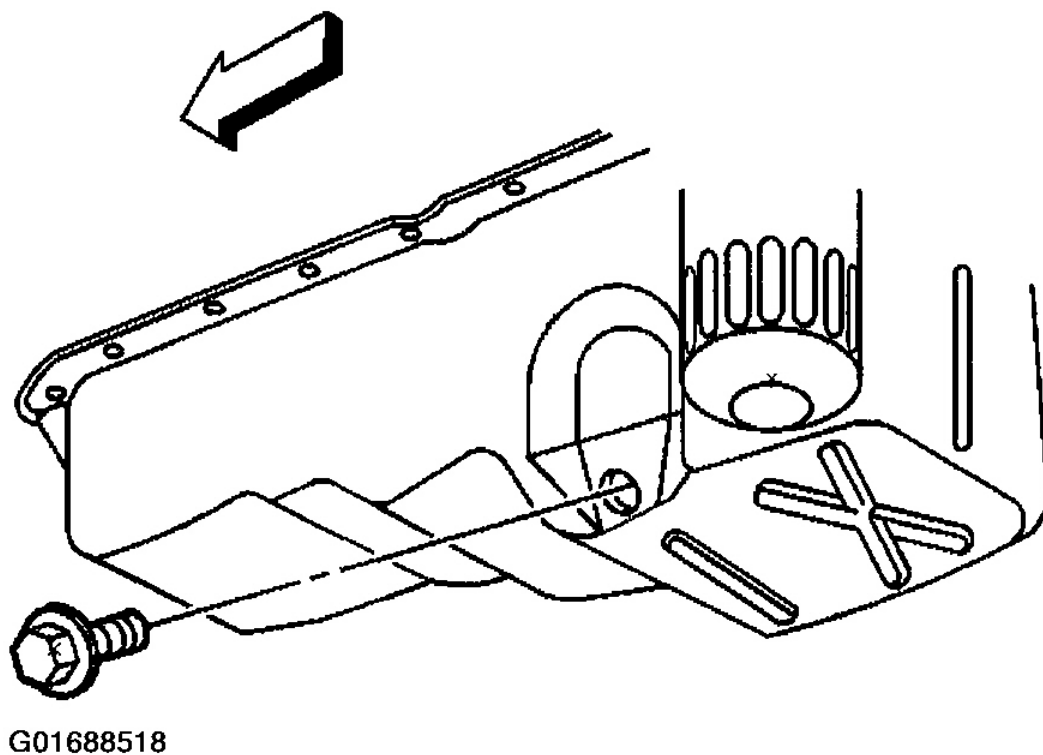


Fig. 145: Installing Drain Plug To Oil Pan
Courtesy of GENERAL MOTORS CORP.

DESCRIPTION AND OPERATION

DRIVE BELT SYSTEM DESCRIPTION

The drive belt system consists of the following components:

- The drive belt
- The drive belt tensioner
- The drive belt idler pulley
- The crankshaft balancer pulley
- The accessory drive component mounting brackets
- The accessory drive components
 - The power steering pump, if belt driven
 - The generator
 - The A/C compressor, if equipped
 - The engine cooling fan, if belt driven
 - The water pump, if belt driven
 - The vacuum pump, if equipped
 - The air compressor, if equipped

The drive belt system may use one belt or two belts. The drive belt is thin so that it can bend backwards and has several ribs to match the grooves in the pulleys. There also may be a V-belt style belt used to drive certain accessory drive components. The drive belts are made of different types of rubbers (chloroprene or EPDM) and have different layers or plys containing either fiber cloth or cords for reinforcement.

Both sides of the drive belt may be used to drive the different accessory drive components. When the back side of the drive belt is used to drive a pulley, the pulley is smooth.

The drive belt is pulled by the crankshaft balancer pulley across the accessory drive component pulleys. The spring loaded drive belt tensioner keeps constant tension on the drive belt to prevent the drive belt from slipping. The drive belt tensioner arm will move when loads are applied to the drive belt by the accessory drive components and the crankshaft.

The drive belt system may have an idler pulley, which is used to add wrap to the adjacent pulleys. Some systems use an idler pulley in place of an accessory drive component when the vehicle is not equipped with the accessory.

TOOLS AND EQUIPMENT

Special tools are listed and illustrated throughout this section with a complete listing at the end of the section. The tools, or the equivalents, are specially designed to quickly and safely accomplish the operations for which the tools are intended. The use of special tools will also minimize possible damage to engine components. Some precision measuring tools are required for inspection of certain critical components. Torque wrenches and a torque angle meter are necessary for the proper tightening of various fasteners.

To properly service the engine assembly, the following items should be readily available:

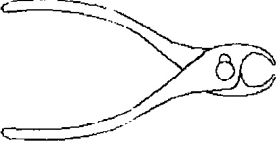
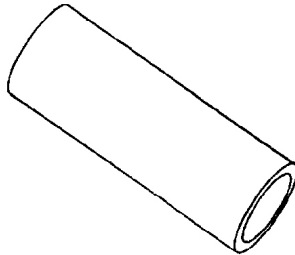
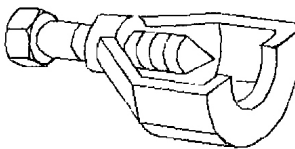
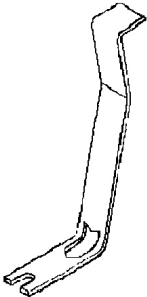
- Approved eye protection and safety gloves
- A clean, well-lit, work area
- A suitable parts cleaning tank

- A compressed air supply
- Trays or storage containers to keep parts and fasteners organized
- An adequate set of hand tools
- Approved engine repair stand
- An approved engine lifting device that will adequately support the weight of the components

SPECIAL TOOLS AND EQUIPMENT

2000 Chevrolet Cab & Chassis C2500

2000-01 ENGINE Engine Mechanical - 5.0L & 5.7L

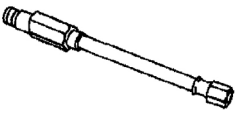
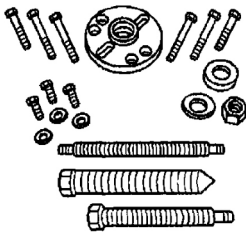
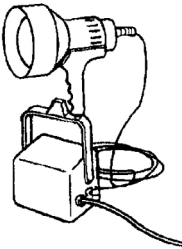
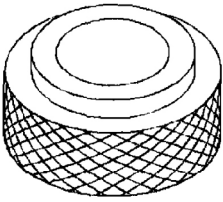
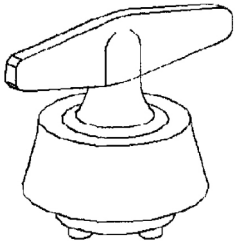
Illustration	Tool Number/ Description
	J 3049-A Valve Lifter Remover
	J 5590 Pinion Bearing Rear Installer
	J 5825-A Crankshaft Gear Remover
	J 5892-D Valve Spring Compressor

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Fig. 146: Special Tools J 3049-A - J 5892-D
Courtesy of GENERAL MOTORS CORP.

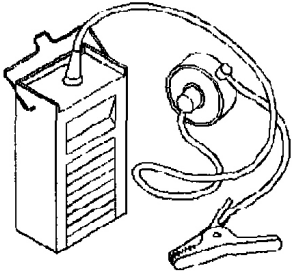
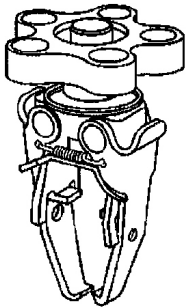
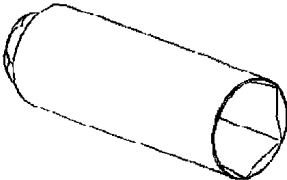
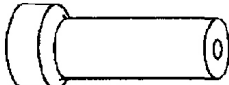
2000 Chevrolet Cab & Chassis C2500

2000-01 ENGINE Engine Mechanical - 5.0L & 5.7L

Illustration	Tool Number/ Description
	J 22794 Spark Plug Port Adapter
	J 23523-F Balancer Remover and Installer
	J 28428-E High Intensity Black Light Kit
	J 35468 Cover Aligner/Seal Installer
	J 35621-B Rear Main Seal Installer

G01688520

Fig. 147: Special Tools J 22794 - J 35621-B
Courtesy of GENERAL MOTORS CORP.

Illustration	Tool Number/ Description
	J 36660-A Electronic Torque Angle Meter
	J 38606 Valve Spring Compressor
	J 41712 Oil Pressure Switch Socket
	J 42073 Valve Stem Seal Installer

G01688521

Fig. 148: Special Tools J 36660-A - J 42073
Courtesy of GENERAL MOTORS CORP.

TORQUE SPECIFICATIONS

2000 Chevrolet Cab & Chassis C2500

2000-01 ENGINE Engine Mechanical - 5.0L & 5.7L

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Belt Idler Pulley Bolt	37 (50)
Camshaft Sprocket Bolt	18 (25)
Connecting Rod Nut	20 (27)
First Tightening Pass	
Final Tightening Pass	
Crankshaft Balancer Bolt	70 (95)
Crankshaft Bearing Cap Bolt & Stud	77 (105)
Optional Strategy	
Two Bolt Type Bearing Cap	
Inboard Bolt & Stud (Four Bolt Type Bearing Cap)	
Outboard Bolt (Four Bolt Type Bearing Cap)	
Preferred Method	20 (27)
First Tightening Pass	
Final Tightening Pass	
First Tightening Pass (Two Bolt Type Bearing Cap)	
Final Tightening Pass (Two Bolt Type Bearing Cap)	
First Tightening Pass (Four Bolt Type Bearing Cap)	
Final Tightening Pass Outboard Bolt (Four Bolt Type Bearing Cap)	
Final Tightening Pass Inboard Bolt & Stud (Four Bolt Type Bearing Cap)	
Crankshaft Oil Deflector Nut	30 (40)
Crankshaft Pulley Bolt	43 (58)
Cylinder Head Bolt ⁽¹⁾	26 (35)
Optional Strategy (On-Vehicle)	
First Tightening Pass	
Second Tightening Pass	
Final Tightening Pass	
Preferred Method	
All Bolts First Pass	
Long Bolt Final Pass	Additional 75°
Medium Bolt Final Pass	Additional 65°
Short Bolt Final Pass	Additional 55°
Cylinder Head Core Hole Plug	15 (20)
Distributor Clamp Bolt	18 (25)
Drive Belt Tensioner Bolt	37 (50)
EGR Valve Bolt	89 (10)
First Tightening Pass	
Final Tightening Pass	

2000 Chevrolet Cab & Chassis C2500

2000-01 ENGINE Engine Mechanical - 5.0L & 5.7L

EGR Valve Pipe Clamp Bracket Bolt	18 (25)
EGR Valve Pipe-To-Exhaust Manifold Nut	22 (30)
EGR Valve Pipe-To-Intake Manifold Nut	18 (25)
Engine Block Coolant Drain Hole Plug	15 (20)
Engine Block Oil Gallery Plug	15 (20)
Engine Coolant Temperature (ECT) Gage Sensor Fastener	15 (20)
Engine Flywheel Bolt	74 (100)
Engine Lift Bracket Bolt (Special Tool J-41427)	11 (15)
Engine Lift Front Bracket Stud	26 (35)
Engine Mount (Thru Bolt)-To-Engine Mount Bracket Bolt	70 (95)
Engine Mount-To-Engine Mount Frame Bracket Bolt	43 (58)
Engine Mount Bracket-To-Engine Bolt	40 (54)
Engine Mount Bracket-To-Frame Bolt	33 (45)
Engine Mount Nut (Through Bolt)	50 (68)
Engine Oil Pressure Gage Sensor Fastener	22 (30)
Engine Oil Pressure Gage Sensor Fitting Fastener (Plus Required Angle)	11 (15)
Exhaust Manifold Bolt	
First Tightening Pass	11 (15)
Final Tightening Pass	22 (30)
Fan & Water Pump Pulley Bolt	30 (41)
Generator & Drive Belt Tensioner Bracket-To-Engine Bolt & Nut	30 (41)
Generator & Drive Belt Tensioner Bracket-To-Engine Stud	15 (20)
Knock Sensor Fastener	15 (20)
Lower Intake Manifold Bolt ⁽²⁾	
First Tightening Pass	27 INCH Lbs. (3 N.m)
Second Tightening Pass	106 INCH Lbs. (12 N.m)
Final Tightening Pass	11 (15)
Oil Filter Adapter Bolt	18 (25)
Oil Filter Fitting Fastener	26 (35)
Oil Level Indicator Tube Bolt	18 (25)
Oil Pan Drain Plug	18 (25)
Oil Pan Stud Nut	18 (25)
Oil Pump-To-Rear Crankshaft Bearing Cap Bolt	
First Tightening Pass	15 (20)
Final Tightening Pass	Additional 65°
Power Steering Pump Bolt	37 (50)
Power Steering Pump Bracket-To-Engine Bolt	30 (41)
Power Steering Pump Bracket-To-Engine Stud	15 (20)
Power Steering Pump Bracket-To-Nut Stud	30 (41)

2000 Chevrolet Cab & Chassis C2500

2000-01 ENGINE Engine Mechanical - 5.0L & 5.7L

Power Steering Pump Rear Bracket Nut	37 (50)
Spark Plug	
Initial Installation (NEW Cylinder Head)	22 (30)
All Subsequent Installations	11 (15)
Square Socket Plug (Engine Block Oil Gallery)	15 (20)
Valve Lifter Guide Retainer Bolt	18 (25)
Water Outlet Stud	18 (25)
Water Pump Bolt	33 (45)
INCH Lbs. (N.m)	
Accelerator Control Cable Bracket Bolt & Nut	106 (12)
Camshaft Retainer Bolt	106 (12)
Crankshaft Position Sensor Bolt	80 (9)
Crankshaft Rear Oil Seal Housing Nut & Bolt	106 (12)
Crankshaft Rear Oil Seal Housing Retainer Stud	53 (6)
Distributor Cap Bolt	21 (2.4)
Engine Front Cover Bolt	106 (12)
Engine Mount Heat Shield-To-Engine Mount Bracket	53 (6)
Engine Wiring Harness Bracket Nut	106 (12)
Evaporative Emission (EVAP) Canister Purge Valve Stud	89 (10)
Fuel Pipe & Bracket Bolt	53 (6)
Fuel Pipe Retainer Nut	27 (3)
Ignition Coil Stud	106 (12)
Oil Pan Bolt/Stud	106 (12)
Oil Pan Stud (Front)	53 (6)
Oil Pump Cover Bolt	106 (12)
Spark Plug Wire Support Bolt	106 (12)
Throttle Body Stud	80 (9)
Transmission Cover Bolt	106 (12)
Upper Intake Manifold Stud	
First Pass	44 (5)
Final Pass	89 (10)
Valve Rocker Arm Cover Bolt	106 (12)
(1) Tighten bolts in sequence as shown. See Fig. 149 .	
(2) Tighten bolts in sequence as shown. See Fig. 150 .	

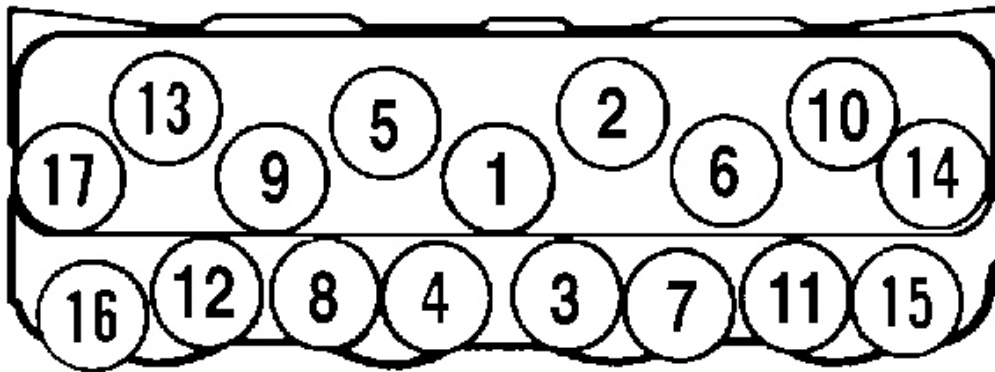
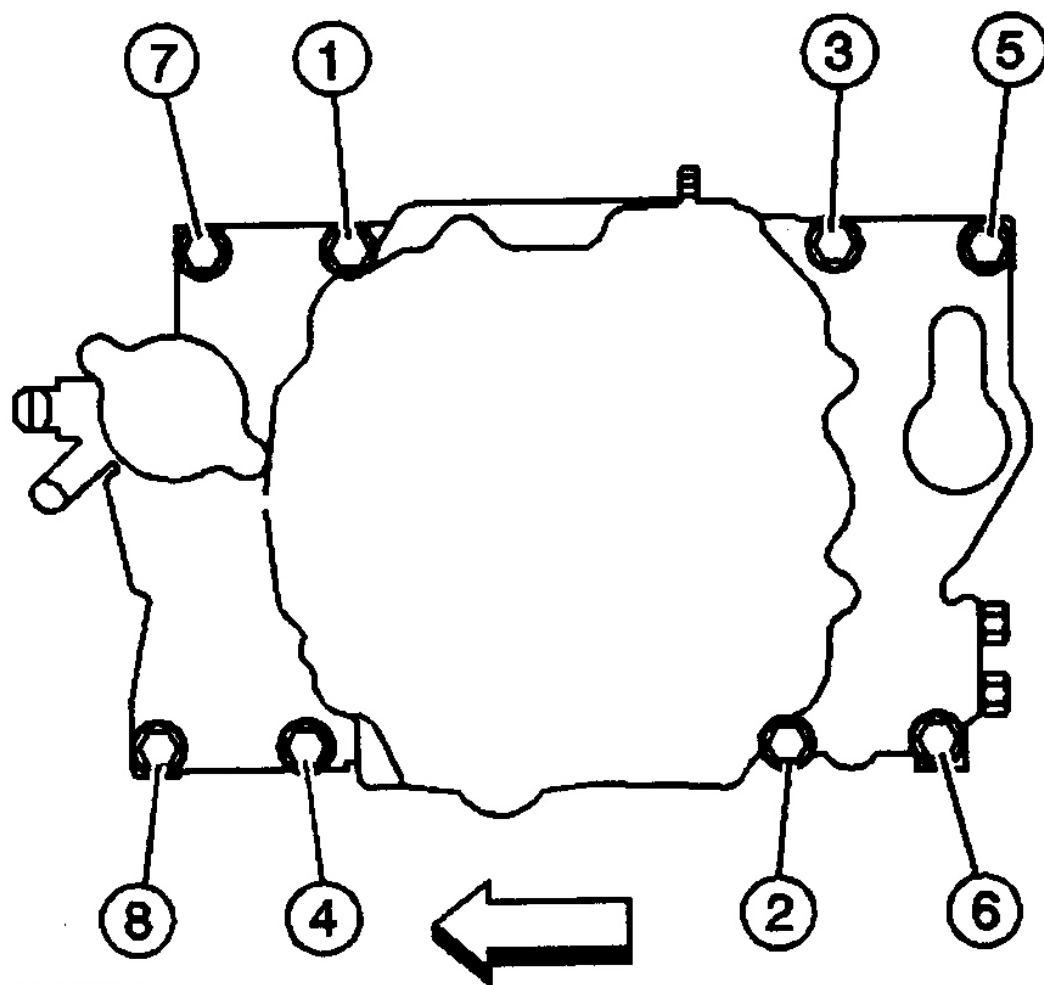


Fig. 149: Identifying Cylinder Head Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.



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Fig. 150: Identifying Lower Intake Manifold Bolt Tightening Sequence
 Courtesy of GENERAL MOTORS CORP.