

2001 Cadillac Catera

2000-01 ENGINE 3.0L DOHC V6 - Catera

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ENGINE IDENTIFICATION

Engine is identified by the 8th digit of Vehicle Identification Number (VIN). VIN is located on left side of instrument panel, near base of windshield.

ENGINE IDENTIFICATION CODES

Engine	VIN Code
3.0L	R

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

Hydraulic valve lash adjusters are used. Valve adjustment is not required.

TROUBLE SHOOTING

NOTE: To trouble shoot mechanical engine components, see ENGINE MECHANICAL in BASIC TROUBLE SHOOTING article in GENERAL INFORMATION.

REMOVAL & INSTALLATION

NOTE: For repair procedures not covered in this article, see ENGINE OVERHAUL PROCEDURES article in GENERAL INFORMATION.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. For 2000, see CATERA in COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery. For 2001, see CATERA in COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION.

NOTE: For reassembly reference, label all electrical connectors, vacuum hoses and fuel lines before removal. Also place mating marks on engine hood and other major assemblies before removal.

FUEL PRESSURE RELEASE

WARNING: Fuel system is under pressure. Release pressure before disconnecting fuel system components.

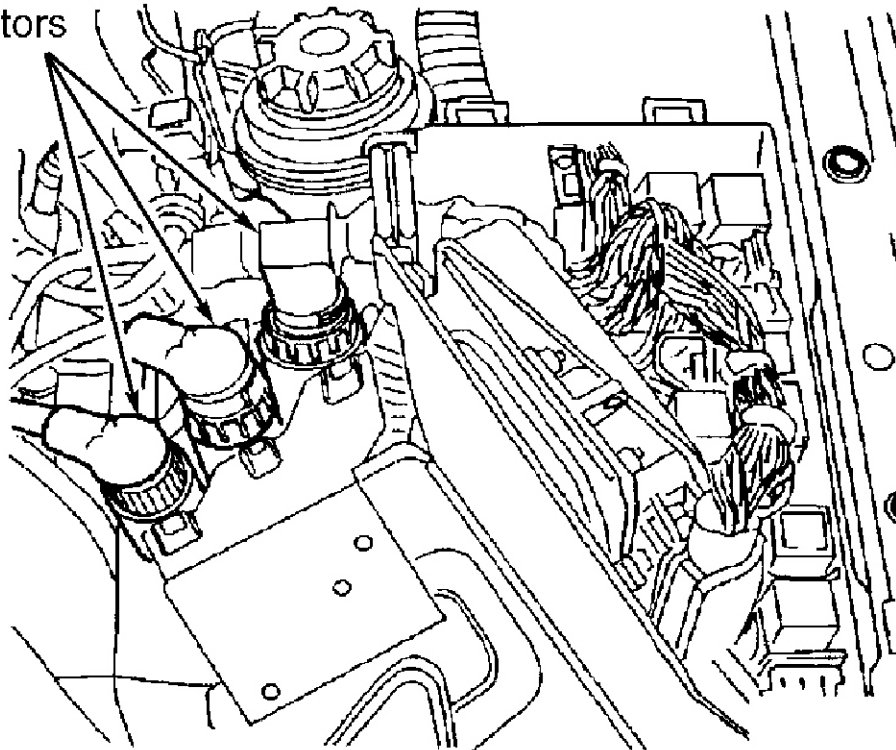
Disconnect negative battery cable. Loosen filler cap. Remove protective cap from fuel pressure test port on fuel rail located at rear of manifold. Connect fuel pressure gauge. Place open end of fuel pressure release hose into an approved container. Connect fitting end of hose to fuel pressure test port. Fuel pressure will bleed off through hose into container.

ENGINE

Removal & Installation

1. Disconnect negative battery cable. Remove hood. Remove wiper arms. Remove air inlet grills. Discharge A/C system using approved refrigerant recovery/recycling equipment. Drain cooling system. Remove air intake resonator. Remove A.I.R. pipe.
2. Disconnect Blue and White electrical wiring harness connectors. See **Fig. 1** . Unclip ECM and relays from electrical center under hood. Drape entire wiring harness over engine. Remove ground-to-body wire. Remove positive battery cable.
3. Remove cooling fan. Siphon power steering fluid from power steering reservoir. Remove hoses from power steering reservoir and power steering pump. Remove brake booster threaded vacuum fitting. Remove vacuum hoses from power brake booster hose.

Blue & White
Wiring Harness
Connectors



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Fig. 1: Identifying Blue & White Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

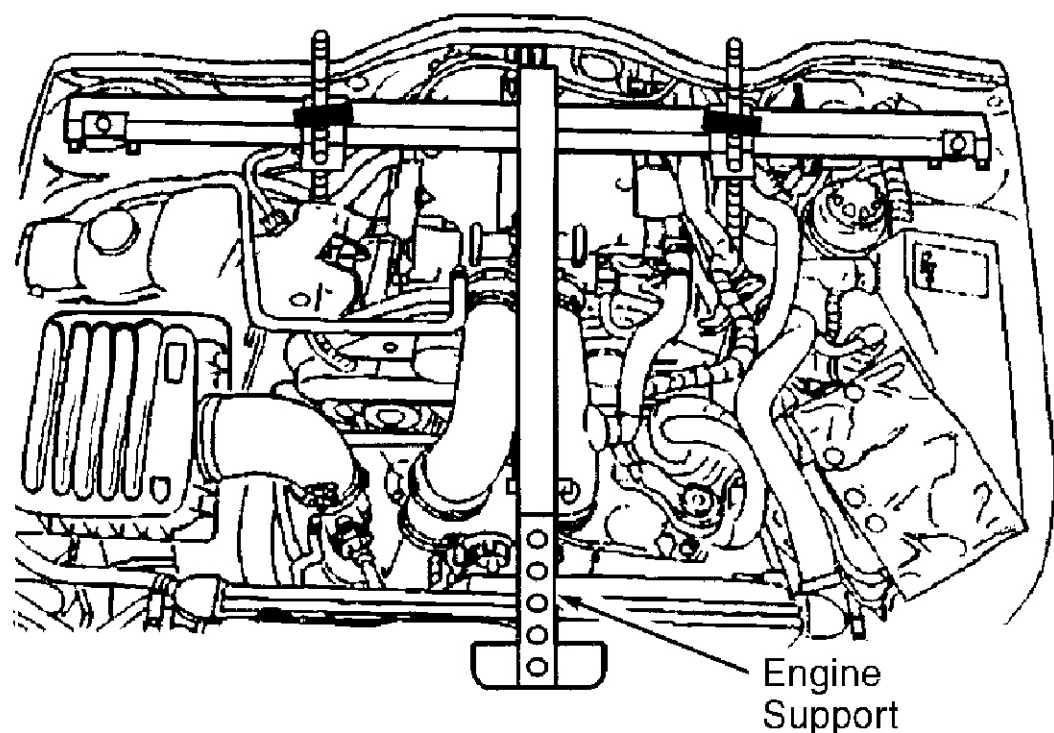
4. Remove accelerator cable and cruise control cable from throttle body. Relieve fuel pressure. See **FUEL PRESSURE RELEASE** . Disconnect fuel supply and return hoses. Remove coolant return hose from throttle body. Remove coolant reservoir hose from coolant intake pipe.
5. Disconnect heater hose quick disconnects at heater core. Access quick disconnects through access cover, near HVAC pollen filter. Remove radiator. Remove A/C hose support clamps or straps. Disconnect A/C hoses at quick connectors near high side fitting and low side fitting. Cap or plug all A/C ports. Install Engine Support (J28467-A). See **Fig. 2** .

WARNING: Engine mounts will not provide sufficient support for engine when transmission is removed. Engine support must be used.

6. Raise and support vehicle. Remove splash shields. Disconnect A/C clutch electrical connector. Remove transmission. See **REMOVAL & INSTALLATION - A/T** article in TRANSMISSION SERVICING. Remove motor mount bolts. Lower vehicle. Install engine hoist chains to 3 support lift shackles of engine. See

Fig. 2 . Jack up hoist to support weight of engine.

7. Remove engine support. Raise engine slowly, ensuring engine is free and clear of obstructions. Remove engine from vehicle.
8. To install, reverse removal procedure. Fill and bleed cooling system. Evacuate and charge A/C system. Check and top off all fluids. See **TORQUE SPECIFICATIONS** .



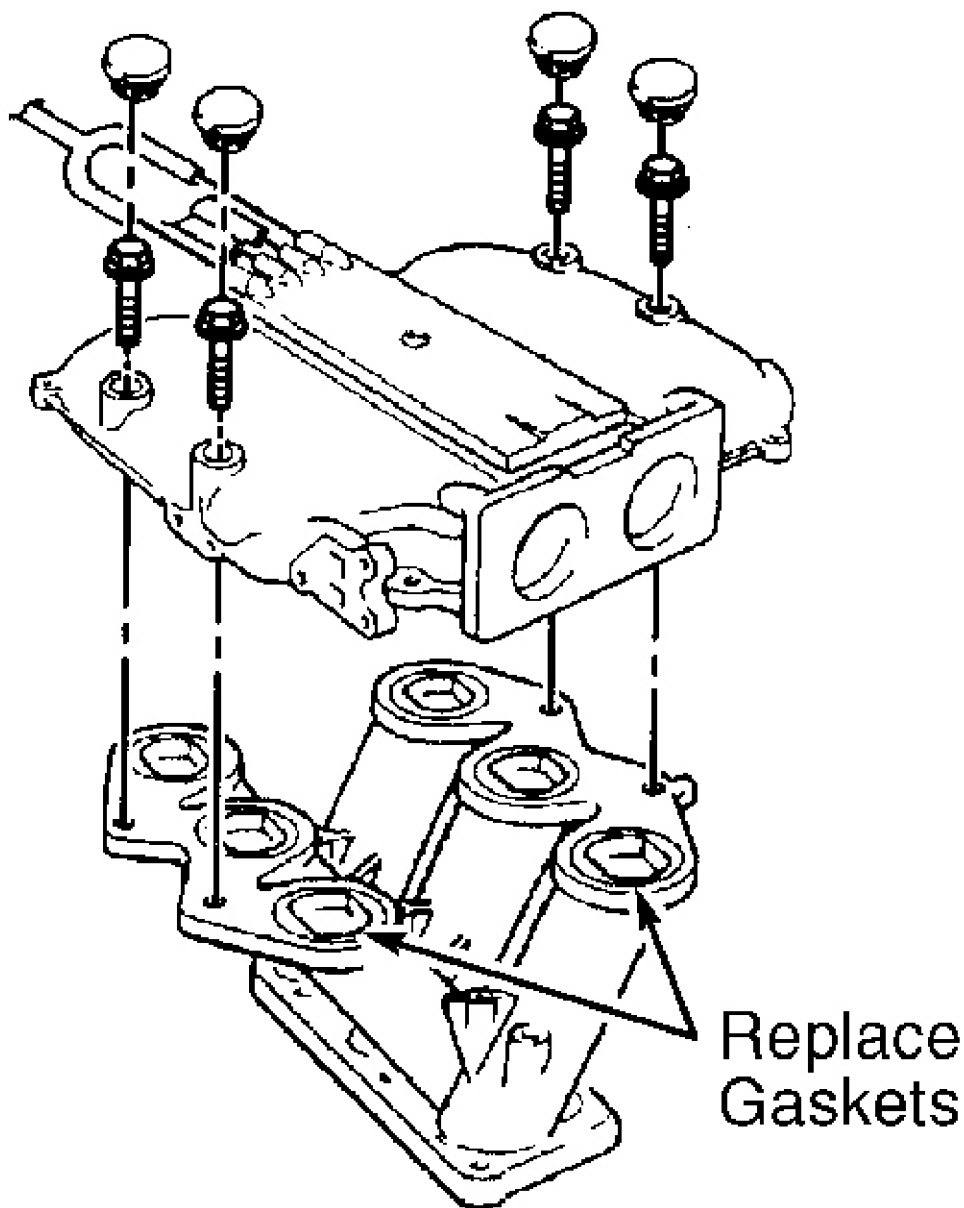
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Fig. 2: Installing Engine Support Brace
Courtesy of GENERAL MOTORS CORP.

INTAKE PLENUM

Removal & Installation

1. Disconnect negative battery cable. Remove intake plenum inlet hose clamps and hoses from throttle body. Remove brake booster vacuum fittings. Remove wiring harness channel bolts and position channel aside.
2. Disconnect vacuum hose and electrical connector from rear of intake plenum. Disconnect throttle body electrical connector. Remove throttle body. Remove crankcase vent tube adapter cover. Remove crankcase vent tube adapter and position aside. Disconnect heater hoses and retaining clamps.
3. Remove intake plenum cap bolt covers and remove mounting bolts. See **Fig. 3** . Remove intake plenum. Remove all gaskets. To install, reverse removal procedure. Replace all gaskets and "O" rings. See **TORQUE SPECIFICATIONS** .



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Fig. 3: Removing Intake Plenum

Courtesy of GENERAL MOTORS CORP.

INTAKE MANIFOLD & SPACER**Removal & Installation**

1. Disconnect negative battery cable. Remove the intake plenum. See **INTAKE PLENUM** . Release system fuel pressure. See **FUEL PRESSURE RELEASE** . Disconnect fuel supply and return hoses from fuel rail. Disconnect fuel injector electrical connectors. Disconnect fuel pressure regulator vacuum connection. Remove intake manifold bolts and remove manifold.
2. Remove intake spacer bolts and remove intake manifold spacer. Mask or cover intake spacer ports to prevent foreign material from entering ports. To install, reverse removal procedure. Replace all gaskets. See **TORQUE SPECIFICATIONS** .

EXHAUST MANIFOLD

Removal & Installation (Left)

Remove engine. See **ENGINE** . Remove exhaust heat shields. Remove air injection from manifold. Remove engine coolant pipe and lift bracket from cylinder head. Remove oil level indicator tube. Remove exhaust manifold mounting nuts. Remove manifold from vehicle. Remove gasket. To install, reverse removal procedure. See **TORQUE SPECIFICATIONS** .

Removal & Installation (Right)

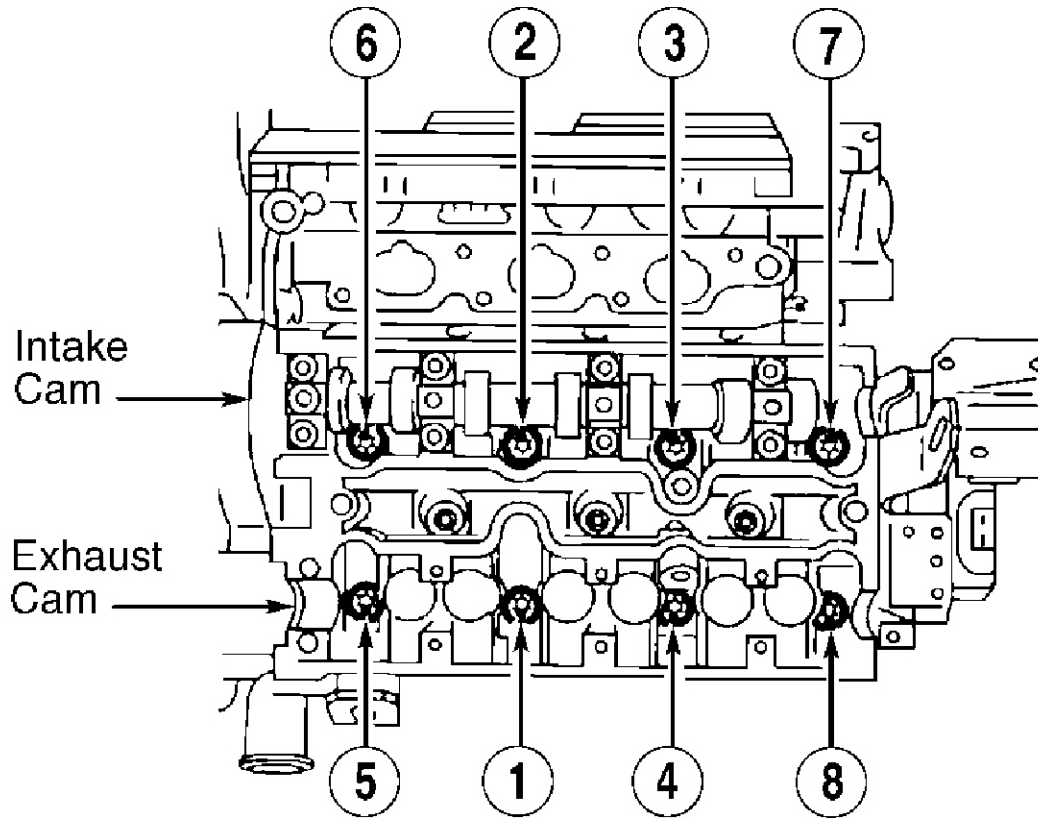
1. Remove transmission. See **REMOVAL & INSTALLATION - A/T** article in TRANSMISSION SERVICING. Remove coolant intake pipe. Remove lower heat shield. Remove catalytic converter hanger bolt. Remove 3 lower rear manifold mounting bolts. Remove catalytic converter from exhaust manifold. Lower vehicle and remove serpentine belt tensioner. Remove 2 front exhaust manifold bolts.
2. Remove upper manifold heat shield bolts, leaving shield in place. Remove air injection mounting bolts. Remove air injection from exhaust manifold. Remove exhaust manifold upper mounting bolts. Raise and support vehicle. Remove exhaust manifold. To install, reverse removal procedure. See **TORQUE SPECIFICATIONS** .

VALVE COVERS**Removal & Installation**

Disconnect the negative battery cable. Remove intake plenum. See **INTAKE PLENUM** . Remove intake manifold. See **INTAKE MANIFOLD & SPACER** . On left valve cover, remove oil filler spout by unlocking tab and turning counterclockwise. Disconnect Camshaft Position Sensor (CMP) on both valve covers. Remove ignition coil pack. Remove spark plug wires. On both valve covers, remove knock sensor wiring harness bracket nut. Remove valve cover bolts. Remove valve cover. Ensure all 8 sealing "O" rings are accounted for on each side. To install, reverse removal procedure. See **TORQUE SPECIFICATIONS** .

CYLINDER HEADS**Removal & Installation**

1. Drain cooling system. Remove intake plenum. See **INTAKE PLENUM** . Remove intake manifold and spacer. See **INTAKE MANIFOLD & SPACER** . Remove coolant bridge. Remove valve covers. See **VALVE COVERS** . Remove timing belt cover. See **FRONT TIMING BELT COVER** .
2. Remove timing belt. See **TIMING BELT** . Remove timing belt tensioner bracket. Remove all camshaft gears from camshafts. Remove water pump. Remove rear timing belt cover. See **REAR TIMING BELT COVER** . Disconnect camshaft sensor connector. Remove exhaust camshaft bearing caps. Remove exhaust camshafts.
3. Remove coolant pipe/engine lift bracket bolt from cylinder head. Remove dipstick tube. Remove upper radiator hose. Remove coolant intake pipe. Remove exhaust manifold mounting bolts. Loosen exhaust manifold-to-pipe flange, and pull exhaust manifolds away from cylinder heads. Disconnect ignition coil electrical connectors.
4. Remove cylinder head bolts in reverse order of tightening sequence. See **Fig. 4** . Remove cylinder heads and gaskets. To install, reverse removal procedure. See **TORQUE SPECIFICATIONS** .



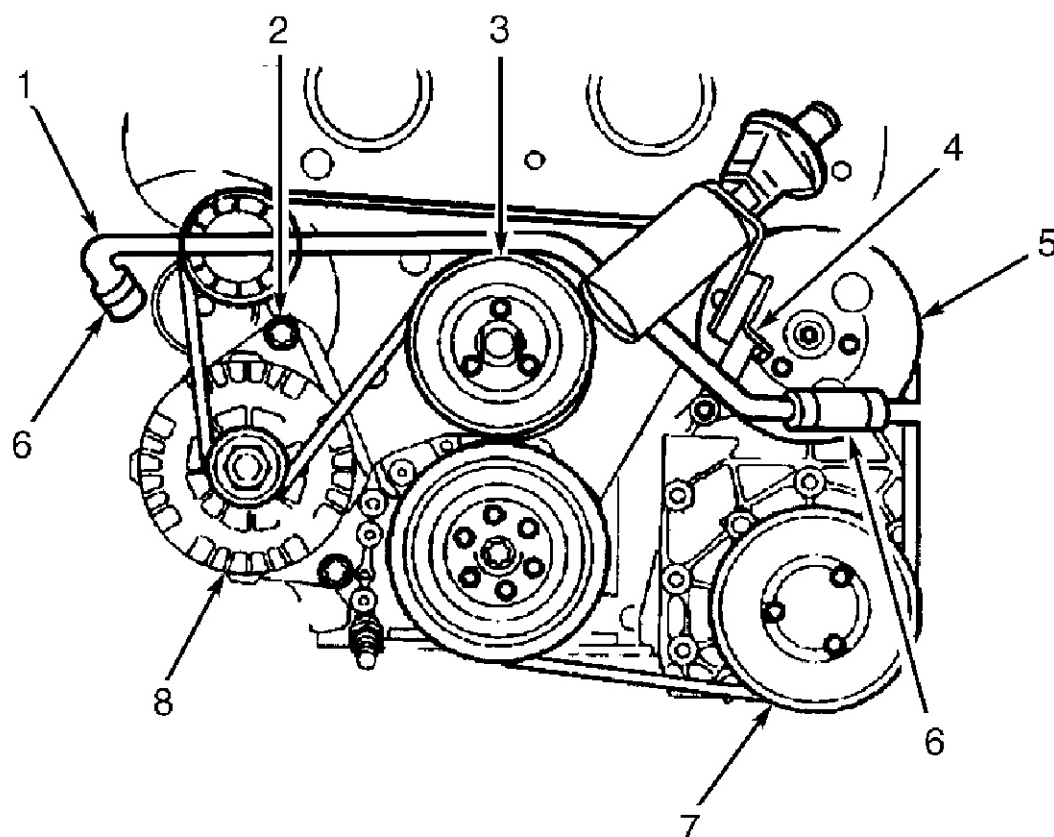
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Fig. 4: Cylinder Head Bolt Tightening Sequence
 Courtesy of GENERAL MOTORS CORP.

FRONT TIMING BELT COVER

Removal & Installation

1. Remove negative battery cable. Remove intake plenum. See **INTAKE PLENUM** . Raise and support vehicle. Remove splash shields. Loosen air injection crossover pipe, from generator mounting bolt, and bracket by diverter valve. Disconnect rubber hose connections. See **Fig. 5** .
2. Lower vehicle. Remove air injection pipe from diverter hose and remove air injection pipe from vehicle. Loosen water pump and P/S pump pulley mounting bolts. Remove A/C compressor hose support strap from air injection crossover bracket. See **Fig. 5** . Remove serpentine belt.
3. Remove wiring harness support brackets and remove harness from channel cover. Remove water pump pulley. Remove P/S pump pulley. Remove serpentine belt tensioner. Remove timing belt cover bolts, and remove cover. To install, reverse removal procedure. See **TORQUE SPECIFICATIONS** .



- | | |
|-----------------------------|-------------------|
| 1. AIR Crossover Pipe | 5. P/S Pump |
| 2. Generator Upper Bolt | 6. AIR Connectors |
| 3. Water Pump | 7. A/C Compressor |
| 4. AIR Crossover Pipe Mount | 8. Generator |

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Fig. 5: Identifying Timing Belt Front Cover & Components
 Courtesy of GENERAL MOTORS CORP.

TIMING BELT

CAUTION: Incorrect timing belt installation can lead to engine damage. If timing belt is installed one tooth off, valve-to-piston contact may occur.

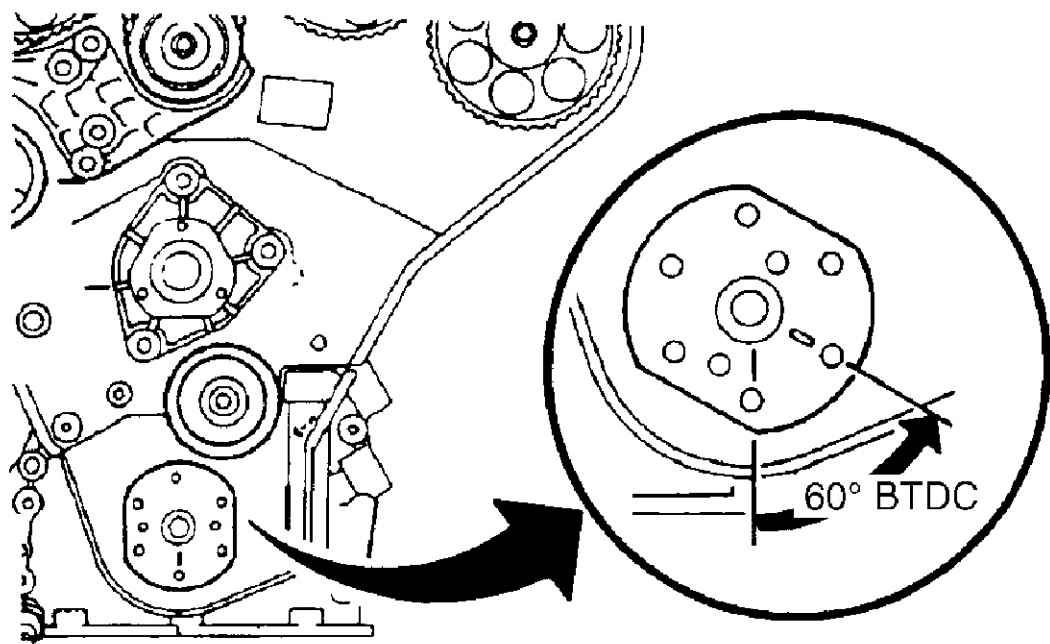
When servicing timing belt:

- Install timing belt with engine at room temperature.
- DO NOT remove timing belt without first setting camshaft gears and crankshaft drive gear to TDC and locking them in place.
- Guide marks on timing belt are to aid in timing belt installation. If guide marks cannot be identified, a NEW belt must be installed.

Removal

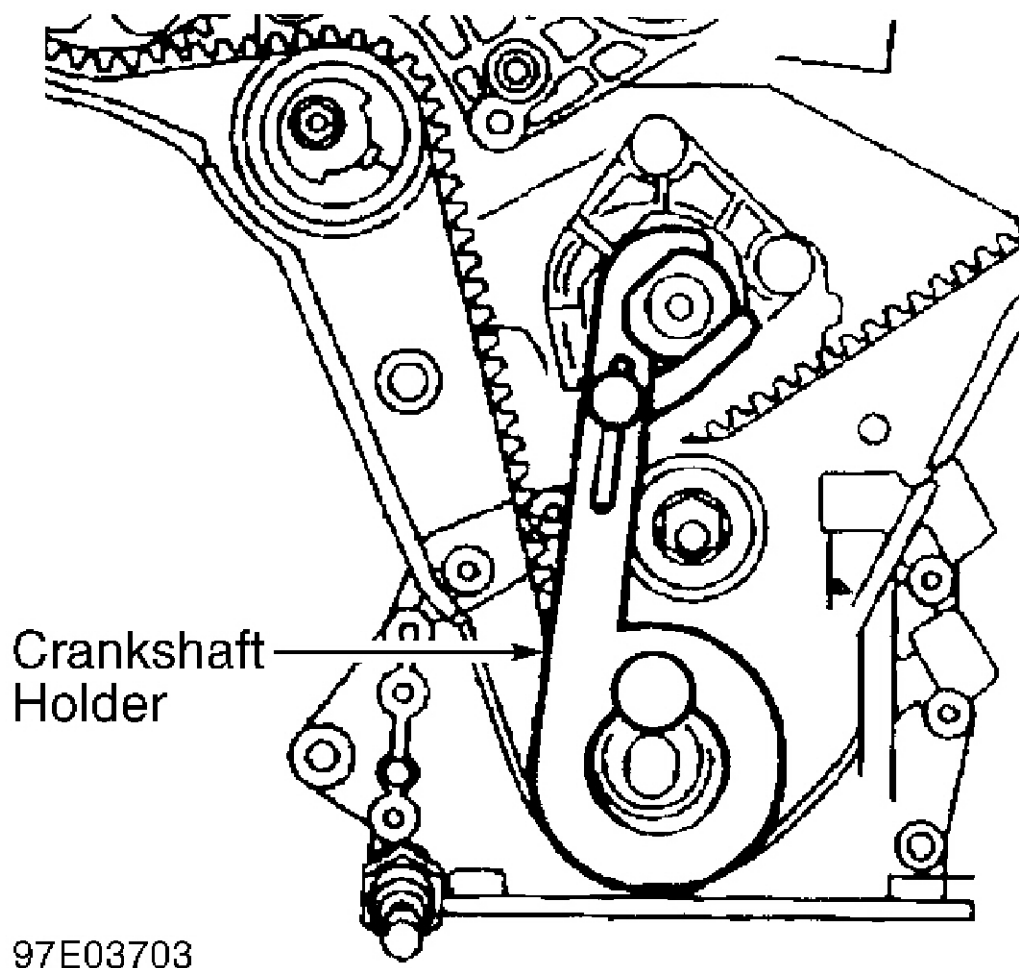
1. Disconnect negative battery cable. Remove intake plenum. See **INTAKE PLENUM**. Place cylinder No. 1 to TDC of compression stroke. Remove front timing belt cover. See **FRONT TIMING BELT COVER**. Remove harmonic balancer bolts and remove harmonic balancer. Rotate engine clockwise to 60 degrees Before Top Dead Center (BTDC). See **Fig. 6**. Ensure timing marks are not 180 degrees out from TDC.
2. Install Crankshaft Holder (J42069-10), and rotate engine until holder contacts water pump. See **Fig. 7**. Ensure alignment marks on camshaft gears align with corresponding marks on rear timing belt cover. Install

Camshaft Gear Holders (J42069-1 and J42069-2). See **Fig. 8** . Loosen timing belt tensioner and remove timing belt.



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Fig. 6: Positioning Crankshaft 60 Degrees BTDC
Courtesy of GENERAL MOTORS CORP.



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Fig. 7: Installing Crankshaft Holder
Courtesy of GENERAL MOTORS CORP.

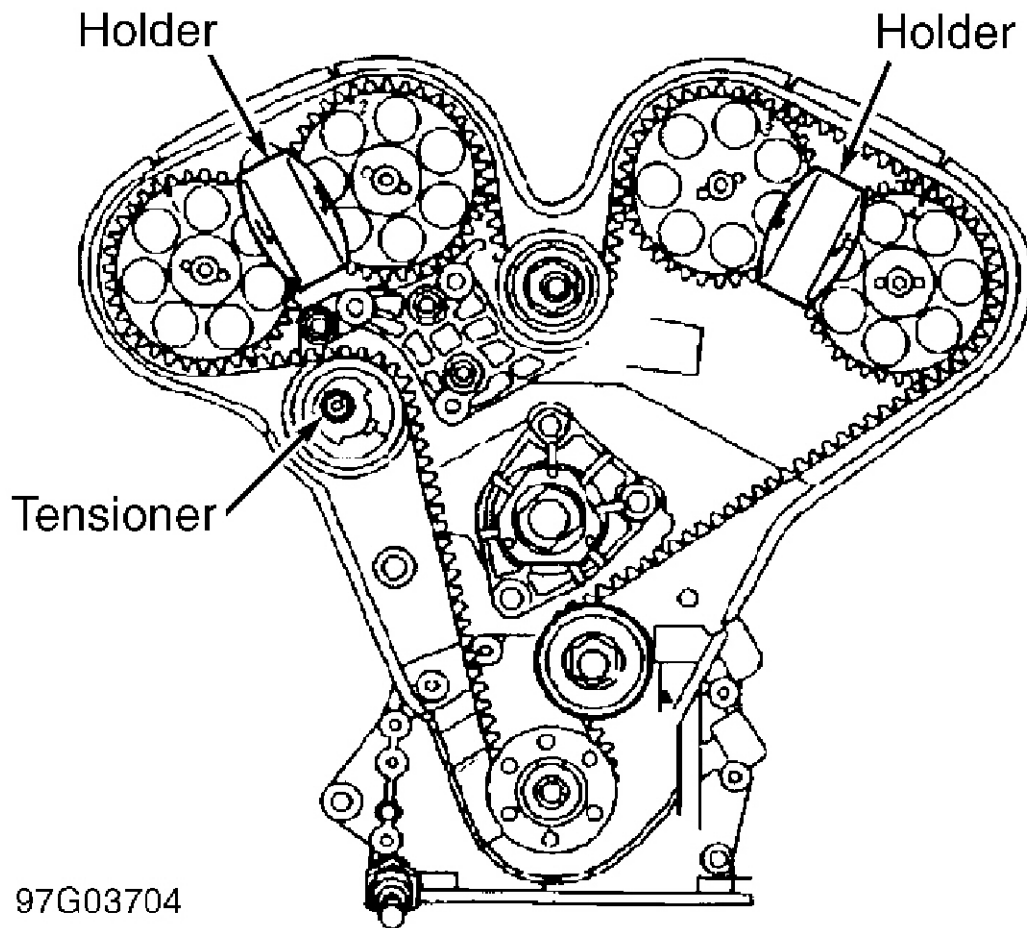
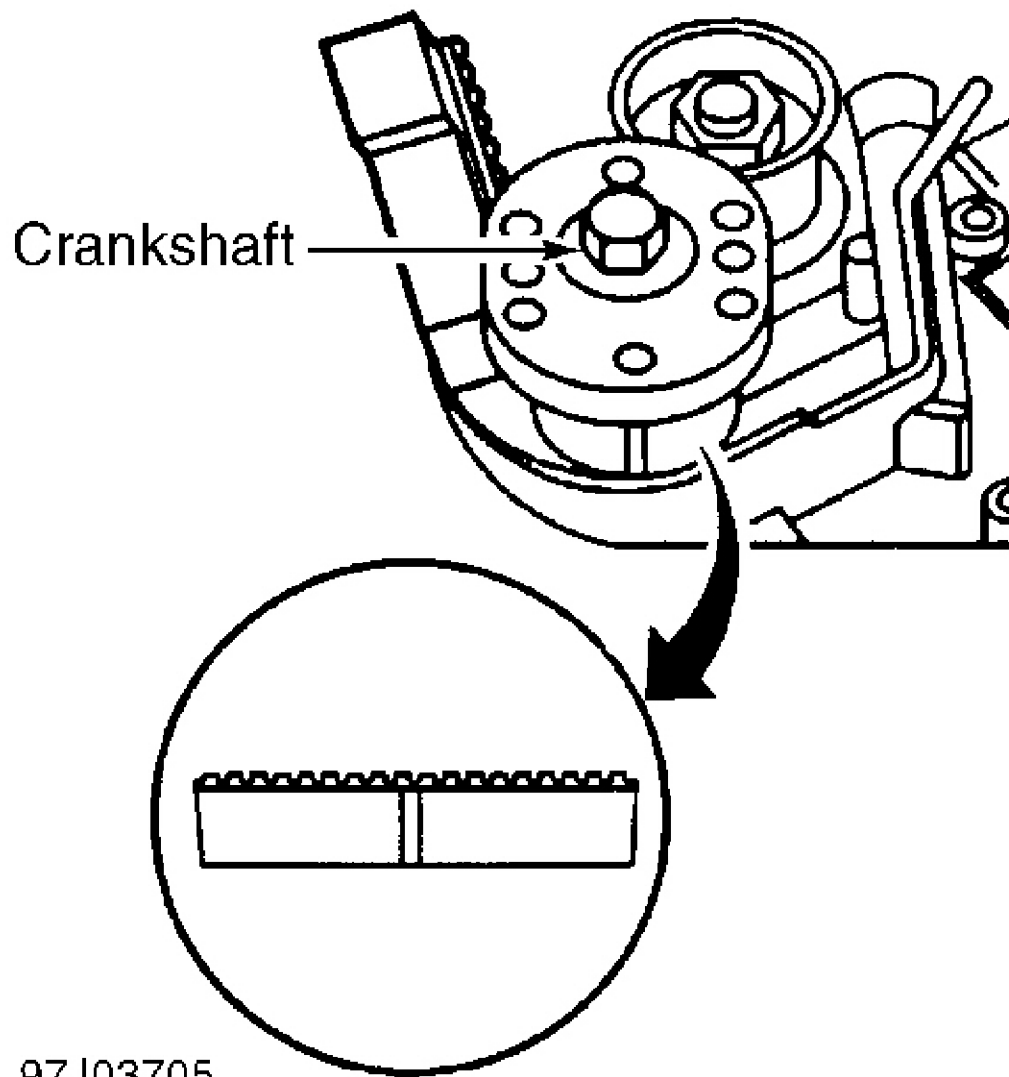


Fig. 8: Installing Camshaft Gear Holders
 Courtesy of GENERAL MOTORS CORP.

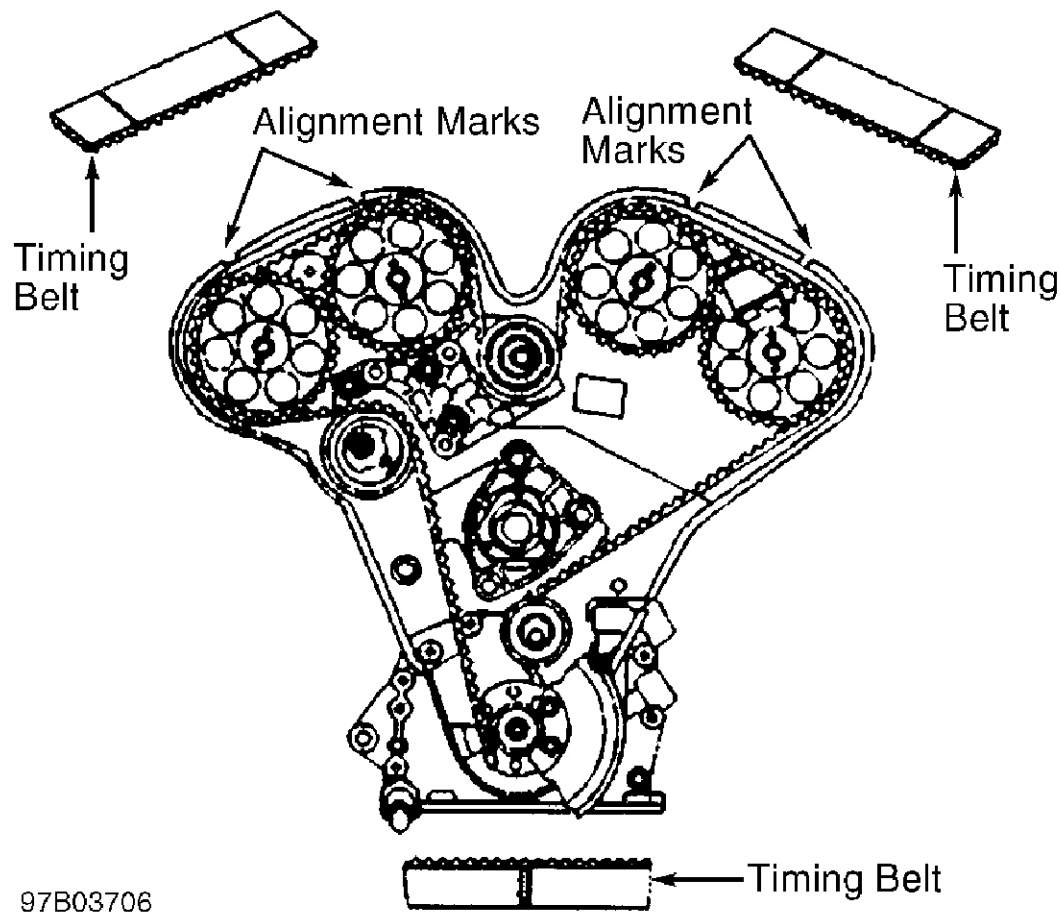
Installation

1. To install, remove crankshaft holder. Raise and support vehicle. Start installation of belt at crankshaft pulley. Install timing belt with double dash marks aligned with oil pump and drive gear marks. Install Timing Belt Holder (J42069-30) onto pinch belt to prevent teeth from jumping during installation. See **Fig. 9** . Lower vehicle
2. Route timing belt through belt tensioner and through right bank camshaft gears, ensuring timing belt marks are aligned with marks on rear timing belt cover. See **Fig. 10** . Route timing belt through camshaft idler pulleys. Route timing belt through left bank camshaft gears, ensuring timing belt marks are aligned with marks on rear timing belt cover.
3. Measure belt deflection between camshaft gear four and camshafts three and four. Maximum deflection is .4" (10 mm). Adjust belt deflection, if necessary. To adjust, rotate idler pulley nut for camshafts No. 3 and 4 counterclockwise, until nut is at 12 o'clock position. Tighten idler pulley lock bolt.



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Fig. 9: Aligning Timing Belt Marks On Crankshaft Drive Pulley
Courtesy of GENERAL MOTORS CORP.



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Fig. 10: Aligning Timing Belt Marks With Rear Cover Marks
 Courtesy of GENERAL MOTORS CORP.

4. Apply tension to timing belt at idler pulley nut for camshafts No. 1 and No. 2. Turn adjusting nut to 9 o'clock position. Tighten idler pulley lock bolt. Set timing belt tension. Turn tensioner nut counterclockwise, to full stop, until reference mark is .003" (1 mm) over flange. See **Fig. 11** . Tighten timing belt tensioner. Ensure timing belt marks align with marks on rear timing belt cover, oil pump housing and camshaft gears. See **Fig. 10** . Remove Timing Belt Aligner(s) (J42069-30, J42069-1 and J42069-2).
5. Using Crank Hub Socket (J42098), rotate engine clockwise, two revolutions, stopping at 60 degrees Before Top Dead Center (BTDC). See **Fig. 6** . Install Timing Belt Aligner (J42069-10), onto crankshaft sprocket. Turn crankshaft until lever of aligner touches water pump pulley flange. Inspect alignment marks.
6. Install Timing Belt Aligner (J42069-20) onto camshaft gears No. 3 and 4. If camshaft gears and alignment tool are properly aligned, no adjustment is necessary. Install aligner onto camshaft gears No. 1 and 2. If camshaft gears and alignment tool are properly aligned, adjustment is not necessary.
7. If all timing marks are exactly aligned, set final belt tension. Loosen timing belt tensioner locking nut. Turn locking nut counterclockwise to full stop. Turn nut back until reference mark is .078-.157" (2-4 mm) above reference mark on flange. See **Fig. 11** . Tighten timing belt tensioner locking nut. See **TORQUE SPECIFICATIONS** . For camshafts No. 1, 2, 3 and 4, hold timing belt idler pulley nut in place with Timing Belt Aligner (J42069-40). Tighten idler pulley bolts to specification. See **TORQUE SPECIFICATIONS** .
8. Inspect idler pulley nut high point. For camshafts No. 3 and 4, nut will be in 12 o'clock position. For camshafts No. 1 and 2, nut will be in 9 o'clock position. Remove (J42069-20) and (J42069-10). Rotate engine clockwise, two revolutions, until it reaches 60 degrees BTDC.
9. Install Timing Belt Aligner (J42069-10) onto crankshaft sprocket. Turn crankshaft until lever on aligner contacts water pump pulley flange. Secure lever to flange. Inspect alignment marks. Using Timing Belt Aligner (J42069-20), to ensure alignment of camshaft gears. Remove tools.
10. Install crankshaft balancer onto crankshaft sprocket. Tighten bolt to specification. See **TORQUE**

SPECIFICATIONS . To complete installation, reverse removal procedure.

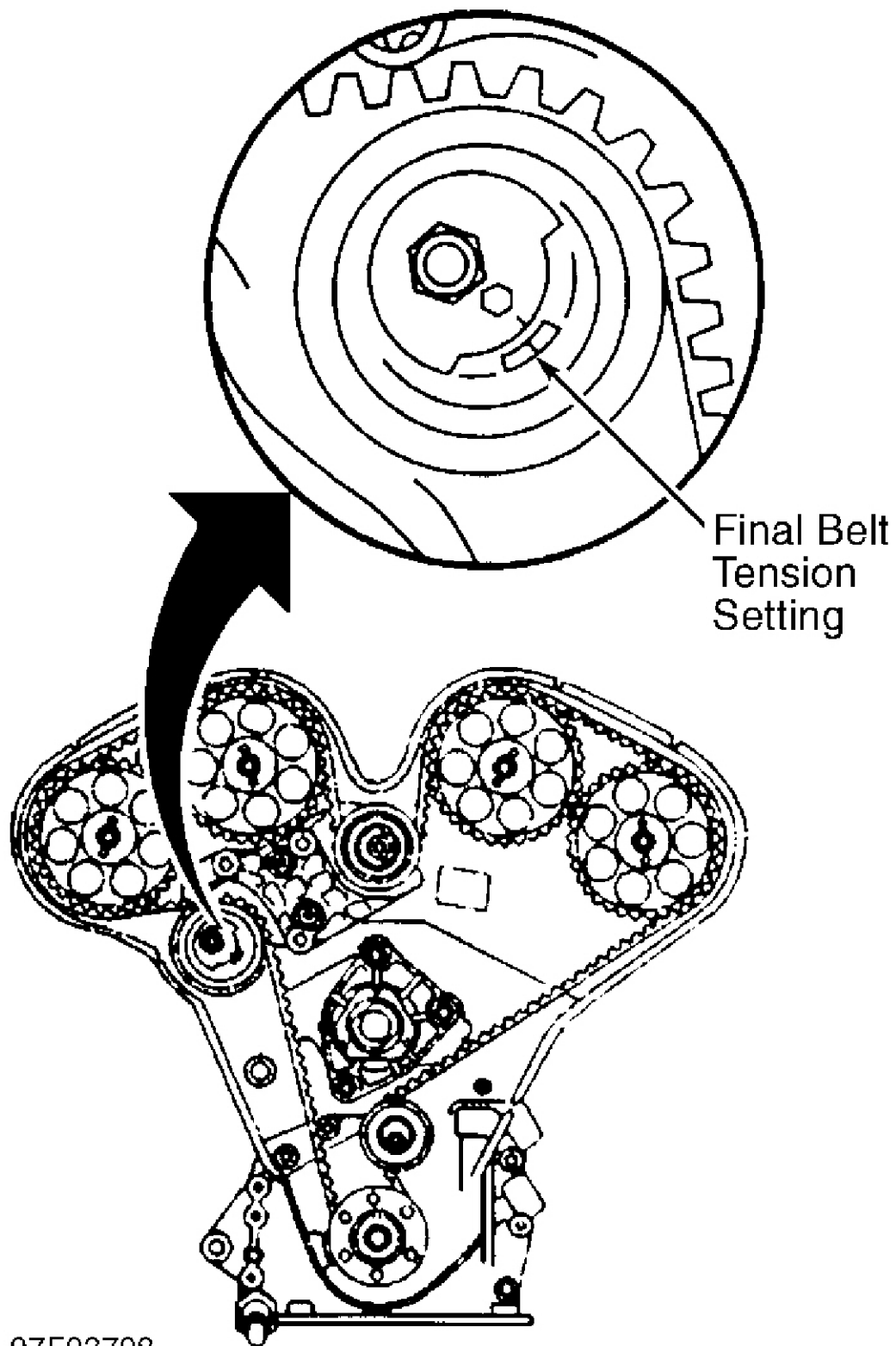


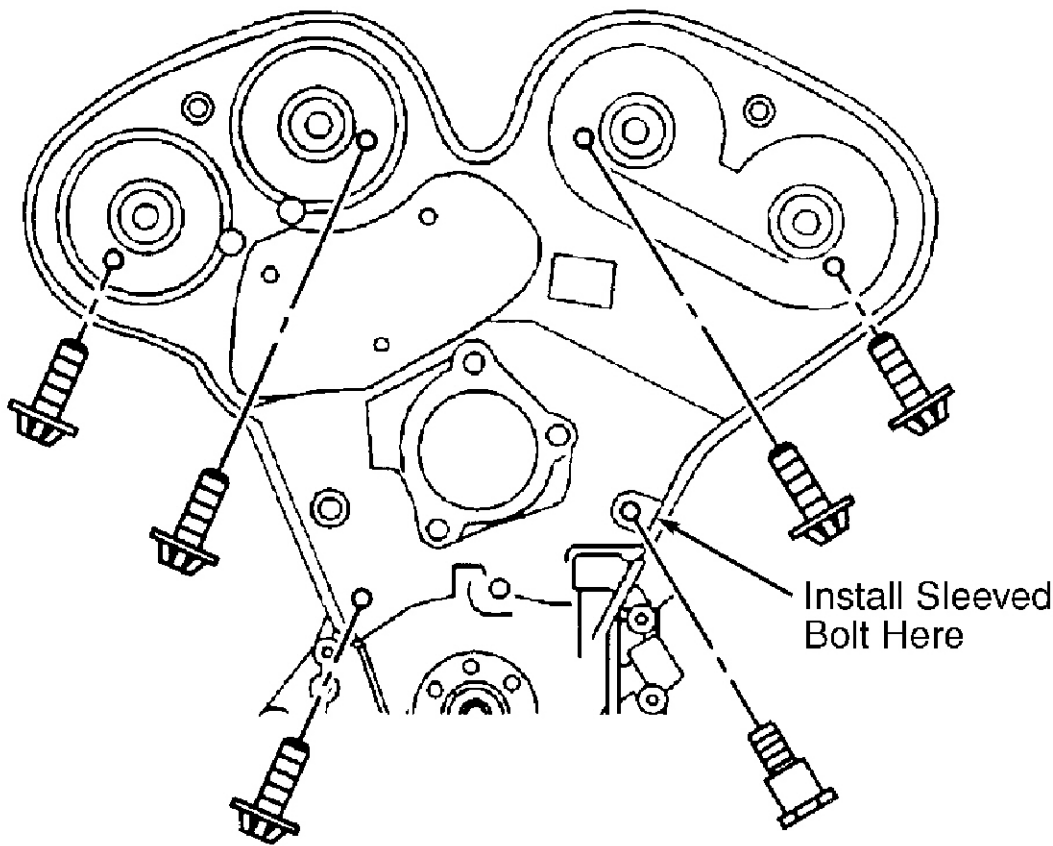
Fig. 11: Setting Final Timing Belt Tension Setting
Courtesy of GENERAL MOTORS CORP.

REAR TIMING BELT COVER

Removal & Installation

1. Disconnect negative battery cable. Remove resonance and air inlet ducting from throttle body. Drain cooling system. Remove front timing belt cover. See **FRONT TIMING BELT COVER** . Install Crankshaft Holder

- (J42069-10). Remove timing belt. See **TIMING BELT** .
2. Remove all camshaft gears. Remove timing belt tensioner bracket with the tensioner pulley attached. Remove timing belt idler pulley. Remove water pump. Remove the rear timing belt mounting bolts. See **Fig. 12** . Remove the rear timing belt cover. See **TORQUE SPECIFICATIONS** .



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Fig. 12: Removing Rear Timing Belt Cover
 Courtesy of GENERAL MOTORS CORP.

CAMSHAFT

Removal & Installation

1. Disconnect negative battery cable. Remove intake plenum. See **INTAKE PLENUM** . Remove valve covers. See **VALVE COVERS** . Remove timing belt. See **TIMING BELT** . Remove camshaft gears. Loosen camshaft bearing caps in a circular pattern, starting from inner caps and working outward. Mark bearing caps for installation reference. Remove camshaft.
2. To install, lubricate camshaft bearing with clean oil. Install bearing caps into their original position. Gradually tighten to specification in a circular pattern, starting from inner caps and working outward. See **TORQUE SPECIFICATIONS** .

FRONT MAIN OIL SEAL

Removal & Installation

1. Disconnect negative battery cable. Remove resonance and air ducting from throttle body. Remove intake plenum. See **INTAKE PLENUM** . Drain cooling system. Remove timing belt. See **TIMING BELT** . Remove crankshaft bolt and discard. Remove crankshaft gear.
2. Remove front cover oil seal. DO NOT damage sealing surface when removing seal. Using Camshaft/Front Main Seal Installer (J35268-A), install front oil seal. To complete installation, reverse removal procedure.

Install NEW crankshaft bolts. Tighten to specification. See **TORQUE SPECIFICATIONS** .

REAR MAIN OIL SEAL

Removal & Installation

1. Install Engine Support (J28467-A). See **Fig. 1** . Raise and support vehicle.

WARNING: Engine mounts will not provide sufficient support for engine when transmission is removed. Engine support must be used.

2. Remove the transmission. See **REMOVAL & INSTALLATION - A/T** article in TRANSMISSION SERVICING. Remove flex plate. Remove and discard flexplate bolts. Remove rear main oil seal. DO NOT damage sealing surface when removing seal.
3. Using Rear Main Oil Seal Installer (J42067), install rear main seal. To complete installation, reverse removal procedure. Install NEW flexplate bolts. See **TORQUE SPECIFICATIONS** .

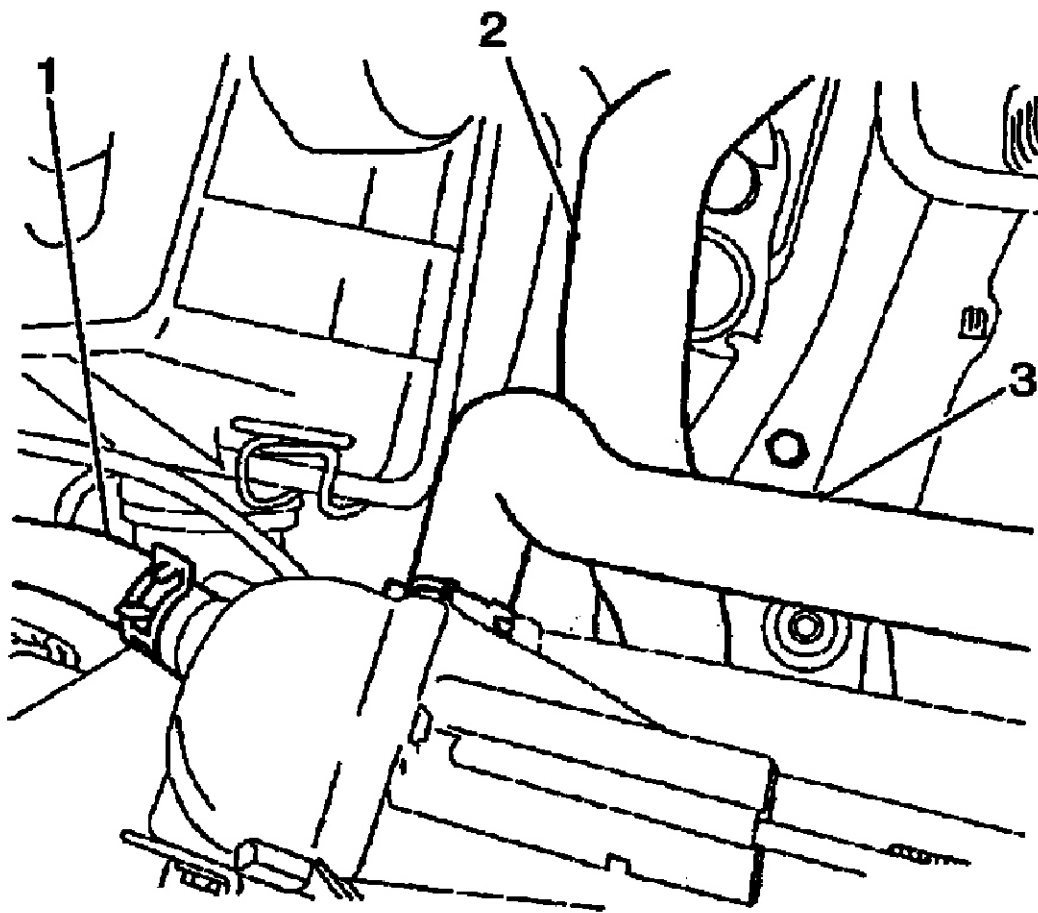
RADIATOR

Removal

CAUTION: Before servicing any electrical component, the ignition key must be in the OFF or LOCK position and all electrical loads must be OFF, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect the negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

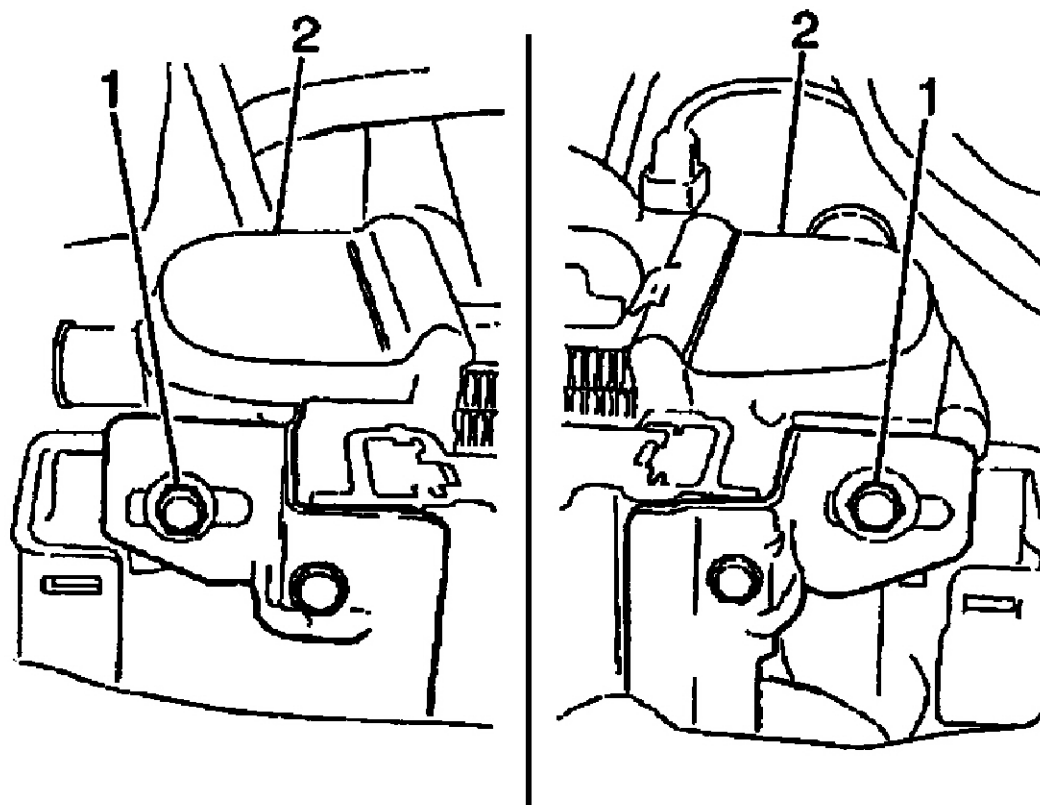
1. Disconnect the negative battery cable.
2. Remove the upper radiator covers:
 - Release the self-locking tabs.
 - Remove the upper radiator cover screws.
 - Remove the upper radiator covers.
3. Drain the cooling system.
4. Remove the intake air resonator.
5. Remove the cooling fan shroud.
6. Disconnect the cooling fan control switches electrical connectors.
7. Remove the surge tank hose (1) from the radiator. See **Fig. 13** .
8. Remove the coolant hose from the secondary auxiliary coolant pump.
9. Remove the condenser-to-radiator bracket bolts (1). See **Fig. 14** .
10. Remove the radiator inlet hose clamp from the radiator.
11. Remove the radiator inlet hose from the radiator.
12. Remove the radiator outlet hose clamp from the radiator.
13. Remove the radiator outlet hose from the radiator.
14. Remove the transmission oil cooler to radiator top bolts.
15. Disconnect the secondary auxiliary coolant pump connector.
16. Remove the upper radiator upper mounting retainers.
17. Lift and rock the radiator to unseat lower retainers.
18. Remove the radiator (2) and the transmission oil cooler together from the radiator support.

19. Remove the transmission oil cooler bolts.
20. Remove the transmission oil cooler from the radiator.
21. Use J 42865 to remove the cooling fan control switches, if necessary.



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Fig. 13: Removing/Installing Surge Tank Hose At Radiator
Courtesy of GENERAL MOTORS CORP.



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Fig. 14: Removing/Installing Condenser-To-Radiator Bolts
 Courtesy of GENERAL MOTORS CORP.

Installation

NOTE: Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. Do not use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

1. Use the J 42865 to install the cooling fan control switches, if removed. Tighten the cooling fan control switches to 16 lb ft (22 N.m).
2. Install the transmission oil cooler to the radiator.
3. Install the radiator and the transmission oil cooler together to the radiator support:
 - Engage the tabs on the bottom of the radiator in the lower retainers.
 - Engage the upper retainers in the radiator support brackets.
4. Connect the secondary auxiliary coolant pump electrical connector.
5. Install the transmission oil cooler to radiator top bolts. Tighten the transmission oil cooler to radiator top bolts to 89 lb INCH (10 N.m).
6. Install the radiator outlet hose to the radiator.
7. Install the radiator outlet hose clamp to the radiator.
8. Install the radiator inlet hose to the radiator.

9. Install the radiator inlet hose clamp to the radiator.
10. Install the condenser-to-radiator bracket bolts (1). See **Fig. 14** . Tighten the condenser-to-radiator bracket bolts (1) to 89 lb INCH (10 N.m).
11. Connect the surge tank hose (1) to the radiator. See **Fig. 13** .
12. Connect the cooling fan control switches electrical connectors.
13. Install the cooling fan shroud.
14. Install the intake air resonator.
15. Install the upper radiator covers:
 - Position the upper radiator covers.
 - Install the upper radiator cover screws.
 - Insert the self-locking tabs.
16. Connect the negative battery cable.
17. Fill the cooling system.

THERMOSTAT

Removal

1. Drain the cooling system.
2. Remove the intake plenum. See **INTAKE PLENUM** .
3. Remove the intake manifold. See **INTAKE MANIFOLD & SPACER** .
4. Remove the power steering reservoir bracket bolt and the power steering reservoir bracket.
5. Reposition the power steering reservoir.
6. Remove the radiator inlet hose clamp from the thermostat outlet pipe.
7. Remove the radiator inlet hose from the thermostat outlet pipe.
8. Remove the thermostat outlet pipe bolt.
9. Remove the thermostat outlet pipe.
10. Discard the O-rings.
11. Remove the O-ring seals from the thermostat outlet pipe.
12. Discard the O-rings.
13. Remove the thermostat housing bolts
14. Remove the thermostat housing
15. Remove and discard the seal ring.

Installation

NOTE: Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. Do not use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

1. Install a new seal ring
2. Install the thermostat with the thermostat outlet housing to the engine.

3. Apply sealant GM P/N 12346004 (Canadian P/N 10953480) to the thermostat housing bolt threads.
4. Install the thermostat outlet housing bolts (1). Tighten the thermostat outlet housing bolts to 15 lb ft (20 N.m).
5. Lubricate two new O-rings with coolant.
6. Install the new O-rings in the thermostat outlet pipe.
7. Install the thermostat outlet pipe.
8. Install the thermostat outlet pipe bolt. Tighten the thermostat outlet pipe bolt to 15 lb ft (20 N.m).
9. Install the radiator inlet hose to the thermostat outlet pipe.
10. Install the radiator inlet hose clamp to the thermostat outlet pipe.
11. Install the power steering reservoir and the power steering reservoir bracket.
12. Install the power steering reservoir bracket bolt. Tighten the power steering reservoir bracket bolt to 62 lb INCH (7 N.m).
13. Install the intake manifold.
14. Install the intake plenum.
15. Fill the cooling system.

WATER PUMP

Removal & Installation

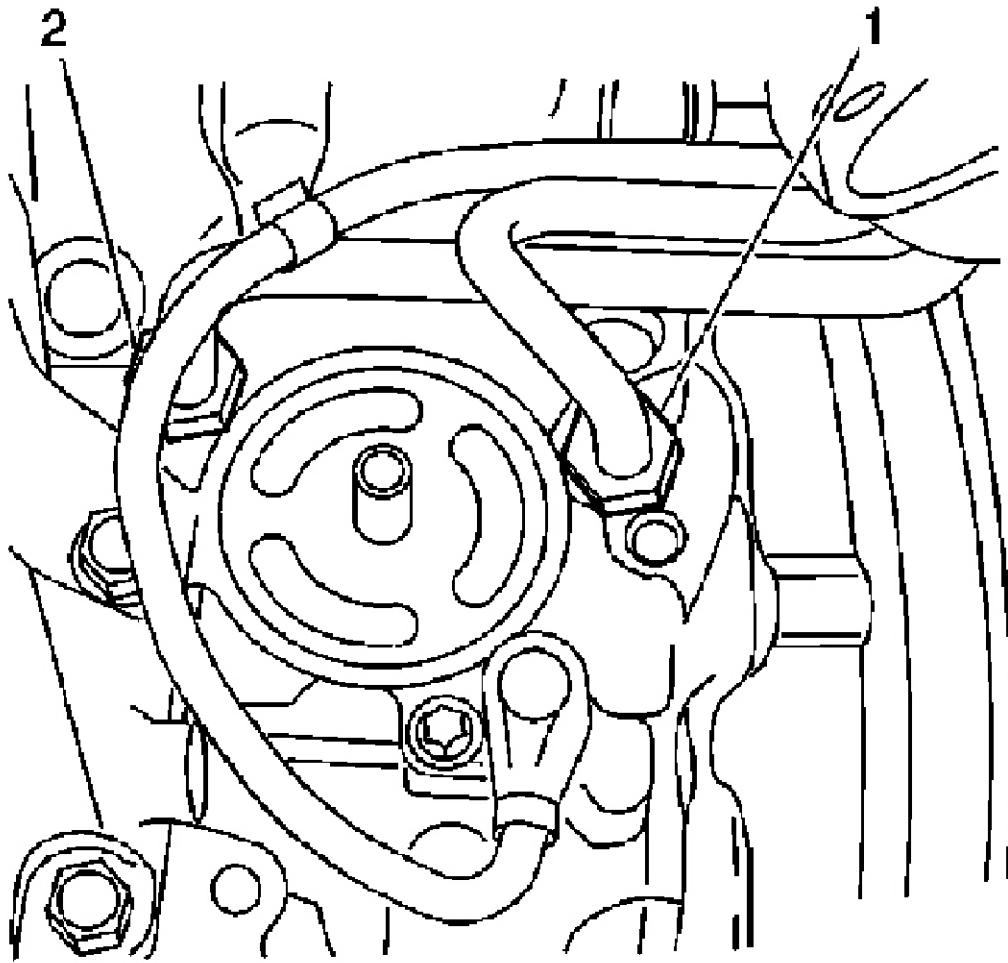
Disconnect negative battery cable. Remove resonance and air inlet ducting from throttle body. Drain cooling system. Remove front timing belt cover. See **FRONT TIMING BELT COVER** . Remove water pump bolts and water pump. To install, reverse removal procedure. See **TORQUE SPECIFICATIONS** .

OIL COOLER

Removal

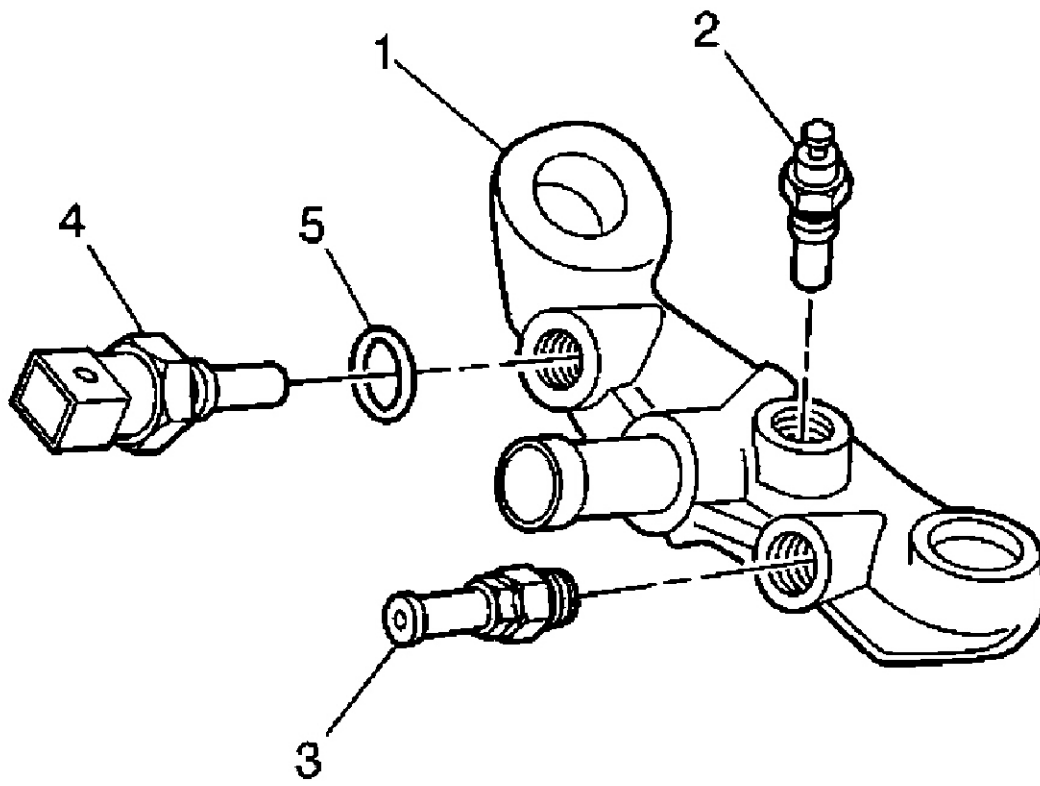
1. Raise and support the vehicle.
2. Drain the engine oil and remove the oil filter housing.
3. Loosen the oil cooler outlet (1) and the inlet (2) lines from engine block. See **Fig. 15** .
4. Lower the vehicle.
5. Remove the intake plenum. See **INTAKE PLENUM** .
6. Remove the intake manifold. See **INTAKE MANIFOLD & SPACER** .
7. Disconnect the following electrical connectors from the water crossover:
 - The engine coolant temperature sender (2).
 - The engine coolant temperature sensor (4). See **Fig. 16** .
8. Remove the water crossover bolts (1).
9. Remove the water crossover upper and lower seals (2). See **Fig. 17** .
10. Loosen the upper heat shield bolts on the left side of the exhaust manifold. See **Fig. 18** .
11. Remove the oil cooler outlet line from the engine oil cooler. See **Fig. 19** .
12. Remove the oil cooler inlet line from the engine oil cooler.
13. Note the positioning of the 4 seals. See **Fig. 20** .
14. Position oil feed and return lines aside and secure with mechanic wire.
15. Remove the engine oil cooler inlet and outlet nuts (1). See **Fig. 21** .
16. Remove the engine oil cooler cover bolts (2).
17. Remove the engine oil cooler cover.
18. Remove the engine oil cooler.

19. Clean all sealing surfaces.



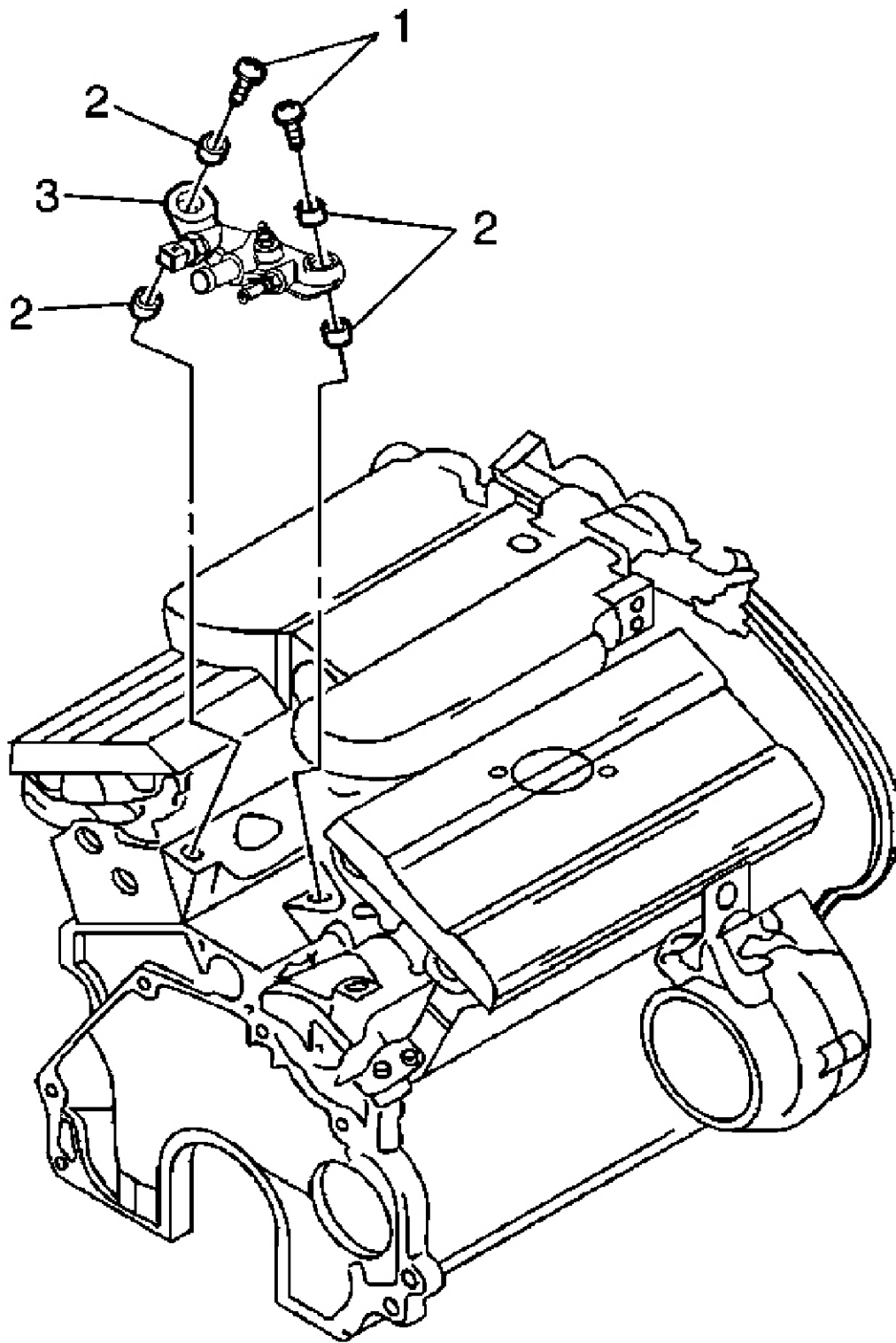
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Fig. 15: Removing/Installing Oil Cooler Lines At Engine Block
Courtesy of GENERAL MOTORS CORP.



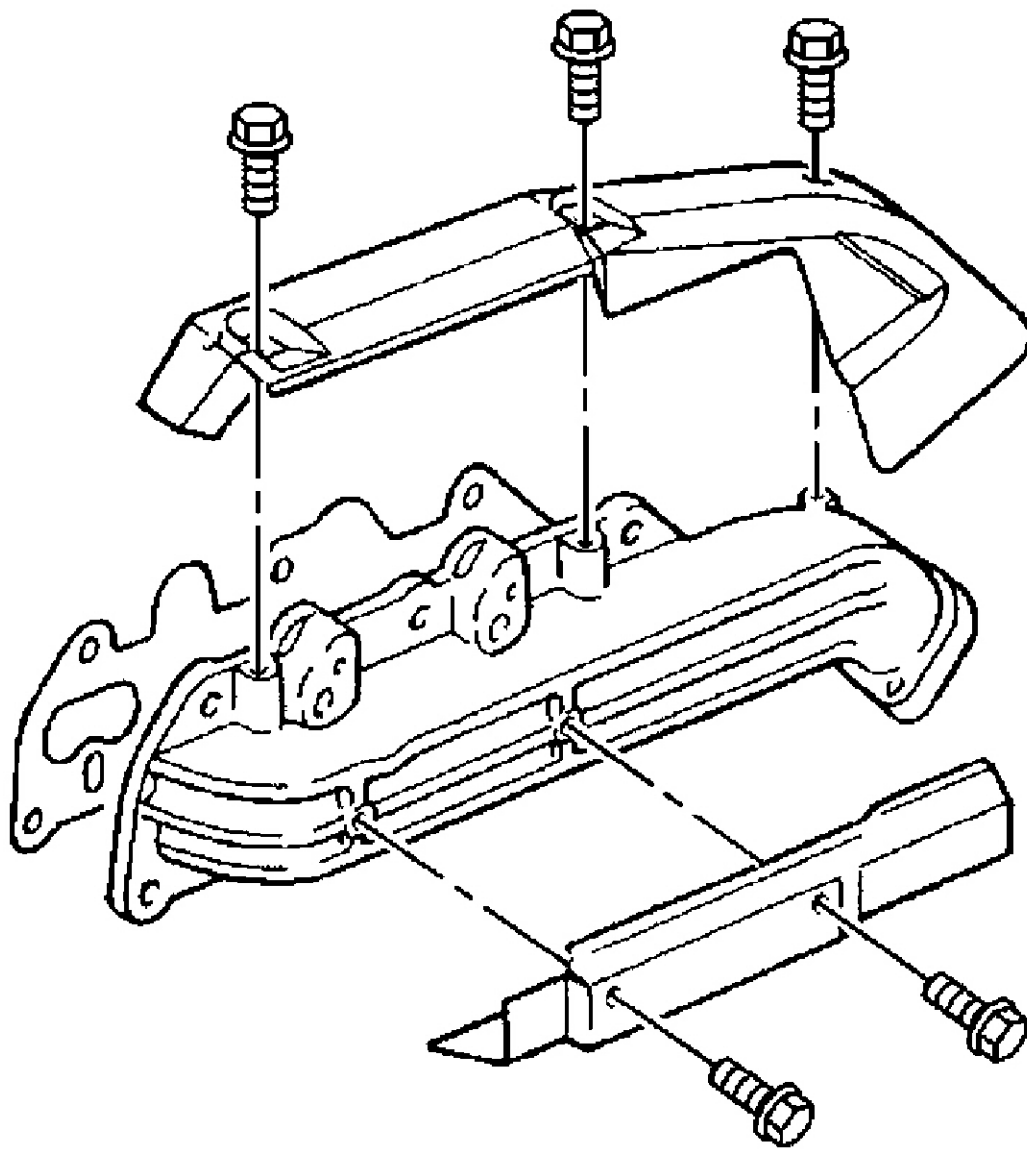
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Fig. 16: Removing Electrical Connectors From Coolant Sensor/Sender
Courtesy of GENERAL MOTORS CORP.



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Fig. 17: Removing/Installing Water Crossover
Courtesy of GENERAL MOTORS CORP.

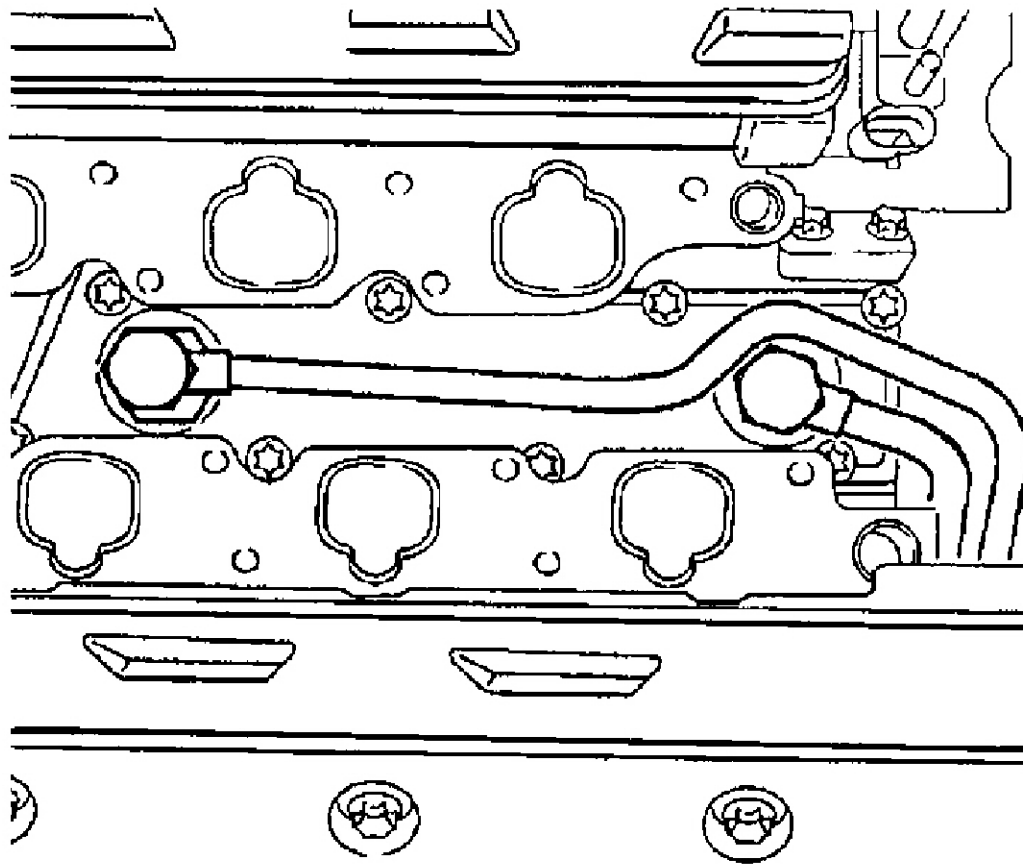


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Fig. 18: Removing Left Exhaust Manifold Heat Shield
Courtesy of GENERAL MOTORS CORP.

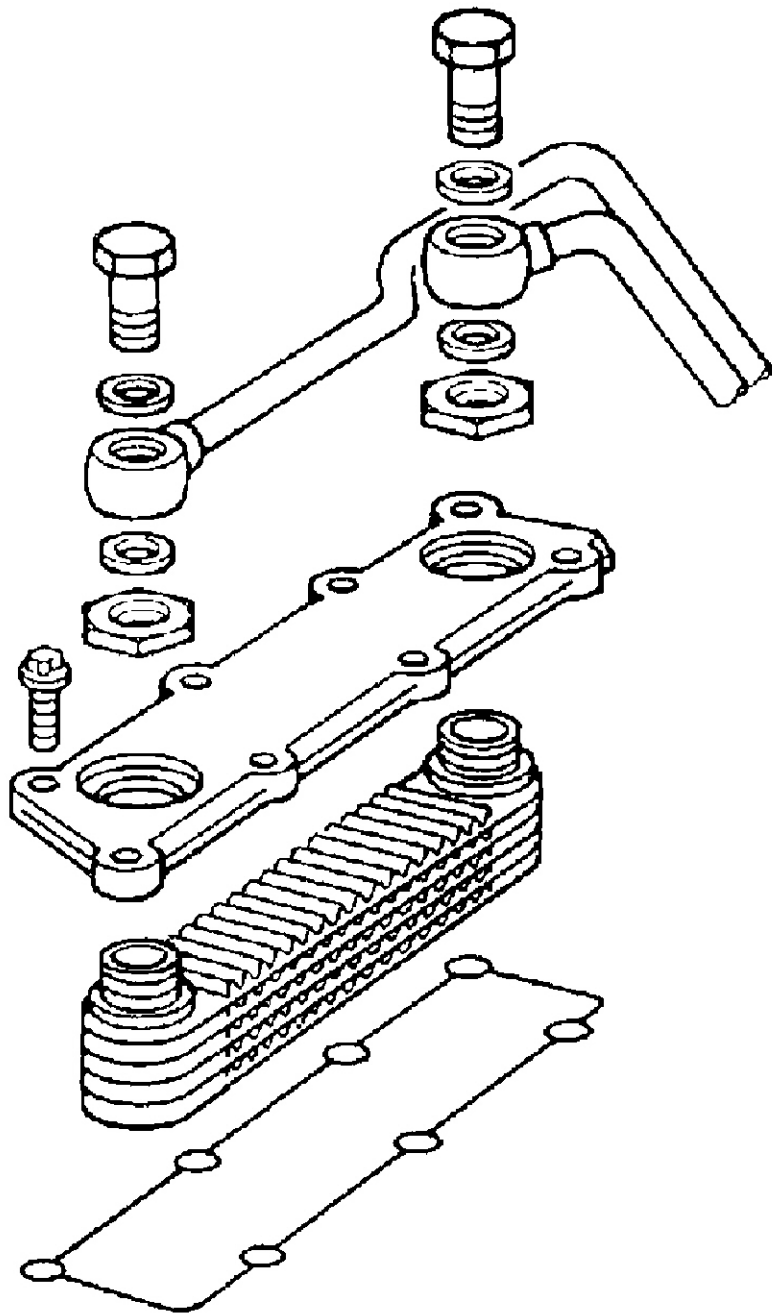
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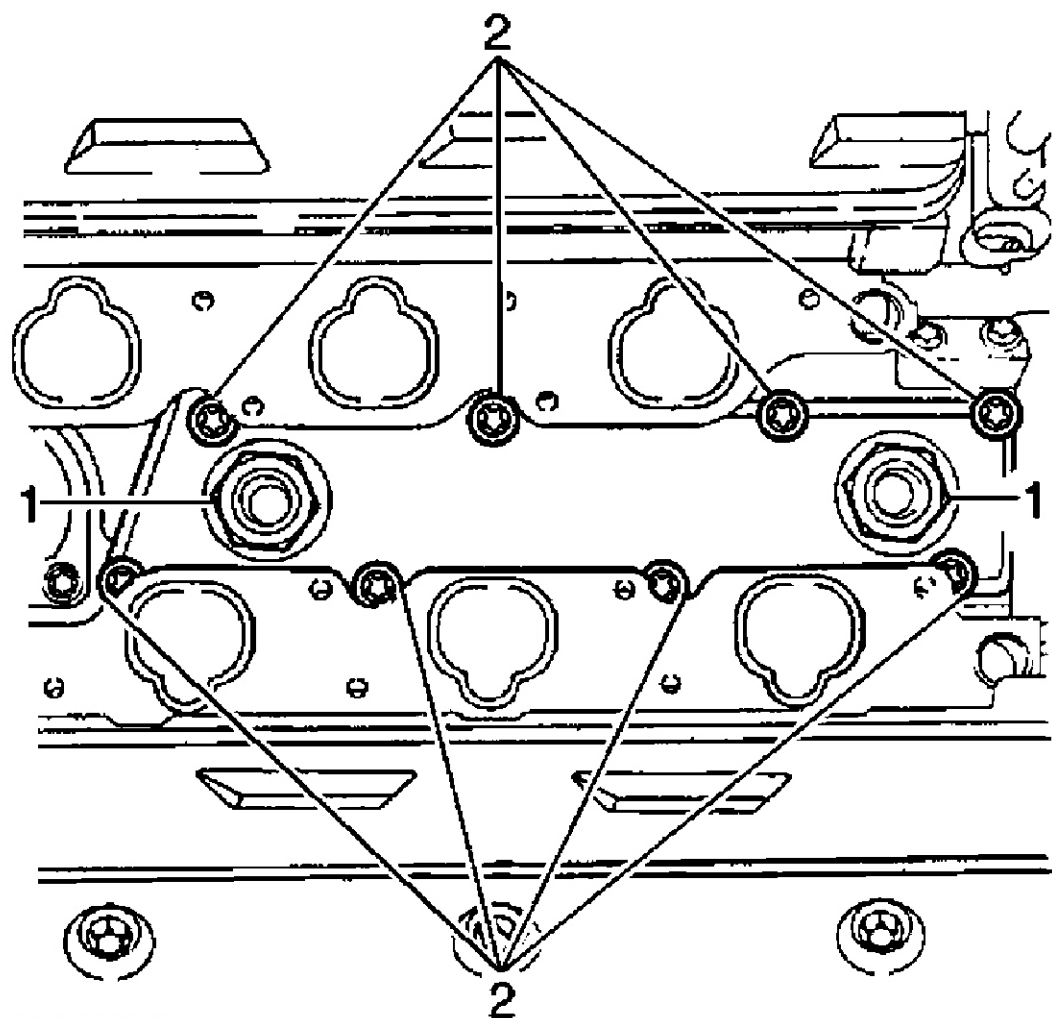
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Fig. 19: Removing Oil Cooler Inlet & Outlet Lines
Courtesy of GENERAL MOTORS CORP.



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Fig. 20: Exploded View Of Oil Cooler & Seals
Courtesy of GENERAL MOTORS CORP.



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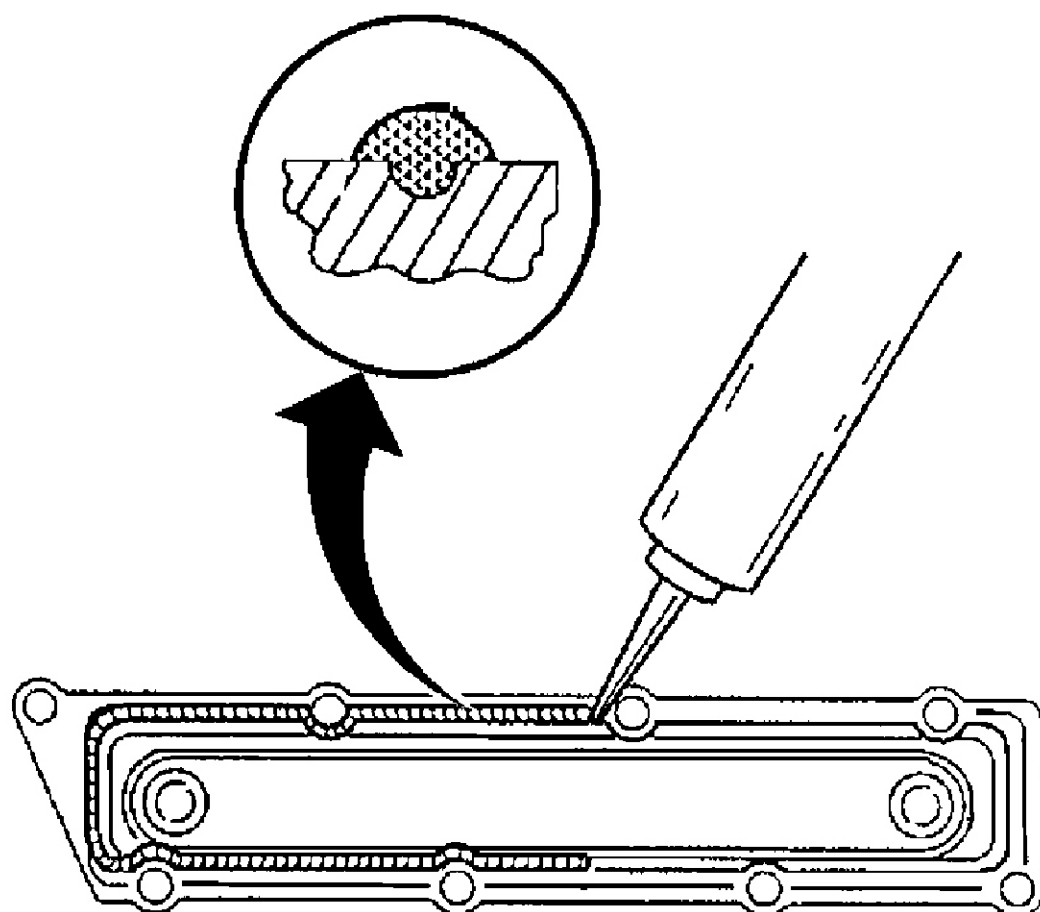
Fig. 21: Removing/Installing Oil Cooler Inlet/Outlet Nuts & Cover Bolts
 Courtesy of GENERAL MOTORS CORP.

Installation

NOTE: Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. Do not use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

1. Install the engine oil cooler.
2. Apply a 2 mm (0.08 in) bead of RTV silicone sealant, GM P/N 12346240, in the groove around the engine oil cooler cover. See **Fig. 22**.
3. Install the engine oil cooler cover.
4. Install the engine oil cooler cover bolts (2). See **Fig. 21**. Tighten the engine oil cooler cover bolts to 22 lb ft (30 N.m).
5. Install the engine oil cooler inlet and outlet nuts (1). See **Fig. 21**. Tighten the engine oil cooler inlet and outlet nuts to 15 lb ft (20 N.m).
6. Reposition the oil feed and return lines.

7. Install the oil cooler outlet and install the oil cooler inlet lines to the engine oil cooler. Use 4 new seals. Tighten the oil feed and return lines to 22 lb ft (30 N.m).
8. Install the water crossover
 - Position the crossover.
 - Install the upper and lower seals (2). See **Fig. 17** .
 - Install the water crossover bolts (1). Tighten the water crossover bolts to 22 lb ft (30 N.m).
- ∴
9. Connect the electrical connectors at the following locations:
 - The engine coolant temperature sensor (4)
 - The engine coolant temperature sender (2).
10. Install the intake manifold.. See **INTAKE MANIFOLD & SPACER** .
11. Install the intake plenum. See **INTAKE PLENUM** .
12. Raise the vehicle.
13. Install the oil cooler outlet (1) line to the engine block. See **Fig. 15** . Tighten oil cooler outlet (1) line to 22 lb ft (30 N.m).
14. Install the oil cooler inlet (2) line to the engine block. Tighten oil cooler inlet (2) line to 22 lb ft (30 N.m).
15. Install the oil filter housing to the engine block. Tighten the oil filter housing to 33 lb ft (45 N.m).
16. Lower the vehicle.
17. Fill the crankcase with engine oil.



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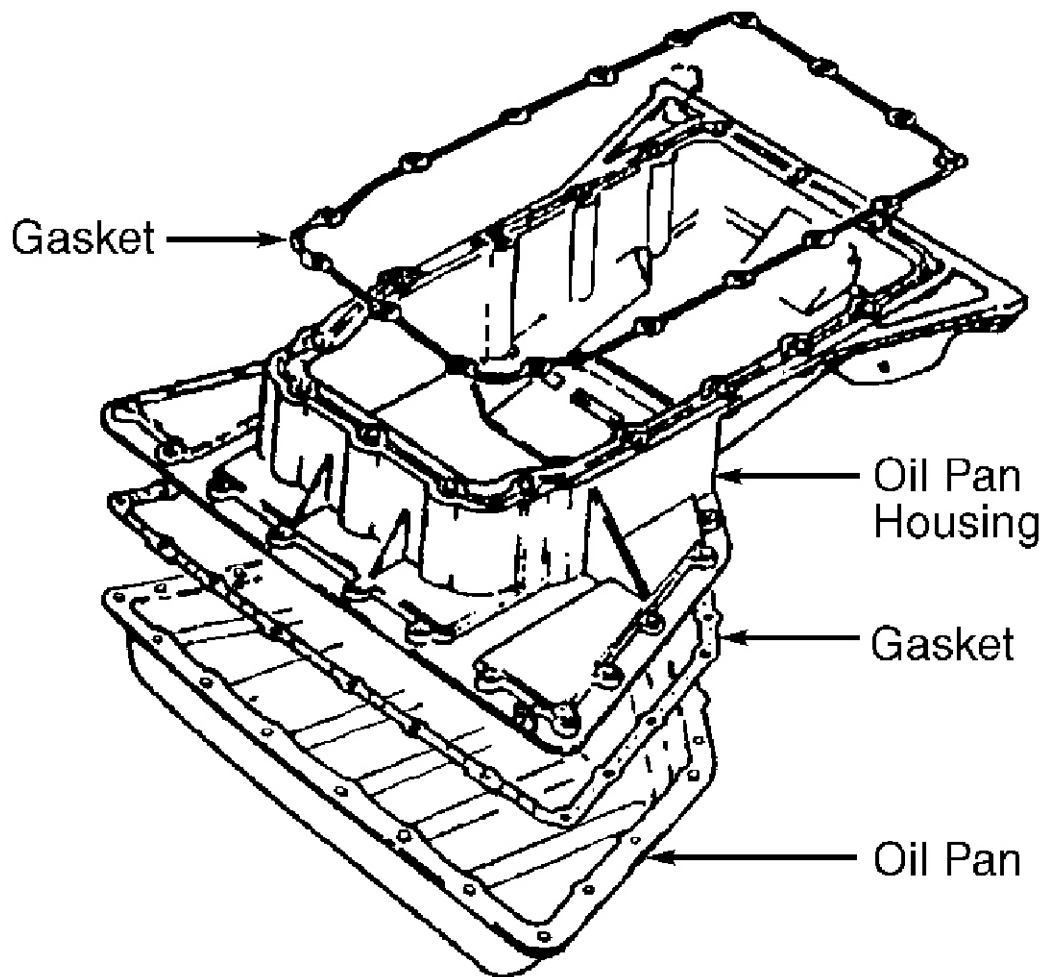
Fig. 22: Applying RTV Sealant To Oil Cooler Cover
Courtesy of GENERAL MOTORS CORP.

OIL PAN**Removal & Installation**

1. Disconnect negative battery cable. Raise and support vehicle. Remove splash shields. Drain engine oil. Disconnect oil level sensor. Remove oil pan mounting bolts and remove oil pan from oil pan housing. Remove oil level sensor retaining clip ("C" clip) from oil pan housing.
2. To install, reverse removal procedure. Install NEW oil level sensor connector "O" ring and lubricate with clean oil. Use NEW oil pan gasket. Tighten oil pan retaining bolts to specification. See **TORQUE SPECIFICATIONS** .

OIL PAN HOUSING**Removal & Installation**

1. Remove oil pan. See **OIL PAN** . Remove motor mount lower nuts from frame bracket. Remove oil intake pipe. On 2001 models, remove splash shield. Remove A/C compressor hose support strap. Remove oil pan housing bolts, leaving corner bolts to hold oil pan housing in place.
2. On 2000 models, mark drive shaft bolts for installation and remove drive shaft bolts. Slide drive shaft rearward, away from transmission, and secure in place. On all models, remove catalytic converter hanger bolts. Lower vehicle.
3. Using Engine Support (J28467-A), support and raise engine. See **Fig. 1** . Remove remaining oil pan housing bolts and remove oil pan housing and gasket. See **Fig. 23** . To install, reverse removal procedure. Apply a bead of silicone sealing compound in oil pan groove. Use NEW gaskets. See **TORQUE SPECIFICATIONS** .



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Fig. 23: Identifying Oil Pan & Oil Pan Housing Gaskets
 Courtesy of GENERAL MOTORS CORP.

OVERHAUL

NOTE: For repair procedures not covered in this article, see ENGINE OVERHAUL PROCEDURES article in GENERAL INFORMATION.

CYLINDER HEAD

Cylinder Head

Measure cylinder head height after resurfacing. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. Check cylinder head for warpage.

Valve Springs

If spring length is less than 1.338" (34 mm) while under a compressive force of 56.6 lbs. (25.62 kg), replace spring. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Installed Spring Height

See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valve Stem Oil Seals

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Coat valve stem with clean oil. Install valve spring seat. Install protective sleeve over valve stem (provided with new seals). Using Seal Installer (J41775), install seal. Remove protective sleeve.

Valve Guides

Valve guides cannot be replaced and must be reamed to oversize.

Valve Seat

Grind valve seats to 45-degree angle.

Valves

Grind valve to an angle of 45 degrees. Use lapping compound to finish face.

Valve Seat Correction Angles

Use a 30-degree or 60-degree stone to correct valve seat width.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

Mark pistons, rods and caps for reassembly reference. Using a bench press, press out piston pins. Check pins and bearings for damage or wear. Replace as necessary.

Fitting Pistons

Install piston and rod assembly with arrow on top of piston pointing toward front of engine. Oil cylinder with clean oil.

Piston Rings

Check piston rings end gap and side clearance. Check ring bore by depressing ring into cylinder using an inverted piston. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS. Lubricate pistons and rings with clean oil. Install rings onto pistons. Stagger ring gaps. See **Fig. 24**.

Rod Bearings

Using a micrometer, measure rod bearing journal diameter, taper and out-of-round. Measure bearing clearance with Plastigage.

Crankshaft & Main Bearings

Turn engine upside-down to prevent weight of crankshaft from affecting measurements. Measure bearing clearance with Plastigage positioned to one side of centerline.

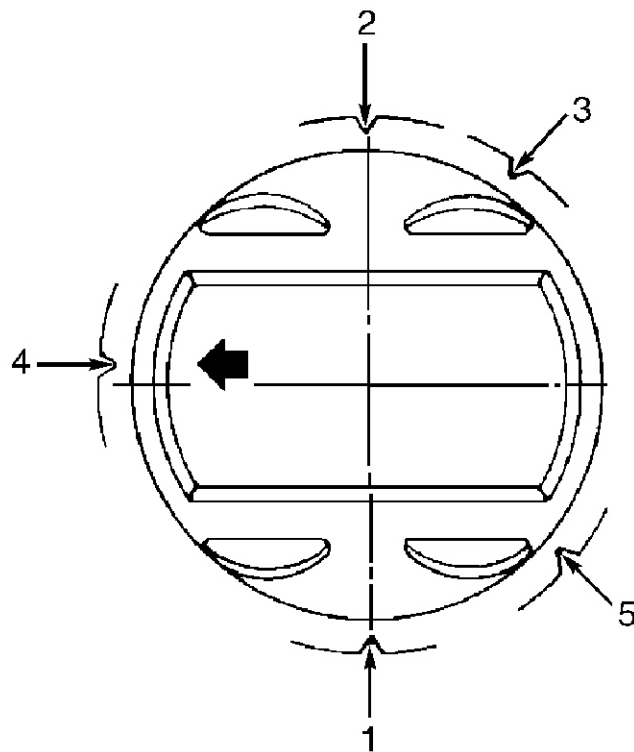
Thrust Bearing

With crankshaft bearing caps and torsional bearing bridge installed, mount a dial indicator onto back of engine block. Move crankshaft forward and rearward, noting total movement. If movement exceeds specification, replace the thrust bearings. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.

Cylinder Block

Check each cylinder for wear or damage. Check for cracks in cylinder walls, coolant passages and main bearing insert cavities. If any cracks are found, replace cylinder block. Ensure oil passages are clean. Ensure freeze plugs are in good condition. Check cylinder walls for gouges, pitting or scores deeper than .002" (.05 mm). If any are

found, cylinders will have to be bored.



PISTON RING POSITION

Position	End Gap
1	1st Compression Ring
2	2nd Compression Ring
3	Upper Oil Control Ring
4	Spacer Oil Control Ring
5	Lower Oil Control Ring

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Fig. 24: Positioning Piston Ring End Gaps
 Courtesy of GENERAL MOTORS CORP.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Oil pump is located in front engine cover and is driven by the crankshaft. Oil flows through a full-flow filter to oil passages which feed main bearings, rod bearings and valve train.

Crankcase Capacity

Oil capacity is 4.8 qts. (4.5L) including filter.

Oil Pressure

With engine at normal operating temperature, oil pressure at idle should be approximately 21.7 psi. (1.525 kg/cm²).

OIL PUMP

Removal & Installation

1. Disconnect negative battery cable. Remove resonance and air inlet ducting from throttle body. Drain cooling

- system. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Remove timing belt. See **TIMING BELT** . Remove rear timing belt cover. See **REAR TIMING BELT COVER** .
2. Remove A/C compressor. Remove A/C and P/S brackets. Remove generator lower bolt, and position aside. Remove upper oil pan housing. See **OIL PAN HOUSING** . Install Crankshaft Holder (J42069-10). Remove crankshaft drive gear bolt and remove crankshaft drive gear.
 3. Remove oil pan housing. See **OIL PAN HOUSING** . Remove oil pump housing bolts and remove oil pump. See **Fig. 25** . Remove front oil seal from oil pump housing. Clean all surfaces.
 4. To install, reverse removal procedure. Lubricate all components and use NEW gaskets. See **Fig. 26** . See **TORQUE SPECIFICATIONS** . Evacuate and charge A/C system using approved equipment.

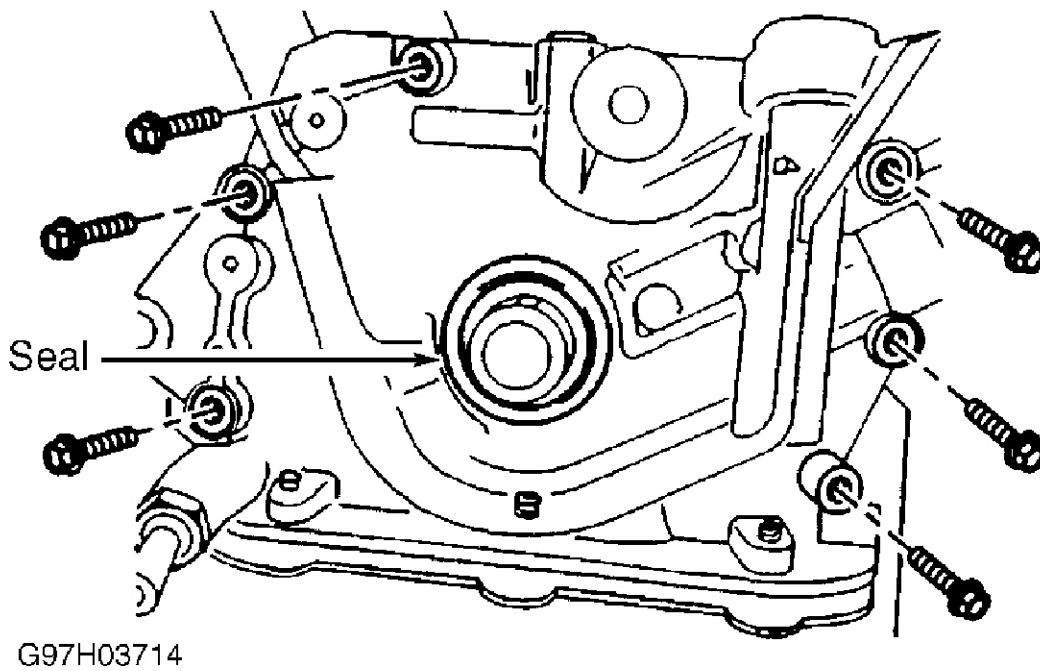
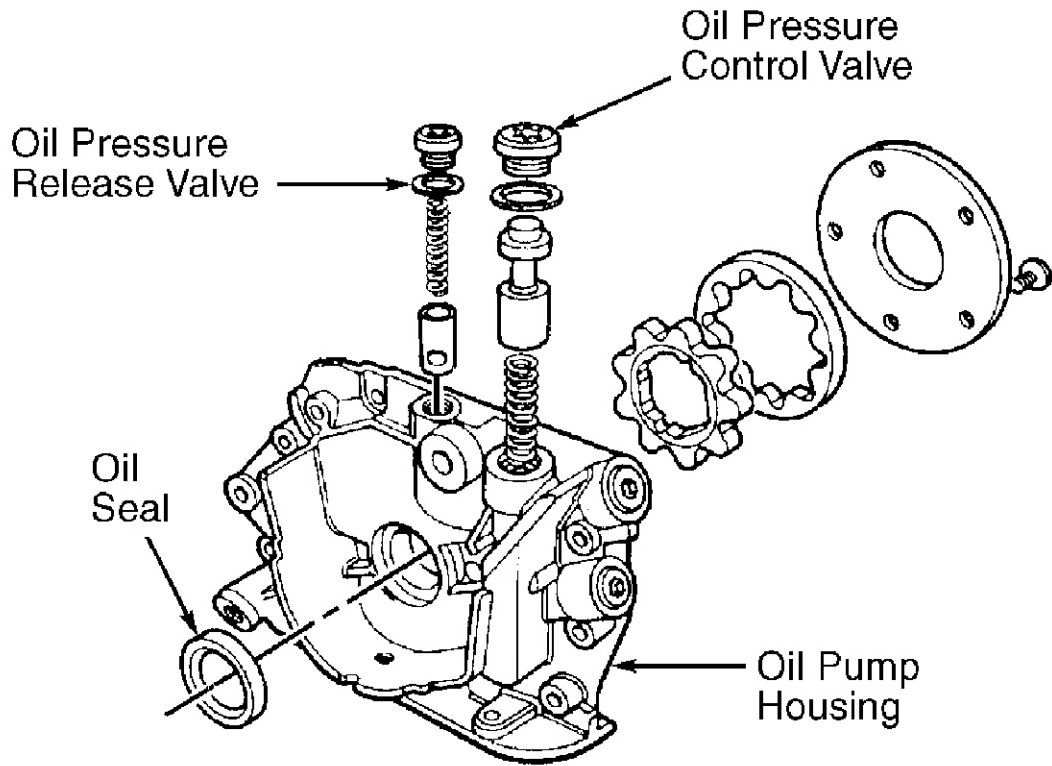


Fig. 25: Removing Oil Pump Housing Bolts
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Fig. 26: Exploded View Of Oil Pump & Components
 Courtesy of GENERAL MOTORS CORP.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
A/C Compressor Mounting Bracket	30 (40)
A/C & P/S Accessory Bracket Bolt	30 (40)
Air Injection Crossover Support Bracket	30 (40)
Air Injection Pipe Bolt	15 (20)
Camshaft Gear Bolt	
Step 1	37 (50)
Step 2	Additional 60 degrees
Step 3	Additional 15 degrees
Catalytic Converter Bolt	15 (20)
Coolant Bridge Bolt	22 (30)
Coolant Pipe/Engine Lift Bracket Bolt	15 (20)
Crankshaft Drive Gear Bolt	
Step 1	184 (250)
Step 2	Additional 45 degrees
Step 3	Additional 15 degrees
Cylinder Head Bolt	

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Step 1	18 (25)
Step 2	Additional 90 degrees
Step 3	Additional 90 degrees
Step 4	Additional 90 degrees
Step 5	Additional 15 degrees
Engine Oil Cover Bolt	22 (30)
Exhaust Manifold Nut	15 (20)
Flex Plate Bolt	
Step 1	48 (65)
Step 2	Additional 30 degrees
Step 3	Additional 15 degrees
Generator Mounting Bolt	
Lower	26 (35)
Upper	30 (40)
Harmonic Balancer	15 (20)
Intake Manifold Bolt	15 (20)
Intake Manifold Spacer Bolt	15 (20)
Motor Mount	
Lower	41 (55)
Upper	30 (40)
Oil Filter	11 (15)
Oil Pan Drain Plug Bolt	41 (55)
Oil Pan Housing Bolt	11 (15)
Reluctor Ring Screw	11 (15)
Serpentine Belt Tensioner Bolt	30 (40)
Spark Plug	18 (25)
Thermostat Housing Bolt	15 (20)
Timing Belt Tensioner Bracket Bolt	30 (40)
Timing Belt Tensioner Fastening Nut	15 (20)
Torsional Bearing Bridge Bolt	15 (20)
INCH Lbs (N.m)	
Air Injection Crossover Pipe Nut	108 (12)
Camshaft Bearing Cap Bolt	71 (8)
Ignition Coil Bolt	71 (8)
Intake Plenum Bolt	71 (8)
Intake Plenum Switchover Valve Bolt	71 (8)
Oil Intake Pipe Bolt	71 (8)
Oil Pan Baffle Bolt	71 (8)
Oil Pan Bolt, Lower	71 (8)
Rear Timing Cover Bolt	71 (8)
Timing Belt Cover Bolt	71 (8)

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Valve Cover Bolt	71 (8)
Water Pump Pulley Bolt	71 (8)
Wiring Harness Support Bracket Bolt	71 (8)

ENGINE SPECIFICATIONS**GENERAL ENGINE SPECIFICATIONS**

Application	Specification
Displacement	181 Cu. In. (3.0L)
Bore	3.3858" (86 mm)
Stroke	3.3464" (85 mm)
Compression Ratio	10.0:1
Fuel System	SFI

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
Crankshaft	
End Play	.0004-.030 (.010-.76)
Main Journal Diameter ⁽¹⁾	
Green ⁽²⁾	2.6763-2.6766 (67.980-67.988)
Brown ⁽²⁾	2.6766-2.6770 (67.988-67.996)
Journal Out-Of-Round	.0012 (.003)
Oil Clearance	.0006-.00117 (.014-.043)
Connecting Rod	
Journal Diameter ⁽²⁾	1.927-1.928 (48.971-48.987)
Journal Out-Of-Round	(3)
Journal Taper	(3)
Oil Clearance	(3)
(1) Color coded to size designation.	
(2) Available in .0098" (.25 mm) and .0197" (.50 mm) undersize.	
(3) Information is not available from manufacturer.	

CONNECTING RODS

Application	In. (mm)
Big End Bore Diameter	2.0472-2.0477 (52.000-52.012)
Side Clearance	.0028-.0110 (.07-.28)
Bearing Clearance	.0005-.0024 (.013-.061)
Maximum Bend	(1)
Maximum Twist	(1)
(1) Information is not available from manufacturer.	

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PISTONS, PINS & RINGS

Application	In. (mm)
Piston Bore Clearance	.0010-.0018 (.025-.045)
Select Piston Diameter ⁽¹⁾	
8	3.3834-3.3838 (85.940-85.950)
99	3.3838-3.3842 (85.950-85.960)
00	3.3842-3.3846 (85.960-85.970)
01	3.3846-3.3850 (85.970-85.980)
02	3.3850-3.3854 (85.980-85.990)
7+0.5 (Oversize)	3.4027-3.4031 (86.430-86.440)
Pin Diameter	.8268 (21.0)
Piston Pin Clearance	.0001-.0003 (.003-.008)
Piston Rings	
Compression Rings	
Thickness	.0590 (1.5)
Side Clearance	.0008-.0015 (.02-.04)
End Gap	.0118-.0196 (.30-.50)
Oil Ring	
Thickness	.1181 (3.0)
Side Clearance	.0004-.0012 (.01-.03)
End Gap	.0157-.0551 (.40-1.40)
(1) Select fit designation stamped on top of piston.	

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore	
Select Bore Diameter ⁽¹⁾	
8	3.3848-3.3852 (85.975-85.985)
99	3.3852-3.3856 (85.985-85.995)
00	3.3856-3.3860 (85.995-86.005)
01	3.3860-3.3864 (86.005-86.015)
02	3.3864-3.3868 (86.015-86.025)
7+0.5 (Oversize)	3.4041-3.4045 (86.465-86.475)
Maximum Out-Of-Round	.0026 (.065)
Taper	.0003 (.0080)

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(1) Select fit designation stamped on top cylinder block.

CYLINDER HEAD, VALVES & VALVE SPRINGS

Application	Specification
Cylinder Head Height (Minimum)	5.27" (134 mm)
Maximum Warpage ⁽¹⁾	.002" (.05 mm)
Valve Face Angle	45°
Valve Seats	
Seat Angle	45°
Seat Width	
Intake	.0394-.0551" (1.00-1.40 mm)
Exhaust	.0551-.0709" (1.40-1.80 mm)
Valve Guide Diameter	
Standard	.2362-.2367" (6.000-6.012 mm)
Oversize	.2392-.2398" (6.075-6.090 mm)
Valve Length	
Standard	
Intake	4.016" (102 mm)
Exhaust	3.622" (92 mm)
Minimum	
Intake	4.004" (101.7 mm)
Exhaust	3.6141" (91.8 mm)
Valve Stem Diameter	
Standard	
Intake	.2344-.2350" (5.955-5.970 mm)
Exhaust	.2341-.2346" (5.945-5.960 mm)
Oversize	
Intake	.2374" (6.030 mm)
Exhaust	.2370" (6.020 mm)
Valve Stem Clearance	
Intake	.0012-.0022" (.030-.057 mm)
Exhaust Valve	.0016-.0026" (.040-.067 mm)
Valve Spring Installed Height	1.543" (39.2 mm)
Valve Spring Compressed Height	1.338" (34mm) @ 56.6 Lbs. (25.7 kg)

(1) Maximum warpage per 3.9" (100 mm) length.

CAMSHAFT

Application	In. (mm)
Bore Diameter	(1)

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End Play	.0016-.0057 (.040-.144)
Journal Diameter	1.099-1.101 (27.939-27.960)
Journal Runout	.0023 (.060)
Bearing Clearance	.0015-.0020 (.038-.051)
Lobe Lift	.3937 (10.0)
Lobe Height	(1)
(1) Information is not available from manufacturer.	

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