

CADILLAC

SRX

22

BRAKES22-10

ANTI-LOCK BRAKE SYSTEM

(ABS).....	22-10
General Information.....	22-10
Precautions.....	22-10
Speed Sensors.....	22-10
Removal & Installation.....	22-10

BLEEDING THE BRAKE

SYSTEM22-11	
Bleeding Procedure.....	22-11
Bleeding the ABS	
System.....	22-11
Fluid Fill Procedure.....	22-13
Hydraulic Brake System	
Bleeding.....	22-12
Master Cylinder Bench	
Bleeding.....	22-13

FRONT DISC BRAKES22-14

Brake Caliper.....	22-14
Removal & Installation.....	22-14
Disc Brake Pads.....	22-14
Removal & Installation.....	22-14

PARKING BRAKE.....22-16

Parking Brake Cables.....	22-16
Adjustment.....	22-16
Parking Brake Shoes.....	22-16
Parking Brake Adjuster	
Disabling.....	22-17
Parking Brake Adjuster	
Enabling.....	22-17
Removal & Installation.....	22-16

REAR DISC BRAKES22-15

Brake Caliper.....	22-15
Removal & Installation.....	22-15
Disc Brake Pads.....	22-16
Removal & Installation.....	22-16

CHASSIS ELECTRICAL22-18

AIR BAG (SUPPLEMENTAL RESTRAINT SYSTEM)22-18

General Information.....	22-18
Arming the System.....	22-18
Clockspring Centering.....	22-19
Disarming the System.....	22-18
Service Precautions.....	22-18

DRIVE TRAIN22-19

Automatic Transmission	
Fluid.....	22-19
Checking Fluid.....	22-19
Fluid Refill.....	22-19
Front Halfshaft.....	22-21
Removal & Installation.....	22-21
Rear Axle Fluid.....	22-21
Drain & Refill.....	22-21
Rear Driveshaft (Propeller Shaft).....	22-22
Removal & Installation.....	22-22
Rear Halfshaft.....	22-22
Removal & Installation.....	22-22
Transfer Case Assembly.....	22-20
Removal & Installation.....	22-20

ENGINE COOLING22-23

Engine Coolant.....	22-23
Drain & Refill Procedure.....	22-23
Flushing.....	22-23
Engine Fan.....	22-23
Removal & Installation.....	22-23
Radiator.....	22-24
Removal & Installation.....	22-24
Thermostat.....	22-24
Removal & Installation.....	22-24
Water Pump.....	22-24
Removal & Installation.....	22-24

ENGINE ELECTRICAL22-25

BATTERY SYSTEM.....22-25

Battery.....	22-25
Removal & Installation.....	22-25

CHARGING SYSTEM22-26

Alternator.....	22-26
Removal & Installation.....	22-26

IGNITION SYSTEM22-26

Firing Order.....	22-26
Ignition Coil.....	22-26
Removal & Installation.....	22-26
Ignition Timing.....	22-26
Adjustment.....	22-26
Spark Plugs.....	22-26
Removal & Installation.....	22-26

STARTING SYSTEM22-27

Starter.....	22-27
Removal & Installation.....	22-27

ENGINE MECHANICAL22-27

Accessory Drive Belts.....	22-27
Accessory BELT Routing.....	22-27
Adjustment.....	22-27
Inspection.....	22-27
Removal & Installation.....	22-27
Air Cleaner.....	22-27
Filter/element	
Replacement.....	22-28
Removal & Installation.....	22-27
Camshaft and Valve Lifters.....	22-28
Inspection.....	22-28
Removal & Installation.....	22-28
Catalytic Converter/	
Exhaust Manifold.....	22-30
Removal & Installation.....	22-30
Crankshaft Front Seal.....	22-32
Removal & Installation.....	22-32
Cylinder Head.....	22-32
Removal & Installation.....	22-32
Engine Oil & Filter.....	22-34
Replacement.....	22-34
Exhaust Manifold.....	22-34
Removal & Installation.....	22-34
Intake Manifold.....	22-35
Removal & Installation.....	22-35
Oil Pan.....	22-35
Removal & Installation.....	22-35
Oil Pump.....	22-36
Inspection.....	22-36
Removal & Installation.....	22-36
Piston and Ring.....	22-36
Positioning.....	22-36
Rear Main Seal.....	22-36
Removal & Installation.....	22-36
Timing Chain & Sprockets.....	22-41
Removal & Installation.....	22-41
Timing Chain Front	
Cover.....	22-37
Removal & Installation.....	22-37
Turbocharger.....	22-43
Removal & Installation.....	22-43

Valve Covers	22-43
Removal & Installation.....	22-43
Valve Lash.....	22-44
Adjustment	22-44

ENGINE PERFORMANCE & EMISSION CONTROLS22-44

Camshaft Position (CMP)	
Sensor	22-44
Location.....	22-44
Removal & Installation.....	22-44
Crankshaft Position (CKP)	
Sensor	22-45
Location.....	22-45
Removal & Installation.....	22-45
Electronic Control Module (ECM)	22-45
Location.....	22-45
Removal & Installation.....	22-45
Engine Coolant Temperature (ECT) Sensor	22-45
Location.....	22-45
Removal & Installation.....	22-45
Heated Oxygen (HO2S)	
Sensor	22-45
Location.....	22-45
Removal & Installation.....	22-46
Intake Air Temperature (IAT)	
Sensor	22-47
Location.....	22-47
Removal & Installation.....	22-47
Knock Sensor (KS).....	22-47
Location.....	22-47
Removal & Installation.....	22-47
Manifold Absolute Pressure (MAP) Sensor	22-47
Location.....	22-47
Removal & Installation.....	22-47
Mass Air Flow (MAF)	
Sensor	22-48
Location.....	22-48
Removal & Installation.....	22-48

FUEL22-48

GASOLINE FUEL INJECTION

SYSTEM	22-48
Fuel Filter.....	22-48
Removal & Installation.....	22-48
Fuel Injectors	22-48
Removal & Installation.....	22-48

Fuel Pump.....	22-50
Removal & Installation.....	22-50
Fuel System Service	
Precautions	22-48
Fuel Tank.....	22-50
Draining.....	22-50
Removal & Installation.....	22-50
Idle Speed.....	22-51
Adjustment	22-51
Relieving Fuel System	
Pressure.....	22-48
Throttle Body.....	22-51
Removal & Installation.....	22-51
Throttle Learn/reset	
Procedure.....	22-51

HEATING & AIR CONDITIONING SYSTEM22-52

Blower Motor	22-52
Removal & Installation.....	22-52
Heater Core	22-52
Removal & Installation.....	22-52

PRECAUTIONS.....22-10

SPECIFICATIONS AND MAINTENANCE CHARTS.....22-3

Additional Maintenance	
Services-Normal	22-9
Additional Maintenance	
Services-Severe	22-9
Brake Specifications.....	22-7
Camshaft Specifications.....	22-5
Capacities	22-7
Crankshaft and Connecting	
Rod Specifications	22-5
Engine and Vehicle	
Identification	22-3
Engine Tune-Up	
Specifications	22-3
Fluid Specifications.....	22-3
General Engine	
Specifications	22-3
Maintenance I and II Service	
Schedules	22-8
Piston and Ring	
Specifications	22-5
Tire and Wheel	
Specifications	22-7

Torque Specifications	22-6
Valve Specifications	22-4
Wheel Alignment.....	22-6

STEERING22-53

Power Steering Gear.....	22-53
Removal & Installation.....	22-53
Power Steering Pump.....	22-53
Bleeding	22-53
Fluid Fill Procedure	22-54
Removal & Installation.....	22-53

SUSPENSION22-54

FRONT SUSPENSION22-54

Control Links	22-54
Removal & Installation.....	22-54
Lower Ball Joint	22-54
Removal & Installation.....	22-54
Lower Control Arm.....	22-54
Removal and & Installation.....	22-54
Stabilizer Bar	22-55
Removal & Installation.....	22-55
Steering Knuckle	22-55
Removal & Installation.....	22-55
Steering Linkage Outer	
Tie Rod	22-56
Removal & Installation.....	22-56
Strut & Spring Assembly	22-56
Removal & Installation.....	22-56
Wheel Bearings	22-57
Adjustment	22-57
Removal & Installation.....	22-57

REAR SUSPENSION22-57

Coil Spring.....	22-57
Removal & Installation.....	22-57
Knuckle	22-57
Removal & Installation.....	22-57
Lower Control Arm.....	22-58
Removal & Installation.....	22-58
Shock Absorber.....	22-58
Removal & Installation.....	22-58
Stabilizer Bar	22-59
Removal & Installation.....	22-59
Upper Control Arm.....	22-59
Removal & Installation.....	22-59
Wheel Bearings	22-59
Adjustment	22-59
Removal & Installation.....	22-59

SPECIFICATIONS AND MAINTENANCE CHARTS

ENGINE AND VEHICLE IDENTIFICATION

Engine							Model Year	
Code ①	Liters	Cu. In.	Cyl.	Fuel Sys.	Engine Type	Eng. Mfg.	Code ②	Year
6	2.8	170	V6	SFI	DOHC	GM	A	2010
Y	3.0	183	V6	SIDI	DOHC	GM	B	2011

① 8th position of VIN

② 10th position of VIN

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GENERAL ENGINE SPECIFICATIONS

All measurements are given in inches.

Year	Model	Engine Displacement	Engine ID/VIN	Fuel System Type	Net Horsepower @ rpm	Net Torque @ rpm (ft. lbs.)	Bore x Stroke (in.)	Compression Ratio	Oil Pressure @ rpm
		Liters							
2010	SRX	2.8	6	SFI	300@5500	295@1850	3.50x2.95	10.0:1	20@2000
		3.0	Y	SIDI	265@6950	223@5700	3.50x3.16	11.7:1	20@2000
2011	SRX	3.0	Y	SIDI	265@6950	223@5700	3.50x3.16	11.7:1	20@2000

25742_CSRX_C0002

ENGINE TUNE-UP SPECIFICATIONS

Year	Engine Displacement		Spark Plug Gap (in.)	Ignition Timing (deg.)		Fuel Pump (psi)	Idle Speed (rpm)		Valve Clearance (in.)	
	Liters	Engine ID/VIN		MT	AT		MT	AT	Intake	Exhaust
2010	2.8	6	0.43	①	①	276-725 PSI	①	①	②	②
	3.0	Y	0.43	①	①	276-725 PSI	①	①	②	②
2011	3.0	Y	0.43	①	①	276-725 PSI	①	①	②	②

NS Not Supplied

NA Not Applicable

① Ignition timing and idle speed are computer controlled and not adjustable.

② Hydraulic lifters

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CAPACITIES

Year	Model	Engine Displacement	Engine ID/VIN	Engine Oil with Filter (qts.)	Transmission (pts.)		Transfer Case (pts.)	Drive Axle (pts.)	Fuel Tank (gal.)	Cooling System (qts.)
		Liters			Auto.	Manual				
2010	SRX	2.8	6	6.0	NA	NA	1.5	1.4	21.0	12.15
		3.0	Y	6.0	18.0	NA	1.5	1.4	21.0	12.3
2011	SRX	3.0	Y	6.0	18.0	NA	1.5	1.4	21.0	12.3

NOTE: All capacities are approximate. Add fluid gradually and ensure a proper fluid level is obtained.

25742_CSRX_C0004

FLUID SPECIFICATIONS

Year	Model	Engine Displacement	Engine Oil	Manual Trans.	Auto. Trans.	Drive Axle Rear	Power Steering Fluid	Brake Master Cylinder	Cooling System
		Liters							
2010	SRX	2.8	5W-30	NA	AW-1	②	③	④	⑤
		3.0	5W-30	NA	①	②	③	④	⑤
2011	SRX	3.0	5W-30	NA	①	②	③	④	⑤

DOT: Department Of Transportation

① Dexron IV

② GM part #88861950

③ GM Power Steering Fluid

④ DOT 3 or equivalent

⑤ Green Engine Coolant

25742_CSRX_C0006

VALVE SPECIFICATIONS

Year	Engine Displacement Liters	Engine ID/VIN	Seat Angle (deg.)	Face Angle (deg.)	Spring Test Pressure (lbs. @ in.)	Spring Installed Height (in.)	Stem-to-Guide Clearance (in.)		Stem Diameter (in.)	
							Intake	Exhaust	Intake	Exhaust
2010	2.8	6	45.0	44.25	61 lbs. @ 1.378 in.	1.378	0.0010- 0.0026	0.0014- 0.0030	0.2344- 0.2352	0.2341- 0.2348
	3.0	Y	45.0	44.25	61 lbs. @ 1.378 in.	1.3870- 1.445	0.0010- 0.0026	0.0014- 0.0030	0.2344- 0.2352	0.2341- 0.2348
2011	3.0	Y	45.0	44.25	61 lbs. @ 1.378 in.	1.3870- 1.445	0.0010- 0.0026	0.0014- 0.0030	0.2344- 0.2352	0.2341- 0.2348

25742_CSRX_C0006

CAMSHAFT SPECIFICATIONS

All measurements in inches unless noted

Year	Engine Displacement	Engine Code/VIN	Journal Diameter	Brg. Oil Clearance	Shaft End-play	Runout	Journal Bore	Lobe Height	
	Liters							Intake	Exhaust
2010	2.8	6	①	0.0016-0.0033	0.0018-0.0085	②	NS	1.6687-1.6805	1.6715-1.6833
	3.0	Y	①	0.0016-0.0033	0.0018-0.0085	②	NS	1.6687-1.6805	1.6715-1.6833
2011	3.0	Y	①	0.0016-0.0033	0.0018-0.0085	②	NS	1.6687-1.6805	1.6715-1.6833

① Journal Diameter 1st: 1.3779-1.3787, Journal Diameter Other: 1.0630-1.0638

② Runout 1st: 1.3779-1.3787, Other: 1.0630-1.0638

25742_CSRX_C0007

CRANKSHAFT AND CONNECTING ROD SPECIFICATIONS

All measurements are given in inches.

Year	Engine Displacement	Engine ID/VIN	Crankshaft			Connecting Rod			
	Liters		Main Brg. Journal Dia.	Main Brg. Oil Clearance	Shaft End-play	Thrust on No.	Journal Diameter	Oil Clearance	Side Clearance
2010	2.8	6	2.6772	0.0004-0.0024	0.0039-0.0130	2	2.2044-2.2050	0.0004-0.0028	0.0037-0.0140
	3.0	Y	2.6772	0.0004-0.0024	0.0039-0.0130	2	2.2044-2.2050	0.0004-0.0028	0.0037-0.0140
2011	3.0	Y	2.6772	0.0004-0.0024	0.0039-0.0130	2	2.2044-2.2050	0.0004-0.0028	0.0037-0.0140

25742_CSRX_C0008

PISTON AND RING SPECIFICATIONS

All measurements are given in inches.

Year	Engine Displacement	Engine ID/VIN	Piston Clearance	Ring Gap			Ring Side Clearance		
	Liters			Top Compression	Bottom Compression	Oil Control	Top Compression	Bottom Compression	Oil Control
2010	2.8	6	0.0008-0.0013	0.0059-0.0118	0.0110-0.0189	0.0059-0.0236	0.0012-0.0026	0.0006-0.0024	0.0012-0.0067
	3.0	Y	0.0008-0.0013	0.0059-0.0118	0.0110-0.0189	0.0059-0.0236	0.0012-0.0026	0.0006-0.0024	0.0012-0.0067
2011	3.0	Y	0.0008-0.0013	0.0059-0.0118	0.0110-0.0189	0.0059-0.0236	0.0012-0.0026	0.0006-0.0024	0.0012-0.0067

① Measured in cylinder bore

25742_CSRX_C0009

22-6

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TORQUE SPECIFICATIONS

All readings in ft. lbs.

Year	Engine	Engine ID/VIN	Cylinder	Main	Rod	Crankshaft	Flywheel	Manifold		Spark	Oil Pan
	Disp. Liters		Head Bolts	Bearing Bolts	Bearing Bolts	Damper Bolts		Intake	Exhaust	Plugs	Drain Plug
2010	2.8	6	①	②	③	④	49	18	15	13	18
	3.0	Y	①	②	③	④	49	18	15	13	18
2011	3.0	Y	①	②	③	④	49	18	15	13	18

NS Not supplied

① Step 1: 22 ft. lbs.

Step 2: Plus 150 degrees

Step 1: M8 Bolt: 11 ft. lbs.

Step 2: Plus 75 degrees

② Inner bolts: 15 ft. lbs. plus 80 degrees

Outer bolts: 11 ft. lbs. plus 110 degrees

Side bolts: 22 ft. lbs. plus 60 degrees

③ Step 1: 22 ft. lbs.

Step 2: Zero

Step 3: 18 ft. lbs.

Step 4: Plus 110 degrees

④ Step 1: 74 ft. lbs.

Step 2: plus 150 degrees

25742_CSRX_C0010

WHEEL ALIGNMENT

Year	Model		Caster		Camber		Toe-in (Deg.)
			Range (+/-Deg.)	Preferred Setting (Deg.)	Range (+/-Deg.)	Preferred Setting (Deg.)	
2010	SRX	Front	0.75	4.50	0.75	0.60	0.20+/-0.20
		Rear	—	—	0.75	-1.00	0.20+/-0.20
2011	SRX	Front	0.75	4.50	0.75	0.60	0.20+/-0.20
		Rear	—	—	0.75	-1.00	0.20+/-0.20

25742_CSRX_C0011

MAINTENANCE I AND II SERVICE SCHEDULES

SRX

When the CHANGE ENGINE OIL light appears, certain services and inspections are required.

Required services are described as Maintenance I and Maintenance II.

The first service of a vehicle should be Maintenance I, and the second service should be Maintenance II.

Alternate between the 2 services thereafter. However, in some cases, Maintenance II may be required more often.

Maintenance I: Use Maintenance I if the CHANGE ENGINE OIL light comes on within 10 months since the vehicle was purchased or, if Maintenance II was performed.

Maintenance II: Use Maintenance II if the previous service performed was Maintenance I. Always use Maintenance II whenever the CHANGE ENGINE OIL light comes on 10 months or more since the last service, or, if the CHANGE ENGINE OIL light has not come on at all for one year.

Service Item	Maintenance I	Maintenance II
Change the engine oil and filter.	✓	✓
Reset the oil life system.	✓	✓
Visually inspect the vehicle for leaks or damage. A fluid loss in the vehicle system could indicate a problem. Inspect, repair and add fluid to the system if necessary.	✓	✓
Inspect the engine air cleaner filter. If necessary, replace the filter.	✓	✓
Rotate the tires. Inspect the tire inflation pressures and the tire wear.	✓	✓
Visually inspect the brake lines and hoses for proper hook-up, binding, leaks, cracks, chafing, etc. Inspect the disc brake pads for wear and the rotors for surface condition. Inspect the drum brake linings for wear or cracks. Inspect other brake parts, including drums, wheel cylinders, calipers, parking brake, etc. Inspect the parking brake adjustment.	✓	✓
Inspect engine coolant and windshield washer fluid levels. Add fluid as needed.	✓	✓
Inspect the suspension and steering components. Inspect the front and rear suspension and the steering system for damaged, loose or missing parts, or signs of wear. Inspect the power steering lines and the hoses for proper hook-up, binding, leaks, cracks, chafing, etc.	—	✓
Visually inspect the coolant hoses and replace the hoses if they are cracked, swollen or deteriorated. Inspect all pipes, fittings and clamps; replace with GM parts as needed. To help ensure proper operation, a pressure test of the cooling system and pressure cap and cleaning the outside of the radiator and air conditioning condenser is recommended at least once a year.	—	✓
Ensure the safety belt reminder light and all the belts, buckles, latch plates, retractors and anchorages are working properly. Look for any other loose or damaged safety belt system parts. If you see anything that might keep a safety belt system from working correctly, repair or replaced the damaged part. Replace torn or frayed safety belts, refer to Operational and Functional Checks in Seat Belts. Inspect for any opened or broken air bag coverings, and repair or replace as needed. The air bag system does require regular maintenance.	—	✓
Lubricate the body components.	✓	✓
Lubricate all key lock cylinders, hood latch assemblies, secondary latches, pivots, spring anchor and release pawl, hood and door hinges, rear folding seats and liftgate hinges. Frequent lubrication may be required when exposed to a corrosive environment, refer to Fluid and Lubricant Recommendations. Applying dielectric silicone grease GM P/N 12345579 (Canadian P/N 1974984) or equivalent on the weatherstrips with a clean cloth.	—	✓
Inspect the wiper blades and replace as necessary.	✓	✓
Inspect the throttle and fuel system.	—	✓
Replace the passenger compartment air filter.	—	✓
Inspect exhaust system and heat shields.	✓	✓

To reset the CHANGE ENGINE OIL light:

1. Turn the ignition key to the ON/RUN position with the engine OFF.
2. Press and release the stem in the lower center of the instrument cluster until the OIL LIFE message is displayed.
3. Once the alternating OIL LIFE and RESET messages appear, press and hold the stem until several beeps sound.
This confirms that the oil life system has been reset to 100 percent.
4. Turn the ignition key to the OFF position.

If the CHANGE ENGINE OIL message comes back on when the vehicle is started, the engine oil life system has not been reset. Repeat the procedure.

TIRE AND WHEEL SPECIFICATIONS

Year	Model	OEM Tires		Tire Pressures (psi)		Wheel Size	Lug Nut (ft. lbs.)
		Front	Rear	Front	Rear		
2010	SRX	P235/65R18	P235/55R20	①	①	②	100
2011	SRX	P235/65R18	P235/55R20	①	①	②	100

OEM: Original Equipment Manufacturer

PSI: Pounds Per Square Inch

① See vehicle tire placard.

② 18: standard; 20: optional

25742_CSRX_C0012

BRAKE SPECIFICATIONS

All measurements in inches unless noted

Year	Model		Brake Disc			Minimum Pad/Lining Thickness		Brake Caliper	
			Original Thickness	Minimum Thickness	Max. Runout	Front	Rear	Bracket Bolts (ft. lbs.)	Mounting Bolts (ft. lbs.)
2010	SRX	F	NS	1.060	0.002	NS	NS	81	44
		R	0.906	0.846	0.002	NS	NS	81	44
2011	SRX	F	NS	1.060	0.002	NS	NS	81	44
		R	0.906	0.846	0.002	NS	NS	81	44

F: Front

R: Rear

NS: Information not supplied

25742_CSRX_C0013

ADDITIONAL MAINTENANCE SERVICES - NORMAL
SRX

TO BE SERVICED	TYPE OF SERVICE	VEHICLE MILEAGE INTERVAL (x1000)					
		25	50	75	100	125	150
Engine coolant	Replace						✓
Air cleaner filter	Replace		✓		✓		✓
Automatic transmissison fluid & filter	Replace				✓		
Spark plugs	Replace				✓		
Transfer case fluid	Replace				✓		
Exhaust system & heat shields	Service/ Inspect	✓	✓	✓	✓	✓	✓
Cooling system hoses and clamps	Service/ Inspect						✓
Fuel system	Inspect	✓	✓	✓	✓	✓	✓
Accessory drive belts	Replace						✓
Evaporative control system	Inspect		✓		✓		✓
Passenger compartment air filter	Replace	✓	✓	✓	✓	✓	✓

25742_CSRX_C0015

ADDITIONAL MAINTENANCE SERVICES - SEVERE
SRX

TO BE SERVICED	TYPE OF SERVICE	VEHICLE MILEAGE INTERVAL (x1000)					
		25	50	75	100	125	150
Engine coolant	Replace						✓
Air cleaner filter	Replace	✓	✓	✓	✓	✓	✓
Automatic transaxle fluid	Replace		✓		✓		✓
Spark plugs	Replace				✓		
Transfer case fluid	Replace		✓		✓		✓
Exhaust system & heat shields	Inspect	✓	✓	✓	✓	✓	✓
Cooling system hoses and clamps	Inspect	✓	✓	✓	✓	✓	✓
Fuel system	Inspect	✓	✓	✓	✓	✓	✓
Accessory drive belt(s)	Replace						✓
Evaporative control system	Inspect		✓		✓		✓
Passenger compartment air cleaner	Replace	✓	✓	✓	✓	✓	✓

25742_CSRX_C0016

PRECAUTIONS

Before servicing any vehicle, please be sure to read all of the following precautions, which deal with personal safety, prevention of component damage, and important points to take into consideration when servicing a motor vehicle:

- Never open, service or drain the radiator or cooling system when the engine is hot; serious burns can occur from the steam and hot coolant.
- Observe all applicable safety precautions when working around fuel. Whenever servicing the fuel system, always work in a well-ventilated area. Do not allow fuel spray or vapors to come in contact with a spark, open flame, or excessive heat (a hot drop light, for example). Keep a dry chemical fire extinguisher near the work area. Always keep fuel in a container specifically designed for fuel storage; also, always properly seal fuel containers to avoid the possibility of fire or explosion. Refer to the additional fuel system precautions later in this section.
- Fuel injection systems often remain pressurized, even after the engine has been turned **OFF**. The fuel system pressure must be relieved before disconnecting any fuel lines. Failure to do so may result in fire and/or personal injury.
- Brake fluid often contains polyglycol ethers and polyglycols. Avoid contact with the eyes and wash your hands thoroughly after handling brake fluid. If you do get brake fluid in your eyes, flush your eyes with clean, running water for 15 minutes. If eye irritation persists, or if you have taken

brake fluid internally, **IMMEDIATELY** seek medical assistance.

- The EPA warns that prolonged contact with used engine oil may cause a number of skin disorders, including cancer. You should make every effort to minimize your exposure to used engine oil. Protective gloves should be worn when changing oil. Wash your hands and any other exposed skin areas as soon as possible after exposure to used engine oil. Soap and water, or waterless hand cleaner should be used.
- All new vehicles are now equipped with an air bag system, often referred to as a Supplemental Restraint System (SRS) or Supplemental Inflatable Restraint (SIR) system. The system must be disabled before performing service on or around system components, steering column, instrument panel components, wiring and sensors. Failure to follow safety and disabling procedures could result in accidental air bag deployment, possible personal injury and unnecessary system repairs.
- Always wear safety goggles when working with, or around, the air bag system. When carrying a non-deployed air bag, be sure the bag and trim cover are pointed away from your body. When placing a non-deployed air bag on a work surface, always face the bag and trim cover upward, away from the surface. This will reduce the motion of the module if it is accidentally deployed. Refer to the additional air bag system precautions later in this section.
- Clean, high quality brake fluid from a sealed container is essential to the safe and

proper operation of the brake system. You should always buy the correct type of brake fluid for your vehicle. If the brake fluid becomes contaminated, completely flush the system with new fluid. Never reuse any brake fluid. Any brake fluid that is removed from the system should be discarded. Also, do not allow any brake fluid to come in contact with a painted surface; it will damage the paint.

- Never operate the engine without the proper amount and type of engine oil; doing so **WILL** result in severe engine damage.
- Timing belt maintenance is extremely important. Many models utilize an interference-type, non-freewheeling engine. If the timing belt breaks, the valves in the cylinder head may strike the pistons, causing potentially serious (also time-consuming and expensive) engine damage. Refer to the maintenance interval charts for the recommended replacement interval for the timing belt, and to the timing belt section for belt replacement and inspection.
- Disconnecting the negative battery cable on some vehicles may interfere with the functions of the on-board computer system(s) and may require the computer to undergo a relearning process once the negative battery cable is reconnected.
- When servicing drum brakes, only disassemble and assemble one side at a time, leaving the remaining side intact for reference.
- Only an MVAC-trained, EPA-certified automotive technician should service the air conditioning system or its components.

BRAKES

GENERAL INFORMATION

PRECAUTIONS

- Certain components within the ABS system are not intended to be serviced or repaired individually.
- Do not use rubber hoses or other parts not specifically specified for and ABS system. When using repair kits, replace all parts included in the kit. Partial or incorrect repair may lead to functional problems and require the replacement of components.
- Lubricate rubber parts with clean, fresh brake fluid to ease assembly. Do not use shop air to clean parts; damage to rubber components may result.
- Use only DOT 3 brake fluid from an unopened container.
- If any hydraulic component or line is

removed or replaced, it may be necessary to bleed the entire system.

- A clean repair area is essential. Always clean the reservoir and cap thoroughly before removing the cap. The slightest amount of dirt in the fluid may plug an orifice and impair the system function. Perform repairs after components have been thoroughly cleaned; use only denatured alcohol to clean components. Do not allow ABS components to come into contact with any substance containing mineral oil; this includes used shop rags.
- The Anti-Lock control unit is a micro-processor similar to other computer units in the vehicle. Ensure that the ignition switch is **OFF** before removing or installing controller harnesses. Avoid static electricity discharge at or near the controller.

ANTI-LOCK BRAKE SYSTEM (ABS)

- If any arc welding is to be done on the vehicle, the control unit should be unplugged before welding operations begin.

SPEED SENSORS

REMOVAL & INSTALLATION

Front

See Figure 1.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and support the vehicle.
3. Remove the tire and wheel assembly.
4. Remove the wheel speed sensor bolt.
5. Clean the wheel speed sensor mounting area on the suspension knuckle of any accumulated dirt and debris.

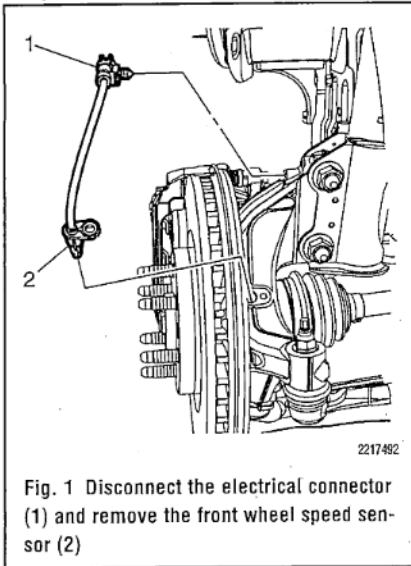


Fig. 1 Disconnect the electrical connector (1) and remove the front wheel speed sensor (2)

6. Disconnect the wheel speed sensor electrical connector and release the connector from the steering knuckle.

7. Remove the wheel speed sensor by pulling the sensor straight out of the steering knuckle.

To install:

8. Connect the wheel speed sensor electrical connector and secure the connector to the steering knuckle.

9. Install the wheel speed sensor to the steering knuckle.

10. Install the wheel speed sensor bolt and tighten to 80 inch lbs. (9 Nm).

11. Install the tire and wheel assembly.

Rear

See Figure 2.

1. Before servicing the vehicle, refer to the Precautions Section.

2. Raise and support the vehicle.

3. Remove the tire and wheel assembly.

4. Remove the rear suspension link.

5. Remove the wheel speed sensor bolt.

6. Clean the wheel speed sensor mounting area on the suspension knuckle of any accumulated dirt and debris.

7. Remove the wheel speed sensor by pulling the sensor straight out of the rear suspension knuckle.

8. Release the wheel speed sensor harness from the retainers.

9. Disconnect the wheel speed sensor electrical connector.

10. Release the wheel speed sensor electrical connector retainer and remove the wheel speed sensor.

To install:

11. Install the wheel speed sensor connector retainer to the rear suspension cradle.

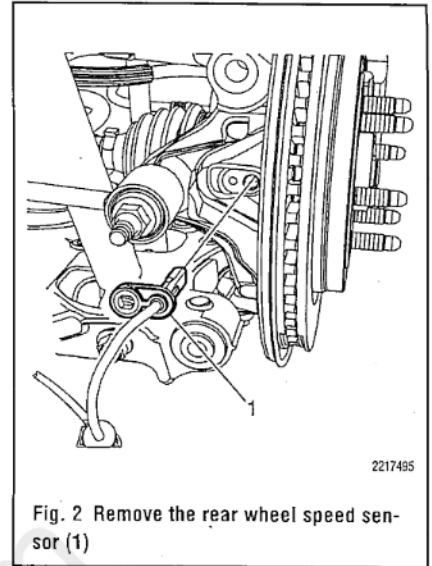


Fig. 2 Remove the rear wheel speed sensor (1)

12. Connect the wheel speed sensor electrical connector.

13. Install the wheel speed sensor harness to the retainers.

14. Install the wheel speed sensor to the rear suspension knuckle.

15. Install the wheel speed sensor bolt and tighten to 80 inch lbs. (9 Nm).

16. Install the rear suspension link.

17. Install the tire and wheel assembly.

BRAKES

BLEEDING PROCEDURE

BLEEDING THE ABS SYSTEM

1. Before servicing the vehicle, refer to the Precautions Section.

➔ Before performing the ABS Automated Bleed Procedure, first perform a pressure bleed of the base brake system. The automated bleed procedure is recommended when one of the following conditions exist: base brake system bleeding does not achieve the desired pedal height or feel, extreme loss of brake fluid has occurred, air ingestion is suspected in the secondary circuits of the brake modulator assembly.

**** WARNING**

The Auto Bleed Procedure may be terminated at any time during the process by pressing the EXIT button. No further Scan Tool prompts pertaining to the Auto Bleed procedure will be given. After exiting the bleed procedure, relieve bleed pressure and disconnect bleed equipment per

manufacturer's instructions. Failure to properly relieve pressure may result in spilled brake fluid causing damage to components and painted surfaces.

The ABS Automated Bleed Procedure uses a scan tool to cycle the system solenoid valves and run the pump in order to purge any air from the secondary circuits. These circuits are normally closed off, and are only opened during system initialization at vehicle start up and during ABS operation. The automated bleed procedure opens these secondary circuits and allows any air trapped in these circuits to flow out toward the brake corners.

2. Raise and support the vehicle.

3. Remove all four tire and wheel assemblies.

4. Inspect the brake system for leaks and visual damage.

5. Lower the vehicle.

6. Inspect the battery state of charge.

7. Install a scan tool.

8. Turn the ignition ON, with the engine OFF.

BLEEDING THE BRAKE SYSTEM

9. With the scan tool, establish communications with the ABS system. Select Special Functions. Select Automated Bleed from the Special Functions menu.

10. Raise and support the vehicle.

11. Following the directions given on the scan tool, pressure bleed the base brake system.

12. Follow the scan tool directions until the desired brake pedal height is achieved.

13. If the bleed procedure is aborted, a malfunction exists. Perform the following steps before resuming the bleed procedure:

a. If a DTC is detected, refer to Diagnostic Trouble Codes (DTC) and diagnose the appropriate DTC.

b. If the brake pedal feels spongy, perform the conventional brake bleed procedure again.

14. When the desired pedal height is achieved, press the brake pedal to inspect for firmness.

15. Lower the vehicle.

16. Remove the scan tool.

17. Install the tire and wheel assemblies.

18. Inspect the brake fluid level.

19. Road test the vehicle while inspecting that the pedal remains high and firm.

HYDRAULIC BRAKE SYSTEM BLEEDING

Manual Bleeding

➔ Before servicing the vehicle, refer to the Precautions Section.

1. Place a clean shop cloth beneath the brake master cylinder to prevent brake fluid spills.

2. With the ignition OFF and the brakes cool, apply the brakes 3–5 times, or until the brake pedal effort increases significantly, in order to deplete the brake booster power reserve.

3. If you have performed a brake master cylinder bench bleeding on this vehicle, or if you disconnected the brake pipes from the master cylinder, you must perform the following steps:

a. Ensure that the brake master cylinder reservoir is full to the maximum-fill level. If necessary, add GM approved brake fluid from a clean, sealed brake fluid container. If removal of the reservoir cap and diaphragm is necessary, clean the outside of the reservoir on and around the cap prior to removal.

b. With the rear brake pipe installed securely to the master cylinder, loosen and separate the front brake pipe from the front port of the brake master cylinder.

c. Allow a small amount of brake fluid to gravity bleed from the open port of the master cylinder.

d. Reconnect the brake pipe to the master cylinder port and tighten securely.

e. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal.

f. Loosen the same brake pipe to purge air from the open port of the master cylinder.

g. Tighten the brake pipe, then have the assistant slowly release the brake pedal.

h. Wait 15 seconds, then repeat the above 5 steps until all air is purged from the same port of the master cylinder.

i. With the front brake pipe installed securely to the master cylinder, after all air has been purged from the front port of the master cylinder, loosen and separate the rear brake pipe from the master cylinder, then repeat the above 6 steps.

j. After completing the final master cylinder port bleeding procedure, ensure that both of the brake pipe-to-master cylinder fittings are properly tightened.

4. Fill the brake master cylinder reservoir with brake fluid. Ensure that the brake master cylinder reservoir remains at least half-full during this bleeding procedure. Add fluid as needed to maintain the proper level. Clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm.

5. Install a proper box-end wrench onto the RIGHT REAR wheel hydraulic circuit bleeder valve.

6. Install a transparent hose over the end of the bleeder valve.

7. Submerge the open end of the transparent hose into a transparent container partially filled with GM approved brake fluid from a clean, sealed brake fluid container.

8. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal.

9. Loosen the bleeder valve to purge air from the wheel hydraulic circuit.

10. Tighten the bleeder valve, then have the assistant slowly release the brake pedal.

11. Wait 15 seconds, then repeat steps 8–10 until all air is purged from the same wheel hydraulic circuit.

12. With the right rear wheel hydraulic circuit bleeder valve tightened securely, after all air has been purged from the right rear wheel hydraulic circuit, install a proper box-end wrench onto the LEFT FRONT wheel hydraulic circuit bleeder valve.

13. Install a transparent hose over the end of the bleeder valve, then repeat steps 7–11.

14. With the left front wheel hydraulic circuit bleeder valve tightened securely, after all air has been purged from the left front wheel hydraulic circuit, install a proper box-end wrench onto the LEFT REAR wheel hydraulic circuit bleeder valve.

15. Install a transparent hose over the end of the bleeder valve, then repeat steps 7–11.

16. With the left rear wheel hydraulic circuit bleeder valve tightened securely, after all air has been purged from the left rear wheel hydraulic circuit, install a proper box-end wrench onto the RIGHT FRONT wheel hydraulic circuit bleeder valve.

17. Install a transparent hose over the end of the bleeder valve, then repeat steps 7–11.

18. After completing the final wheel hydraulic circuit bleeding procedure, ensure that each of the 4 wheel hydraulic circuit bleeder valves are properly tightened.

19. Fill the brake master cylinder reservoir to the maximum-fill level with GM approved brake fluid from a clean, sealed brake fluid container.

20. Slowly depress and release the brake pedal. Observe the feel of the brake pedal.

➔ If it is determined that air was introduced into the system upstream of the ABS modulator prior to servicing, the Antilock Brake System Automated Bleed must be performed.

21. If the brake pedal feels spongy, repeat the bleeding procedure again. If the brake pedal still feels spongy after repeating the bleeding procedure, perform the following steps:

a. Inspect the brake system for external leaks.

b. Pressure bleed the hydraulic brake system in order to purge any air that may still be trapped in the system.

22. Turn the ignition key ON, with the engine OFF. Check the brake system warning lamp. If it remains illuminated, diagnose and repair.

** CAUTION

DO NOT allow the vehicle to be driven until it is diagnosed and repaired.

Pressure Bleeding

➔ Before servicing the vehicle, refer to the Precautions Section.

1. Place a clean shop cloth beneath the brake master cylinder to prevent brake fluid spills.

2. With the ignition OFF and the brakes cool, apply the brakes 3–5 times, or until the brake pedal effort increases significantly, in order to deplete the brake booster power reserve.

3. If you have performed a brake master cylinder bench bleeding on this vehicle, or if you disconnected the brake pipes from the master cylinder, you must perform the following steps:

a. Ensure that the brake master cylinder reservoir is full to the maximum-fill level. If necessary, add GM approved brake fluid from a clean, sealed brake fluid container. If removal of the reservoir cap and diaphragm is necessary, clean the outside of the reservoir on and around the cap prior to removal.

b. With the rear brake pipe installed securely to the master cylinder, loosen and separate the front brake pipe from the front port of the brake master cylinder.

c. Allow a small amount of brake fluid to gravity bleed from the open port of the master cylinder.

d. Reconnect the brake pipe to the master cylinder port and tighten securely.

- e. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal.
- f. Loosen the same brake pipe to purge air from the open port of the master cylinder.
- g. Tighten the brake pipe, then have the assistant slowly release the brake pedal.
- h. Wait 15 seconds, then repeat the above 5 steps until all air is purged from the same port of the master cylinder.
- i. With the front brake pipe installed securely to the master cylinder, after all air has been purged from the front port of the master cylinder, loosen and separate the rear brake pipe from the master cylinder, then repeat the above 6 steps.
- j. After completing the final master cylinder port bleeding procedure, ensure that both of the brake pipe-to-master cylinder fittings are properly tightened.
4. Fill the brake master cylinder reservoir to the maximum-fill level with GM approved brake fluid from a clean, sealed brake fluid container. Clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm.
5. Install an appropriate brake pressure bleeder adapter to the brake master cylinder reservoir.
6. Check the brake fluid level in the brake pressure bleeder. Add GM approved brake fluid from a clean, sealed brake fluid container as necessary to bring the level to approximately the half-full point.
7. Connect the brake pressure bleeder to the brake pressure bleeder adapter.
8. Charge the brake pressure bleeder air tank to 25–30 psi (175–205 kPa).
9. Open the brake pressure bleeder fluid tank valve to allow pressurized brake fluid to enter the brake system.
10. Wait approximately 30 seconds, then inspect the entire hydraulic brake system in order to ensure that there are no existing external brake fluid leaks. Any brake fluid leaks identified require repair prior to completing this procedure.
11. Install a proper box-end wrench onto the RIGHT REAR wheel hydraulic circuit bleeder valve.
12. Install a transparent hose over the end of the bleeder valve.
13. Submerge the open end of the transparent hose into a transparent container partially filled with GM approved brake fluid from a clean, sealed brake fluid container.
14. Loosen the bleeder valve to purge air from the wheel hydraulic circuit. Allow fluid to flow until air bubbles stop flowing from the bleeder, then tighten the bleeder valve.

15. With the right rear wheel hydraulic circuit bleeder valve tightened securely, after all air has been purged from the right rear hydraulic circuit, install a proper box-end wrench onto the LEFT FRONT wheel hydraulic circuit bleeder valve.

16. Install a transparent hose over the end of the bleeder valve, then repeat steps 13–14.

17. With the left front wheel hydraulic circuit bleeder valve tightened securely, after all air has been purged from the left front hydraulic circuit, install a proper box-end wrench onto the LEFT REAR wheel hydraulic circuit bleeder valve.

18. Install a transparent hose over the end of the bleeder valve, then repeat steps 13–14.

19. With the left rear wheel hydraulic circuit bleeder valve tightened securely, after all air has been purged from the left rear hydraulic circuit, install a proper box-end wrench onto the RIGHT FRONT wheel hydraulic circuit bleeder valve.

20. Install a transparent hose over the end of the bleeder valve, then repeat steps 13–14.

21. After completing the final wheel hydraulic circuit bleeding procedure, ensure that each of the 4 wheel hydraulic circuit bleeder valves are properly tightened.

22. Close the brake pressure bleeder fluid tank valve, then disconnect the brake pressure bleeder from the brake pressure bleeder adapter.

23. Remove the brake pressure bleeder adapter from the brake master cylinder reservoir.

24. Fill the brake master cylinder reservoir to the maximum-fill level with GM approved brake fluid from a clean, sealed brake fluid container.

25. Slowly depress and release the brake pedal. Observe the feel of the brake pedal.

➔ **If it is determined that air was introduced into the system upstream of the ABS modulator prior to servicing, the Antilock Brake System Automated Bleed must be performed.**

26. If the brake pedal feels spongy perform the following steps:

- a. Inspect the brake system for external leaks.
- b. Using a scan tool, perform the antilock brake system automated bleeding procedure to remove any air that may have been trapped in the BPMV.

27. Turn the ignition key ON, with the engine OFF. Check the brake system warning lamp. If it remains illuminated, diagnose and repair.

*** CAUTION

DO NOT allow the vehicle to be driven until it is diagnosed and repaired.

MASTER CYLINDER BENCH BLEEDING

➔ **Before servicing the vehicle, refer to the Precautions Section.**

1. Secure the mounting flange of the brake master cylinder in a bench vise so that the rear of the primary piston is accessible.
2. Remove the master cylinder reservoir cap and diaphragm.
3. Install suitable fittings to the master cylinder ports that match the type of flare seat required and also provide for hose attachment.
4. Install transparent hoses to the fittings installed to the master cylinder ports, then route the hoses into the master cylinder reservoir.
5. Fill the master cylinder reservoir to at least the half-way point with GM approved brake fluid from a clean, sealed brake fluid container.
6. Ensure that the ends of the transparent hoses running into the master cylinder reservoir are fully submerged in the brake fluid.
7. Using a smooth, round-ended tool, depress and release the primary piston as far as it will travel, a depth of about 1 in. (25 mm), several times. Observe the flow of fluid coming from the ports. As air is bled from the primary and secondary pistons, the effort required to depress the primary piston will increase and the amount of travel will decrease.
8. Continue to depress and release the primary piston until fluid flows freely from the ports with no evidence of air bubbles.
9. Remove the transparent hoses from the master cylinder reservoir.
10. Install the master cylinder reservoir cap and diaphragm.
11. Remove the fittings with the transparent hoses from the master cylinder ports. Wrap the master cylinder with a clean shop cloth to prevent brake fluid spills.
12. Remove the master cylinder from the vise.

FLUID FILL PROCEDURE

1. Visually inspect the brake fluid level through the brake master cylinder reservoir.
2. If the brake fluid level is at or below

22-14 CADILLAC SRX

the half-full point during routine fluid checks, the brake system should be inspected for wear and possible brake fluid leaks.

3. If the brake fluid level is at or below the half-full point during routine fluid checks, and an inspection of the brake system did not reveal wear or brake fluid leaks,

the brake fluid may be topped-off up to the maximum-fill level.

4. If brake system service was just completed, the brake fluid may be topped-off up to the maximum-fill level.

5. If the brake fluid level is above the half-full point, adding brake fluid is not recommended under normal conditions.

6. If brake fluid is to be added to the master cylinder reservoir, clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm. Use only GM approved brake fluid from a clean, sealed brake fluid container.

BRAKES

** CAUTION

Dust and dirt accumulating on brake parts during normal use may contain asbestos fibers from production or aftermarket brake linings. Breathing excessive concentrations of asbestos fibers can cause serious bodily harm. Exercise care when servicing brake parts. Do not sand or grind brake lining unless equipment used is designed to contain the dust residue. Do not clean brake parts with compressed air or by dry brushing. Cleaning should be done by dampening the brake components with a fine mist of water, then wiping the brake components clean with a dampened cloth. Dispose of cloth and all residue containing asbestos fibers in an impermeable container with the appropriate label. Follow practices prescribed by the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA) for the handling, processing, and disposing of dust or debris that may contain asbestos fibers.

BRAKE CALIPER

REMOVAL & INSTALLATION

See Figure 3.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and support the vehicle.
3. Remove the tire and wheel assembly.
4. Remove the brake hose fitting bolt.
5. Remove the 2 brake hose fitting gaskets from the brake hose fitting and discard the gaskets.
6. Cap the brake hose fitting to prevent brake fluid loss and contamination.
7. Using a backup wrench to hold the brake caliper guide pins stationary, remove the brake caliper guide pin bolts.

—DO NOT use any air tools to remove or install the guide pin bolts. Use hand tools ONLY. Install an open end wrench

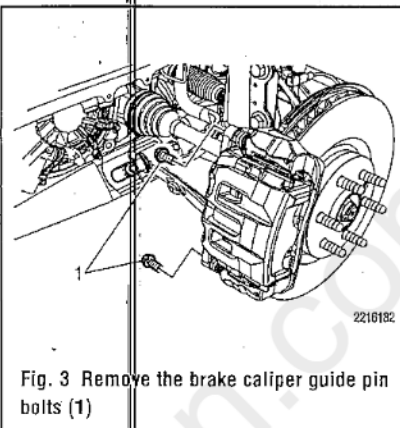


Fig. 3 Remove the brake caliper guide pin bolts (1)

to hold the caliper guide pin in line with the brake caliper while removing or installing the caliper guide pin bolt. DO NOT allow the open end wrench to come in contact with the brake caliper. Allowing the open end wrench to come in contact with the brake caliper will cause a pulsation when the brakes are applied.

8. Remove the brake caliper.

To install:

9. Install the brake caliper to the caliper bracket.
10. Using a backup wrench to hold the brake caliper guide pins stationary, install the brake caliper guide pin bolts and tighten to 44 ft. lbs. (60 Nm).
11. Assemble the brake hose fitting bolt and 2 new brake hose fitting gaskets to the brake hose fitting.
12. Install the brake hose assembly to the brake caliper and tighten the fitting bolt to 30 ft. lbs. (40 Nm).
13. Bleed the hydraulic brake system.
14. Install the tire and wheel assembly.
15. Lower vehicle.

DISC BRAKE PADS

REMOVAL & INSTALLATION

See Figure 4.

1. Before servicing the vehicle, refer to the Precautions Section.

FRONT DISC BRAKES

2. Inspect the fluid level in the brake master cylinder reservoir.

a. If the brake fluid level is midway between the maximum full point and the minimum allowable level, no brake fluid needs to be removed from the reservoir before proceeding.

b. If the brake fluid level is higher than midway between the maximum full point and the minimum allowable level, remove brake fluid to the midway point before proceeding.

3. Raise and support the vehicle.

4. Remove the tire and wheel assembly.

5. Install a C-clamp against the outer brake pad and the rear of the brake caliper body.

6. Slowly tighten the C-clamp until the brake caliper pistons are compressed into the brake caliper bores.

—DO NOT use any air tools to remove or install the guide pin bolts. Use hand tools ONLY. Install an open end wrench to hold the caliper guide pin in line with the brake caliper while removing or installing the caliper guide pin bolt. DO NOT allow the open end wrench to come in contact with the brake caliper. Allowing the open end wrench to come in contact with the brake caliper will

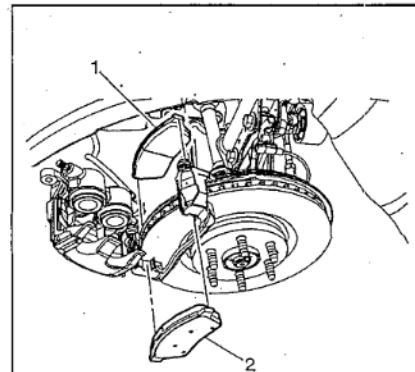


Fig. 4 Remove the inner (1) and outer brake pads (2)

cause a pulsation when the brakes are applied.

7. Using a backup wrench to hold the brake caliper guide pin stationary, remove the upper brake caliper guide pin bolt.

*** WARNING

Support the brake caliper with heavy mechanic wire, or equivalent, whenever it is separated from its mount and the hydraulic flexible brake hose is still connected.

8. Pivot the brake caliper forward and support with heavy mechanics wire or equivalent.

9. Place a block of wood or an old brake pad against the brake caliper pistons.

10. Using a brake pad spreader tool or equivalent, fully seat the caliper pistons in the caliper bores.

11. Remove the inner brake pad and the outer brake pad.

12. Remove the upper and lower brake pad springs. If installing new brake pads, discard the springs.

To install:

13. Install the upper and lower brake pad springs.

14. Install the inner brake pad and the outer brake pad.

15. Rotate the brake caliper into position.

16. Using a backup wrench to hold the brake caliper guide pin stationary, install the brake caliper guide pin bolt and tighten to 44 ft. lbs. (60 Nm).

17. Install the tire and wheel assembly.

18. With the engine OFF, gradually apply the brake pedal to approximately $\frac{3}{4}$ of its travel distance.

19. Slowly release the brake pedal.

20. Wait 15 seconds, then repeat the above 2 steps until a firm brake pedal apply is obtained; this will properly seat the brake caliper pistons and brake pads.

21. Fill the brake master cylinder reservoir to the proper level.

22. Burnish the brake pads and rotors:

- Select a smooth road with little or no traffic.

- Accelerate the vehicle to 30 mph (48 km/h). Use care to avoid overheating the brakes while performing this step.

- Using moderate to firm pressure, apply the brakes to bring the vehicle to a stop. Do not allow the brakes to lock.

- Repeat the above 2 steps until approximately 20 stops have been completed. Allow sufficient cooling periods between stops in order to properly burnish the brake pads and rotors.

BRAKES

*** CAUTION

Dust and dirt accumulating on brake parts during normal use may contain asbestos fibers from production or aftermarket brake linings. Breathing excessive concentrations of asbestos fibers can cause serious bodily harm. Exercise care when servicing brake parts. Do not sand or grind brake lining unless equipment used is designed to contain the dust residue. Do not clean brake parts with compressed air or by dry brushing. Cleaning should be done by dampening the brake components with a fine mist of water, then wiping the brake components clean with a dampened cloth. Dispose of cloth and all residue containing asbestos fibers in an impermeable container with the appropriate label. Follow practices prescribed by the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA) for the handling, processing, and disposing of dust or debris that may contain asbestos fibers.

BRAKE CALIPER

REMOVAL & INSTALLATION

See Figure 5.

1. Release the electronic parking brake cable tension.

2. Raise and support the vehicle.

3. Remove the tire and wheel assembly.

4. Remove the brake hose fitting bolt.

→ Do not reuse the brake hose fitting gaskets.

5. Remove the brake hose fitting gaskets and the brake hose.

6. Discard the brake hose fitting gaskets.

→ DO NOT use any air tools to remove or install the guide pin bolts. Use hand tools ONLY. Install an open end wrench to hold the caliper guide pin in line with the brake caliper while removing or installing the caliper guide pin bolt. DO NOT allow the open end wrench to come in contact with the brake caliper. Allowing the open end wrench to come in contact with the brake caliper will cause a pulsation when the brakes are applied.

7. Using a backup wrench to hold the brake caliper guide pins stationary, remove the brake caliper guide pin bolts.

8. Remove the brake caliper.

To install:

9. Install the brake caliper.

10. Using a backup wrench to hold the brake caliper guide pins stationary, install the brake caliper guide pin bolts and tighten to 44 ft. lbs. (60 Nm).

11. Assemble the brake hose fitting bolt and 2 new brake hose fitting gaskets to the brake hose.

REAR DISC BRAKES

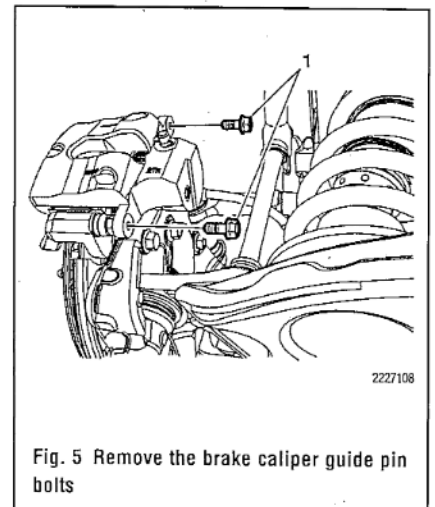


Fig. 5 Remove the brake caliper guide pin bolts

12. Install the brake hose assembly to the caliper and tighten the fitting bolt to 30 ft. lbs. (40 Nm).

13. Bleed the hydraulic brake system.

14. Install the tire and wheel assembly.

15. With the engine OFF, gradually apply the brake pedal to approximately $\frac{3}{4}$ of its travel distance.

16. Slowly release the brake pedal.

17. Wait 15 seconds, then repeat the above 2 steps until a firm brake pedal apply is obtained. This will properly seat the brake caliper pistons and brake pads.

18. Fill the brake master cylinder reservoir to the proper level.

19. Set the electronic parking brake cable tension.

DISC BRAKE PADS

REMOVAL & INSTALLATION

See Figure 6.

1. Before servicing the vehicle, refer to the Precautions Section.

2. Inspect the fluid level in the brake master cylinder reservoir.

a. If the brake fluid level is midway between the maximum full point and the minimum allowable level, no brake fluid needs to be removed from the reservoir before proceeding.

b. If the brake fluid level is higher than midway between the maximum full point and the minimum allowable level, remove brake fluid to the midway point before proceeding.

3. Release the electronic parking brake cable tension, if equipped.

4. Raise and support the vehicle.

5. Remove the tire and wheel assembly.

6. Install a C-clamp against the outer brake pad and the rear of the brake caliper body.

7. Slowly tighten the C-clamp until the brake caliper piston is compressed into the brake caliper bore.

DO NOT use any air tools to remove or install the guide pin bolts. Use hand tools **ONLY**. Install an open end wrench to hold the caliper guide pin in line with the brake caliper while removing or installing the caliper guide pin bolt. **DO NOT** allow the open end wrench to come in contact with the brake caliper. Allowing the open end wrench to come

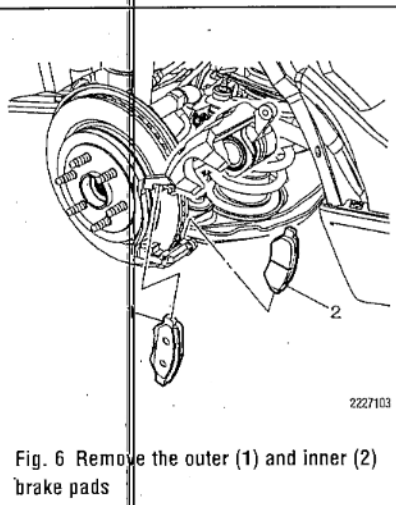


Fig. 6 Remove the outer (1) and inner (2) brake pads

in contact with the brake caliper will cause a pulsation when the brakes are applied.

8. Using a backup wrench on the brake caliper guide pin, remove the lower brake caliper guide pin bolt.

** WARNING

Support the brake caliper with heavy mechanic wire, or equivalent, whenever it is separated from its mount and the hydraulic flexible brake hose is still connected.

9. Pivot the brake caliper forward and support with heavy mechanics wire or equivalent.

10. Remove the outer brake pad.

11. Remove the inner brake pad.

12. Remove the brake pad springs. If

installing new brake pads, discard the brake pad springs.

To install:

13. Install the brake pad springs.

14. Install the outer brake pad.

15. Install the inner brake pad.

16. Pivot the brake caliper into position.

17. Using a backup wrench to hold the brake caliper guide pin stationary, install the brake caliper guide pin bolt and tighten to 44 ft. lbs. (60 Nm).

18. Install the tire and wheel assembly.

19. With the engine OFF, gradually apply the brake pedal to approximately $\frac{3}{4}$ of its travel distance.

20. Slowly release the brake pedal.

21. Wait 15 seconds; then repeat the above 2 steps until a firm brake pedal apply is obtained. This will properly seat the brake caliper pistons and brake pads.

22. Fill the brake master cylinder reservoir to the proper level.

23. Set the electronic parking brake cable tension, if equipped.

24. Burnish the brake pads and rotors:

a. Select a smooth road with little or no traffic.

b. Accelerate the vehicle to 30 mph (48 km/h). Use care to avoid overheating the brakes while performing this step.

c. Using moderate to firm pressure, apply the brakes to bring the vehicle to a stop. Do not allow the brakes to lock.

d. Repeat the above 2 steps until approximately 20 stops have been completed. Allow sufficient cooling periods between stops in order to properly burnish the brake pads and rotors.

BRAKES

PARKING BRAKE CABLES

ADJUSTMENT

The parking brake cable tension is controlled by the Electronic Park Brake (EPB) module.

PARKING BRAKE SHOES

REMOVAL & INSTALLATION

See Figure 7.

1. Before servicing the vehicle, refer to the Precautions Section.

2. Disable the parking brake cable adjuster.

3. Raise and support the vehicle.

4. Remove the tire and wheel assembly.

5. Remove the rear brake rotor.

6. Remove the parking brake shoe upper return spring.

7. Compress the parking brake shoe hold down springs and rotate the pins $\frac{1}{4}$ turn to remove the hold down springs.

8. Remove the parking brake shoes by grasping the shoes near the parking brake shoe actuator, spread the parking brake shoes apart and lift around the wheel hub and bearing assembly.

9. Cross the top of one of the parking brake shoes over the opposite parking brake shoe.

10. Remove the parking brake shoe lower return spring.

11. Remove the parking brake shoe adjuster.

12. Disassemble the parking brake shoe adjuster.

PARKING BRAKE

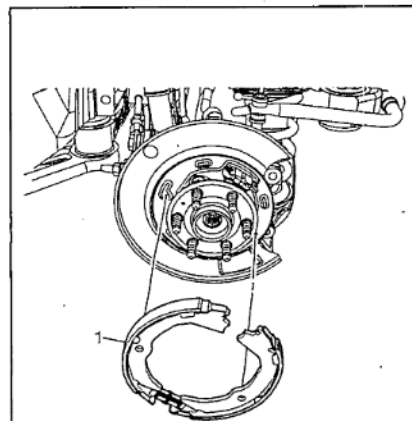


Fig. 7 Remove the parking brake shoes (1)

13. Clean the parking brake shoe adjuster components of any corrosion or debris.

14. Lubricate the parking brake shoe adjuster threads with high temperature brake lubricant.

15. Lubricate the parking brake shoe adjuster clevis with high temperature brake lubricant.

16. Assemble the parking brake shoe adjuster to the fully retracted position.

To install:

17. Install the parking brake shoe adjuster to the parking brake shoes.

18. Cross the top of one of the parking brake shoe over the opposite parking brake shoe.

19. Install the parking brake shoe return spring.

20. Clean the parking brake shoe mounting plate.

21. Apply high temperature brake lubricant to the parking brake shoe mounting plate contact points.

22. Install the parking brake shoes by grasping the shoes near the parking brake shoe actuator, spread the parking brake shoes apart and lift around the wheel hub and bearing assembly.

23. Install the hold down spring pins through the parking brake shoe mounting plate.

24. Compress the parking brake shoe hold down springs and rotate the pins 1/4 turn to install the hold down springs.

25. Install the parking brake shoe upper return spring.

26. Adjust the parking brake.

27. Install the rear brake rotor.

28. Install the tire and wheel assembly.

29. Enable the parking brake cable adjuster.

PARKING BRAKE ADJUSTER DISABLING

The parking brake cable tension is controlled by the Electronic Park Brake (EPB) module. Tension can be fully released from the parking brake cables to allow for service of the parking brake system. Perform one of the following three methods to fully release cable tension.

With Scan Tool—Preferred Method

1. Block the drive wheels.
2. Install a scan tool to the vehicle.

3. Turn the ignition switch to the ON/RUN position with the engine OFF.

4. Using the scan tool, perform the following:

- a. From the scan tool menu, select Diagnostics
- b. Enter the appropriate vehicle information
- c. Select Chassis
- d. Select Parking Brake Control Module
- e. Select Special Functions
- f. Select Cable Replacement

5. Follow the instructions on the scan tool to fully release the tension on the parking brake cables.

Without Scan Tool—Optional Method

6. Block the drive wheels.

7. Turn the ignition switch to the ON/RUN position with the engine OFF.

8. Place the automatic transmission in PARK or manual transmission in NEUTRAL, as equipped.

9. Apply and hold the brake pedal. The brake pedal must remain applied throughout the parking brake cable tension release process.

10. Press and hold down the EPB switch approximately 5 seconds.

11. Observe the PARK BRAKE lamp on the instrument cluster.

12. When the PARK BRAKE lamp flashes, release then immediately press and release the EPB switch. The parking brake cable tension is fully released.

13. Release the brake pedal.

Manual Parking Brake Cable Tension Release

If the other methods to release the parking brake cable tension are unsuccessful, the following procedure may be necessary to release the parking brake cable tension.

14. Raise and support the vehicle.

15. Remove the protective plug from the EPB manual release. The protective plug for the manual release is located near the electrical connector.

16. Using an appropriate square-drive tool, rotate the mechanism clockwise until the tension is fully released from the parking brake cables. Up to 50 cycles may be

required until the parking brake cable tension is fully released.

17. Install the protective plug to the EPB module.

PARKING BRAKE ADJUSTER ENABLING

The parking brake cable tension is controlled by the Electronic Park Brake (EPB) module. Cable tension needs to be set and the EPB module needs to be calibrated following the cable tension disabling procedure. Perform one of the following two methods to fully restore cable tension.

With Scan Tool—Preferred Method

1. Block the drive wheels.
2. Install a scan tool to the vehicle.
3. Turn the ignition switch to the ON/RUN position with the engine OFF.
4. Using the scan tool, perform the following:

- a. From the scan tool menu, select Diagnostics
- b. Enter the appropriate vehicle information
- c. Select Chassis
- d. Select Parking Brake Control Module
- e. Select Module Setup
- f. Select Parking Brake Calibration

5. The EPB module will be calibrated and proper tension will be applied to the parking brake cables.

Without Scan Tool—Optional Method

6. Block the drive wheels.
7. Turn the ignition switch to the ON/RUN position with the engine OFF.
8. Apply the brake pedal.
9. Place the automatic transmission in PARK or manual transmission in NEUTRAL, as equipped.
10. Momentarily lift then release the EPB switch to apply the EPB.

11. Momentarily press down then release the EPB switch to release the EPB.

12. Repeat the above two steps to cycle the EPB on then off an additional 4 times.

13. The EPB module will be calibrated and proper tension will be applied to the parking brake cables.

CHASSIS ELECTRICAL

AIR BAG (SUPPLEMENTAL RESTRAINT SYSTEM)

GENERAL INFORMATION

** CAUTION

These vehicles are equipped with an air bag system. The system must be disarmed before performing service on, or around, system components, the steering column, instrument panel components, wiring and sensors. Failure to follow the safety precautions and the disarming procedure could result in accidental air bag deployment, possible injury and unnecessary system repairs.

SERVICE PRECAUTIONS

Disconnect and isolate the battery negative cable before beginning any airbag system component diagnosis, testing, removal, or installation procedures. Allow system capacitor to discharge for two minutes before beginning any component service. This will disable the airbag system. Failure to disable the airbag system may result in accidental airbag deployment, personal injury, or death.

Do not place an intact undeployed airbag face down on a solid surface. The airbag will propel into the air if accidentally deployed and may result in personal injury or death.

When carrying or handling an undeployed airbag, the trim side (face) of the airbag should be pointing away from the body to minimize possibility of injury if accidental deployment occurs. Failure to do this may result in personal injury or death.

Replace airbag system components with OEM replacement parts. Substitute parts may appear interchangeable, but internal differences may result in inferior occupant protection. Failure to do so may result in occupant personal injury or death.

Wear safety glasses, rubber gloves, and long sleeved clothing when cleaning powder residue from vehicle after an airbag deployment. Powder residue emitted from a deployed airbag can cause skin irritation. Flush affected area with cool water if irritation is experienced. If nasal or throat irritation is experienced, exit the vehicle for fresh air until the irritation ceases. If irritation continues, see a physician.

Do not use a replacement airbag that is not in the original packaging. This may result in improper deployment, personal injury, or death.

The factory installed fasteners, screws

and bolts used to fasten airbag components have a special coating and are specifically designed for the airbag system. Do not use substitute fasteners. Use only original equipment fasteners listed in the parts catalog when fastener replacement is required.

During, and following, any child restraint anchor service, due to impact event or vehicle repair, carefully inspect all mounting hardware, tether straps, and anchors for proper installation, operation, or damage. If a child restraint anchor is found damaged in any way, the anchor must be replaced. Failure to do this may result in personal injury or death.

Deployed and non-deployed airbags may or may not have live pyrotechnic material within the airbag inflator.

Do not dispose of driver/passenger/curtain airbags or seat belt tensioners unless you are sure of complete deployment. Refer to the Hazardous Substance Control System for proper disposal.

Dispose of deployed airbags and tensioners consistent with state, provincial, local, and federal regulations.

After any airbag component testing or service, do not connect the battery negative cable. Personal injury or death may result if the system test is not performed first.

If the vehicle is equipped with the Occupant Classification System (OCS), do not connect the battery negative cable before performing the OCS Verification Test using the scan tool and the appropriate diagnostic information. Personal injury or death may result if the system test is not performed properly.

Never replace both the Occupant Restraint Controller (ORC) and the Occupant Classification Module (OCM) at the same time. If both require replacement, replace one, then perform the Airbag System test before replacing the other.

Both the ORC and the OCM store Occupant Classification System (OCS) calibration data, which they transfer to one another when one of them is replaced. If both are replaced at the same time, an irreversible fault will be set in both modules and the OCS may malfunction and cause personal injury or death.

If equipped with OCS, the Seat Weight Sensor is a sensitive, calibrated unit and must be handled carefully. Do not drop or handle roughly. If dropped or damaged, replace with another sensor. Failure to do so may result in occupant injury or death.

If equipped with OCS, the front passenger seat must be handled carefully as well.

When removing the seat, be careful when setting on floor not to drop. If dropped, the sensor may be inoperative, could result in occupant injury, or possibly death.

If equipped with OCS, when the passenger front seat is on the floor, no one should sit in the front passenger seat. This uneven force may damage the sensing ability of the seat weight sensors. If sat on and damaged, the sensor may be inoperative, could result in occupant injury, or possibly death.

DISARMING THE SYSTEM

Air Bag Fuse Method

1. Before servicing the vehicle, refer to the Precautions Section.
2. Turn the steering wheel so that the vehicles wheels are pointing straight ahead.
3. Place the ignition in the OFF position.

➔The SDM may have more than one fused power input. To ensure there is no unwanted SIR deployment, personal injury, or unnecessary SIR system repairs, remove all fuses supplying power to the SDM. With all SDM fuses removed and the ignition switch in the ON position, the AIR BAG warning indicator illuminates. This is normal operation, and does not indicate a SIR system malfunction.

4. Locate and remove the fuse(s) supplying power to the Sensing and Diagnostic Module (SDM).

5. Wait 1 minute before working on the system.

Negative Battery Cable Method

1. Before servicing the vehicle, refer to the Precautions Section.
2. Turn the steering wheel so that the vehicles wheels are pointing straight ahead.
3. Place the ignition in the OFF position.
4. Disconnect the negative battery cable from the battery.
5. Wait 1 minute before working on system.

ARMING THE SYSTEM

Air Bag Fuse Method

1. Before servicing the vehicle, refer to the Precautions Section.
2. Place the ignition in the OFF position.
3. Install the fuse(s) supplying power to the SDM.
4. Turn the ignition switch to the ON position. The AIR BAG indicator will flash then turn OFF. If the AIR BAG warning indi-

cator does not operate as described, perform the Diagnostic System Check.

Negative Battery Cable Method

1. Before servicing the vehicle, refer to the Precautions Section.
2. Place the ignition in the OFF position.
3. Connect the negative battery cable to the battery.
4. Turn the ignition switch to the ON position. The AIR BAG indicator will flash then turn OFF. If the AIR BAG warning indicator does not operate as described, perform the Diagnostic System Check.

CLOCKSPRING CENTERING

See Figure 8.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Verify the following before centering the Supplemental Inflatable Restraint (SIR) coil:
 - a. The wheels on the vehicle are straight ahead.
 - b. The centering mark of the steering shaft assembly is in the 6 o'clock position.
3. Turn the lobe of the clock spring clockwise until the coil ribbon stops. Do not force.
4. Turn the lobe of the clock spring counterclockwise approximately 3 turns to the Neutral position.
5. Properly align until the centering window turns yellow. This indicates the CENTER position.

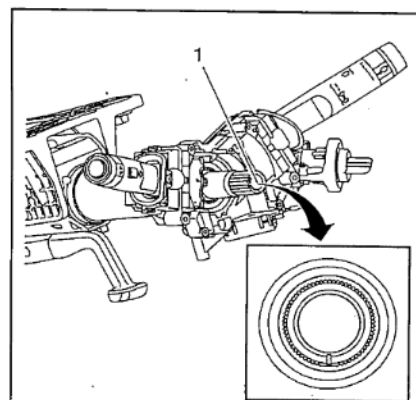


Fig. 8 Clockspring with centering mark (1) in the 6 o'clock position

DRIVE TRAIN

AUTOMATIC TRANSMISSION FLUID

CHECKING FLUID

*** WARNING

Use Dexron VI transmission fluid only. Failure to use the proper fluid may result in transmission internal damage. Ensure the transmission has enough fluid in it to safely start the vehicle without damaging the transmission. With the vehicle off there must be at least enough fluid to wet the end of the dipstick bullet. This will ensure that there is enough fluid in the sump to fill the components once the vehicle is started.

➔ Check the transmission fluid level when the Transmission Fluid Temperature (TFT) is between 180°F–200°F (82°C–93°C).

1. Park the vehicle on a level surface, apply the parking brake and place the shift lever in PARK (P).
2. Start the engine.
3. Depress the brake pedal and move the shift lever through each gear range, pausing for about 3 seconds in each range. Then move the shift lever back to PARK (P).
4. Allow the engine to idle 500–800 rpm for at least 1 minute. Release the brake pedal.
5. Keep the engine running and observe the Transmission Fluid Temperature (TFT) using the Driver Information Center or a scan tool.

6. Remove the dipstick and wipe it with a clean rag or paper towel.

7. Inspect the fluid color. The fluid should be red or dark brown.

- a. If the fluid color is very dark or black and has a burnt odor, inspect the fluid for excessive metal particles or other debris. A small amount of "friction" material is a "normal" condition. If large pieces and/or metal particles are noted in the fluid, flush the oil cooler and cooler lines and overhaul the transmission. If there are no signs of transmission internal damage noted, replace the fluid, repair the oil cooler, and flush the cooler lines. Fluid that is cloudy or milky or appears to be contaminated with water indicates engine coolant or water contamination.

8. Install the dipstick and tighten. Wait three seconds and then remove it again.

➔ Always check the fluid level at least twice. Consistent readings are important to maintaining proper fluid level. If inconsistent readings are noted, inspect the transmission vent assembly to ensure it is clean and unclogged.

9. Check both sides of the dipstick and read the lower level.

➔ It is not necessary to get the fluid level all the way up to the MAX mark. Anywhere within the crosshatch band is acceptable.

10. Install and remove the dipstick again to verify the reading.
11. If the fluid level is not within the crosshatch band, add or drain fluid as necessary to bring the level into the crosshatch band. If the fluid level is low, add only

enough fluid to bring the level into the crosshatch band.

- a. Do not add more than one pint (0.5L) at a time without rechecking the level. Once the oil is on the dipstick bullet, it will not take much more fluid to raise the fluid level into the crosshatch band. Do not overfill. Also, if the fluid level is low, inspect the transmission for leaks.

12. If the fluid level is in the acceptable range, install the dipstick.

13. If the fluid was changed, reset the transmission oil life monitor, if applicable.

FLUID REFILL

See Figure 9.

1. Place a drain pan capable of containing more than 5 quarts of fluid under the transmission.

2. Remove the drain plug and drain the fluid.

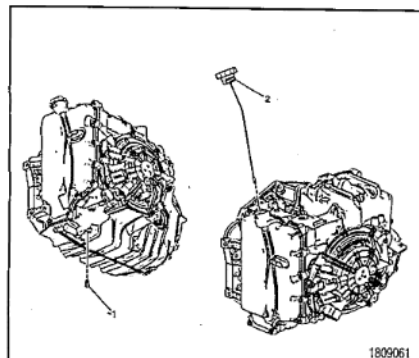


Fig. 9 Fluid fill tube plug assembly (1) hole, and oil level check plug (2) hole

3. Replace the drain plug.
4. Fill the transmission with fluid. Transmission will require approximately 5 quarts of fluid.

TRANSFER CASE ASSEMBLY

REMOVAL & INSTALLATION

2.8L Engines

See Figures 10 through 12.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Remove the driveshaft.
3. Drain the oil from the transmission.
4. Remove the right halfshaft.
5. Remove the transmission rear mount bracket.
6. Remove the front catalytic converters.
7. Remove the transfer case vent hose strap, bolt, and hose.
8. Remove the transfer case bracket-to-transfer case bolts.
9. Remove the transfer case bracket-to-engine bolts.
10. Remove the brackets.
11. Support the transfer case with a suitable jack and secure with suitable straps.
12. Remove the transfer case-to-transmission bolts. The center bolt is accessed through the opening in the center of the transfer case.
13. Remove the remaining transfer case-to-transmission bolts.
14. Separate the transfer case from the transmission and remove the transfer case.
15. Remove and discard the transfer case-to-transmission O-ring.

To install:

16. Clean the contact surfaces between the transfer case and the transmission.

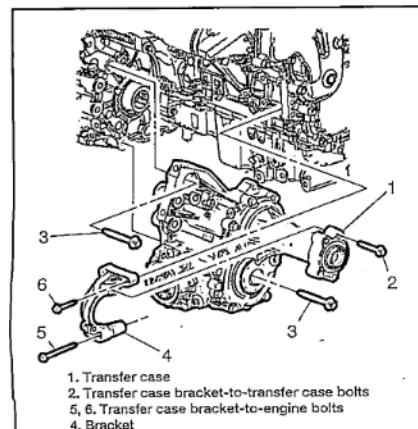


Fig. 10 Remove the transfer case bolts

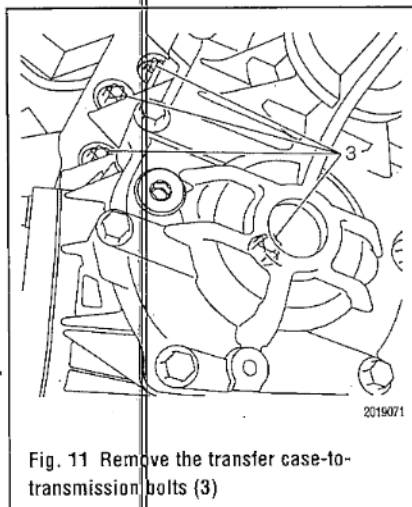


Fig. 11 Remove the transfer case-to-transmission bolts (3)

17. Install a new transfer case-to-transmission O-ring.
18. Support the transfer case with a suitable jack, and secure with suitable straps.
19. Raise and align the transfer case in the correct position in relation to the transmission.
20. Install the transfer case to the transmission.
21. Install the transfer case-to-transmission bolts. Tighten to 81 ft. lbs. (110 Nm).
22. Install the transfer case-to-transmission bolts (3). The center bolt is accessed through the opening in the center of the transfer case.
 - a. Tighten the bolts a first pass to 73 ft. lbs. (100 Nm).
 - b. Tighten the bolts a second pass 60 degrees.
23. Install the bracket (4).
24. Install the transfer case bracket-to-transfer case bolts (2).
25. Install the transfer case bracket-to-engine bolts (5, 6).
26. Tighten the bracket-to-transfer case bolts to 44 inch lbs. (5 Nm).
27. Tighten the bracket-to-engine bolts to 16 ft. lbs. (22 Nm).

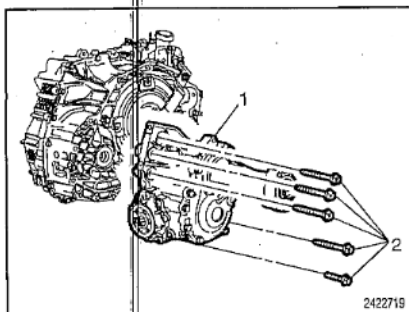


Fig. 12 Install the transfer case (1) and the transfer case-to-transmission bolts (2)

28. Tighten the bracket-to-transfer case bolts to 42 ft. lbs. (58 Nm).
29. Install the transmission rear mount bracket.
30. Install the transfer case vent hose, strap, and bolt.
31. Tighten the transfer case vent hose bolt to 17 ft. lbs. (22 Nm).
32. Install the front catalytic converters.
33. Install the right halfshaft.
34. Install the driveshaft.
35. Fill the transmission with oil.
36. Fill with transfer case oil.

3.0L Engines

See Figures 13 and 14.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Remove the driveshaft.
3. Drain the oil from the transmission.
4. Remove the right halfshaft.
5. Remove the transmission rear mount bracket.
6. Remove the front catalytic converters.
7. Remove the transfer case vent hose strap, bolt, and hose.
8. Remove the transfer case bracket-to-transfer case bolts.
9. Remove the transfer case bracket-to-engine bolts.
10. Remove the brackets.
11. Support the transfer case with a suitable jack and secure with suitable straps.
12. Remove the remaining transfer case-to-transmission bolts.
13. Separate the transfer case from the transmission and remove the transfer case.
14. Remove and discard the transfer case-to-transmission O-ring.

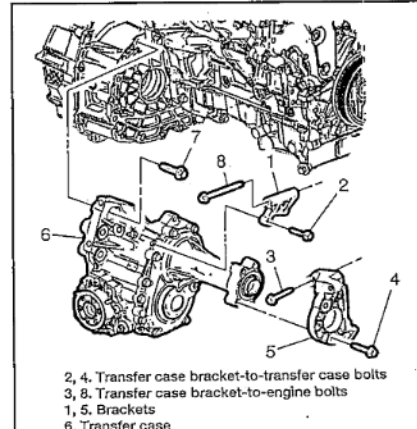


Fig. 13 Remove the transfer case bolts

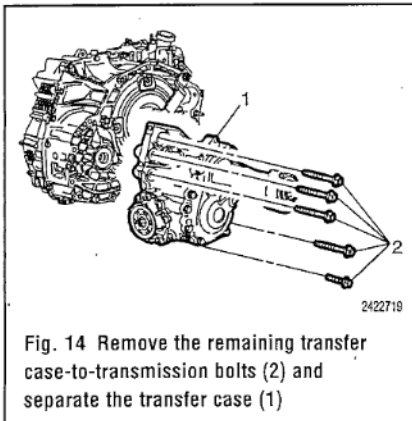


Fig. 14 Remove the remaining transfer case-to-transmission bolts (2) and separate the transfer case (1)

To install:

15. Clean the contact surfaces between the transfer case and the transmission.
16. Install a new transfer case-to-transmission O-ring.
17. Support the transfer case with a suitable jack, and secure with suitable straps.
18. Raise and align the transfer case in the correct position in relation to the transmission.
19. Install the transfer case to the transmission.
20. Install the transfer case-to-transmission bolts and tighten to 81 ft. lbs. (110 Nm).
21. Install the brackets (1, 5).
22. Install the transfer case bracket-to-transfer case bolts (2, 4).
23. Install the transfer case bracket-to-engine bolts (3, 6).
24. Tighten the bracket-to-transfer case bolts (2, 4) to 44 inch lbs. (5 Nm).
25. Tighten the bracket-to-engine bolts (3, 6) to 16 ft. lbs. (22 Nm).
26. Tighten the bracket-to-transfer case bolts (2, 4) to 42 ft. lbs. (58 Nm).
27. Install the transmission rear mount bracket.
28. Install the transfer case vent hose, strap, and bolt.
29. Tighten the transfer case vent hose bolt to 17 ft. lbs. (22 Nm).
30. Install the front catalytic converters.
31. Install the right halfshaft.
32. Install the driveshaft.
33. Fill the transmission with oil.
34. Fill with transfer case oil.

FRONT HALFSHAFT

REMOVAL & INSTALLATION

See Figure 15.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and safely support the vehicle.

3. Remove the tire and wheel assembly.
4. Insert a drift or punch in the cooling fins of the brake rotor.
5. Rotate the brake rotor until the drift or punch contacts the brake caliper mounting bracket.
6. Using a breaker bar, loosen the halfshaft (wheel drive shaft) nut.
7. Remove the halfshaft nut.
8. Using the J-45859 puller, separate the halfshaft from the knuckle assembly.
9. Remove the lower control arm from the knuckle.
10. Remove the outer tie rod end from the knuckle.
11. Using a large flat-bladed screwdriver, remove the halfshaft from the differential.
12. Remove the halfshaft from the vehicle.

—It may be necessary to have an assistant hold the knuckle assembly while removing the halfshaft. If removing the halfshaft to service other suspension or driveline components, use care when removing or installing the halfshaft so as not to damage the halfshaft boots. The front axle shaft seal must be replaced once the halfshaft has been removed. Replace with NEW only. DO NOT reuse the front shaft axle seal.

13. Remove and discard the washer from the halfshaft. DO NOT re-use the washer, replace with NEW only. If there is no washer on the halfshaft, install a NEW washer.
14. Remove the front axle shaft seal.

To install:

15. Install the NEW front axle shaft seal.

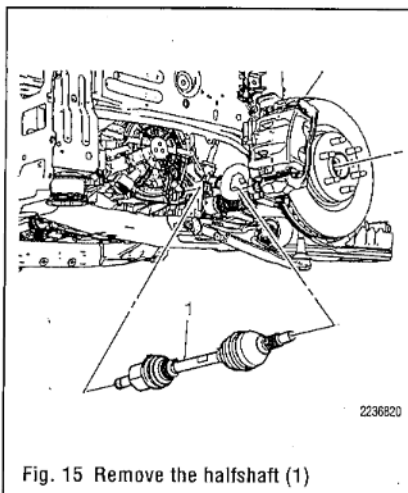


Fig. 15 Remove the halfshaft (1)

16. Install the DT-44394-A protector into the differential seal. Halfshaft seal protector must be installed into the differential output shaft seal prior to removing and installing the halfshaft.

** WARNING

Failure to install the halfshaft seal protector as indicated may cause the splines of the halfshaft to cut the differential output seal.

17. For vehicles equipped with an intermediate shaft, on the right halfshaft, apply a very small amount of grease to the splines of the halfshaft inner joint.
18. Install the halfshaft into the differential.
19. Remove the DT-44394-A protector from the halfshaft.
20. Insert the halfshaft in the knuckle.
21. Install the lower control arm in the knuckle.
22. Install the outer tie rod end in the knuckle.
23. Install the halfshaft nut.
24. Insert a drift or punch in the cooling fins of the brake rotor.
25. Rotate the brake rotor until the drift or punch contacts the brake caliper mounting bracket.
26. Using a torque wrench, tighten the halfshaft nut to 184 ft. lbs. (250 Nm).
27. Install the tire and wheel assembly.
28. Remove the support and lower the vehicle.

REAR AXLE FLUID

DRAIN & REFILL

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and support the vehicle.
3. Ensure the vehicle is level.
4. Inspect the rear axle for leaks, repair if necessary.
5. Position a drain pan under drain plug.
6. Remove the drain plug and drain the fluid.
7. Install the drain plug and tighten to 18 ft. lbs. (25 Nm).
8. Remove the fill plug.
9. Clean the area-around the rear axle fill plug.
10. Add lubricant until the level is even with the bottom edge of the fill plug opening. Use the proper fluid.
11. Install the fill plug to and tighten to 18 ft. lbs. (25 Nm).
12. Lower the vehicle.

REAR DRIVESHAFT (PROPELLER SHAFT)

REMOVAL & INSTALLATION

See Figure 16.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and support the vehicle.
3. Mark a reference point between the propeller shaft and the rear differential flange.
4. Using the appropriate tools, remove the rear differential drive flange bolts and retainers.
5. Pull the propeller shaft from the rear differential (use the DT 49064 puller, if necessary).
6. Lower the evaporator canister to gain access to the center bearing bolts.
7. Support the support bearings with jack stands and remove the support bearing mounting bolts.
8. Using the DT-49030 fork, remove the propeller shaft from the transfer case. It may

be necessary to have the help of an assistant to remove the propeller shaft.

To install:

9. Installation is the reverse of removal, noting the following:
 - a. Apply grease on the propeller shaft spline.
 - b. Clean the mounting bolt threads, apply thread locker to the bolts, and tighten the bolts to 43 ft. lbs. (58 Nm).
 - c. Tighten the rear differential drive flange bolts to 27 ft. lbs. (36 Nm).

REAR HALFSHAFT

REMOVAL & INSTALLATION

See Figure 17.

Before servicing the vehicle, refer to the Precautions Section.

1. Raise and safely support the vehicle.
2. Remove the tire and wheel assembly.
3. Insert a brass drift or punch in the cooling fins of the brake rotor.
4. Rotate the brake rotor until the drift

or punch is resting against the brake mounting bracket.

5. Using a breaker bar and the proper size socket, loosen the halfshaft nut.
6. Remove the halfshaft nut.
7. Using the J 45859 tool or equivalent hub puller, separate the halfshaft from the knuckle assembly.
8. Remove the knuckle assembly from the vehicle.
9. Using a long flat-bladed screwdriver, remove the halfshaft from the differential.
10. Remove the halfshaft from the vehicle.
11. Remove the washer from the halfshaft.

To install:

12. Install the NEW washer on the halfshaft, if needed.
13. Install the rear halfshaft in the rear differential.
14. Install the knuckle assembly.
15. Install the halfshaft nut.
16. Insert a brass drift or punch in the cooling fins of the brake rotor.
17. Rotate the brake rotor until the brass drift or punch rest against the brake caliper mounting bracket.
18. Using a torque wrench and the proper size socket, tighten the halfshaft nut to 184 ft. lbs. (250 Nm).
19. Install the tire and wheel assembly.
20. Remove the support and lower the vehicle.

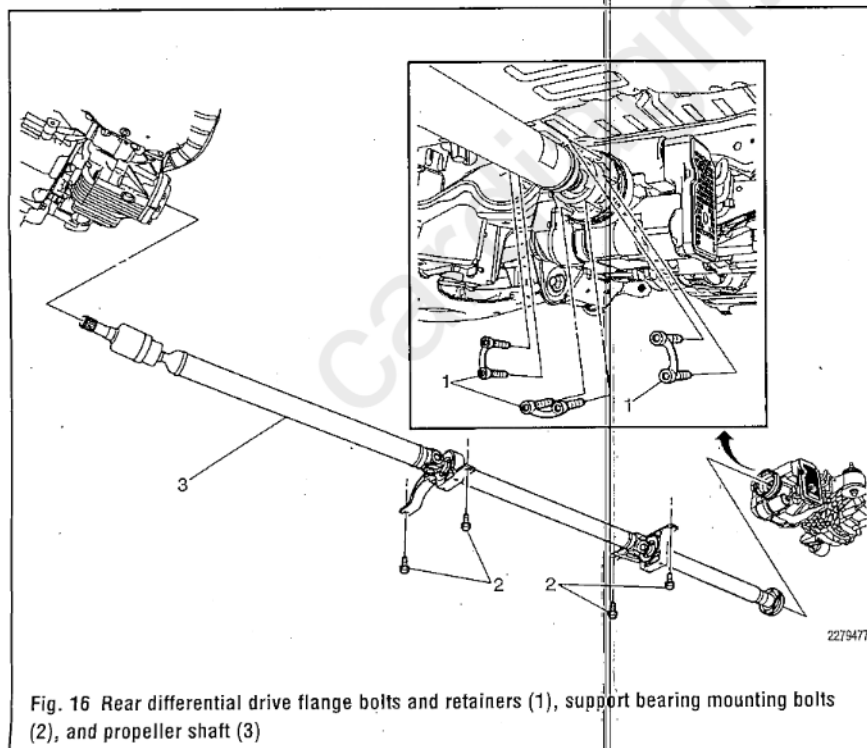


Fig. 16 Rear differential drive flange bolts and retainers (1), support bearing mounting bolts (2), and propeller shaft (3)

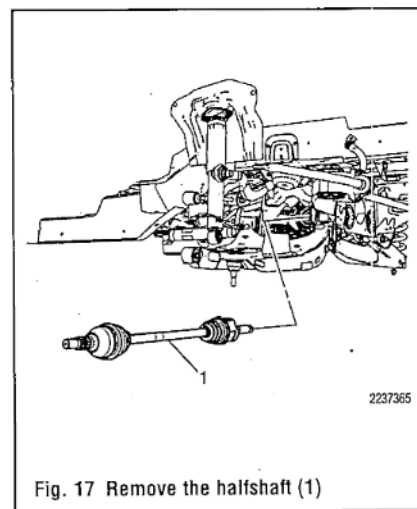


Fig. 17 Remove the halfshaft (1)

ENGINE COOLING

ENGINE COOLANT

DRAIN & REFILL PROCEDURE

** CAUTION

Do not remove the radiator cap or surge tank cap while the engine is hot. The cooling system will release scalding fluid and steam under pressure if radiator cap or surge tank cap is removed while the engine and radiator are still hot.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Remove the coolant pressure cap from the radiator surge tank.
3. Raise and support the vehicle.
4. Remove the radiator air lower deflector.
5. Place a drain pan under the drain cock.
6. Loosen the radiator drain cock.
7. Drain the cooling system.
8. Lower the vehicle.
9. Inspect the coolant.
10. Follow the appropriate procedure based on the condition of the coolant:
 - Discolored appearance: Follow the flush procedure
 - Normal in appearance: Follow the fill procedure below

To install:

11. Use a coolant refill tool according to the manufacturer's instructions, or, if not using a coolant refill tool, perform a static refill as directed below.

** WARNING

The fill procedure below must be followed. Improper coolant level could result in a low or high coolant level condition, causing engine damage.

12. Raise and support the vehicle.
13. Tighten the radiator drain cock to 18 inch lbs. (2 Nm).
14. Install the radiator air lower deflector.
15. Lower the vehicle.
16. Slowly fill the radiator with a mixture of 50/50 DEX-COOL antifreeze and clean drinkable water until the coolant level reaches the base of the radiator surge tank.
17. Allow 30 seconds for the coolant level to stabilize and continue to fill the coolant filler neck until the level stabilizes for at least 2 minutes.

18. Start the engine and allow to the engine to idle in PARK or NEUTRAL with the parking brake engaged.

19. Slowly fill the coolant mixture until the level stabilizes at the base of the radiator surge tank.

20. Install the coolant pressure cap.

21. Raise the engine RPM to 2500 RPM for 30–40 seconds.

22. Shut the engine OFF.

23. Allow the engine to cool, remove coolant fill cap and repeat steps 4–10 until the coolant level has completely stabilized within the radiator surge tank.

24. Inspect the concentration of the engine coolant using a tester (GE-26568 Coolant and Battery Fluid Tester, or equivalent).

25. Inspect and fill the coolant reservoir bottle as necessary.

26. Rinse away any excess coolant from the engine and the engine compartment.

27. Inspect the cooling system for leaks.

28. Top off the radiator surge tank, if necessary.

FLUSHING

** WARNING

Do not use a chemical flush.

** CAUTION

Store used coolant in the proper manner, such as in a used engine coolant holding tank. Do not pour used coolant down a drain. Ethylene glycol antifreeze is a very toxic chemical. Do not dispose of coolant into the sewer system or ground water. This is illegal and ecologically unsound.

➔ Various methods and equipment can be used to flush the cooling system. If special equipment is used, such as a back flusher, follow the manufacturer's instruction. However, always remove the thermostat before back flushing the system.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Block the drive wheels.
3. Place the transmission in PARK (P).
4. Engage the park brake.
5. Run the engine until the thermostat opens.
6. Stop the engine.

** CAUTION

Approved safety glasses and gloves should be worn when performing this procedure to reduce the chance of personal injury.

7. Follow the drain and fill procedure using only clean drinkable water. Repeat the procedure if necessary, until the fluid is nearly colorless.

8. Fill the cooling system when flushing is complete.

ENGINE FAN

REMOVAL & INSTALLATION

See Figure 18.

** CAUTION

An electric fan under the hood can start up even when the engine is not running and can injure you. Keep hands, clothing and tools away from any under hood electric fan.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Disconnect the negative battery cable.
3. Remove or reposition the components necessary to access the radiator and cooling fan.
4. Reposition the radiator forward.
5. Disconnect the cooling fan electrical connectors.
6. Remove the fan shroud bolts and the shroud.
7. Remove the cooling fan retainer bolts and remove the cooling fan from the shroud.
8. Unclip cooling fan motor wiring harness from cooling fan shroud.

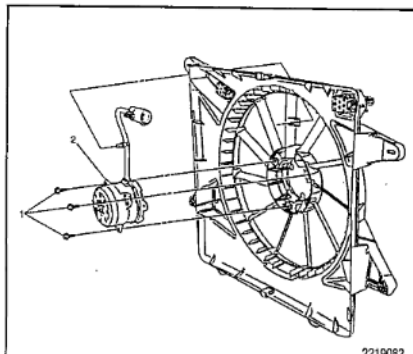


Fig. 18 Remove the cooling fan motor (1) and bolts (1)

22-24 CADILLAC SRX

9. Remove the mounting bolts and the motor.

To install:

10. Installation is the reverse of removal, noting the following:

- Tighten the motor mounting bolts to 62 inch lbs. (7 Nm).
- Tighten the shroud mounting bolts to 70 inch lbs. (8 Nm).

RADIATOR

REMOVAL & INSTALLATION

See Figure 19.

- Before servicing the vehicle, refer to the Precautions Section.
- Drain the cooling system.
- Disconnect the negative battery cable.
- Remove the front bumper fascia.
- Remove the front compartment front sight shield.
- Remove the hood primary latch bracket.
- Remove the cooling fan and shroud.
- Remove the radiator air upper seal.
- Remove the radiator air lower seal.
- Remove the radiator air side seal.
- Remove the radiator air side baffles.
- Remove the air conditioning condenser.
- Remove the charge air cooler, if applicable.
- Remove the radiator inlet and outlet hoses.
- Remove the radiator upper support bracket bolts.
- Remove the radiator upper support brackets.
- Remove the radiator from the vehicle.

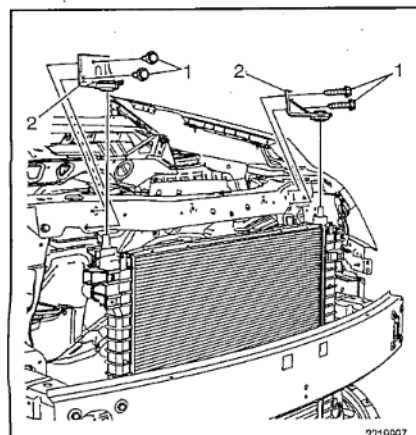


Fig. 19 Remove the radiator upper support brackets (2) and bolts (1)

To install:

- Install the radiator to the vehicle.
- Install the radiator upper support bracket.
- Install the radiator upper support bracket bolts and tighten to 80 inch lbs. (9 Nm).
- Install the radiator outlet and inlet hoses.
- Install the charge air cooler, if applicable.
- Install the air conditioning condenser.
- Install the radiator air side baffles.
- Install the radiator air side seal.
- Install the radiator air lower seal.
- Install the radiator air upper seal.
- Install the cooling fan and shroud.
- Install the primary latch bracket.
- Install the front compartment front sight shield.
- Install the front bumper fascia.
- Fill the cooling system.
- Connect the negative battery cable.
- Fill the cooling system.

THERMOSTAT

REMOVAL & INSTALLATION

3.0L Engines

See Figure 20.

- Before servicing the vehicle, refer to the Precautions Section.
- Drain the cooling system.

- Disconnect the negative battery cable.
- Remove the intake manifold cover.
- Remove the fuel pipe shield.
- Remove the heater outlet hose.
- Remove the heater inlet hose.
- Remove the surge tank hose.
- Remove the radiator outlet hose.
- Remove the thermostat housing.
- Remove the thermostat and discard the gasket.

To install:

- Clean the engine block and the thermostat gasket surfaces.
- Install the thermostat with a new gasket.
- Install the thermostat housing and tighten the bolts to 88 inch lbs. (10 Nm).
- Install the hoses. Replace any worn hoses.
- Install the fuel pipe shield.
- Install the intake manifold cover.
- Connect the negative battery cable.
- Fill the cooling system.

WATER PUMP

REMOVAL & INSTALLATION

2.8L Engines

See Figure 21.

- Before servicing the vehicle, refer to the Precautions Section.
- Drain the cooling system.
- Disconnect the negative battery cable.

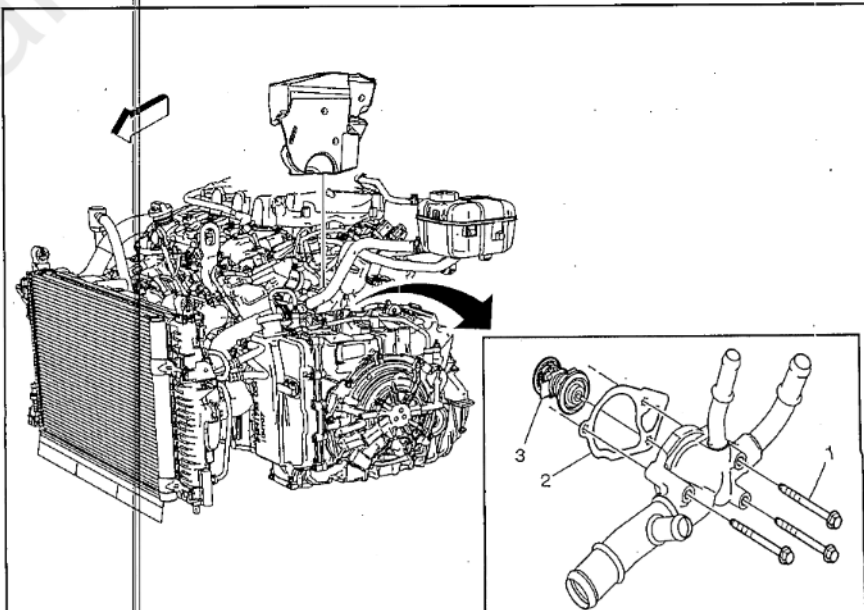


Fig. 20 Bolts (1), thermostat (3) and gasket (2)

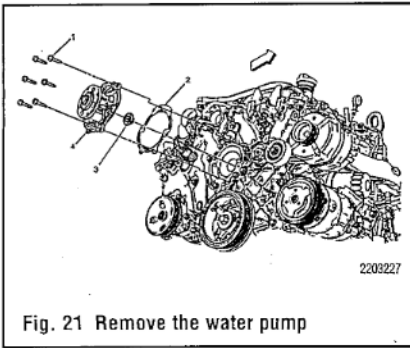


Fig. 21 Remove the water pump

4. Remove the drive belt.
5. Remove the water pump bolts.
6. Remove the water pump.
7. Remove and DISCARD the water pump seal.
8. Carefully clean the water pump sealing surfaces.

To install:

9. Install a NEW water pump seal.
10. Install the water pump.
11. Tighten the water pump bolts to 88 inch lbs. (10 Nm).
12. Install the drive belt.
13. Fill the cooling system.
14. Connect the negative battery cable.

3.0L Engines

See Figures 22 and 23.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Drain the cooling system.

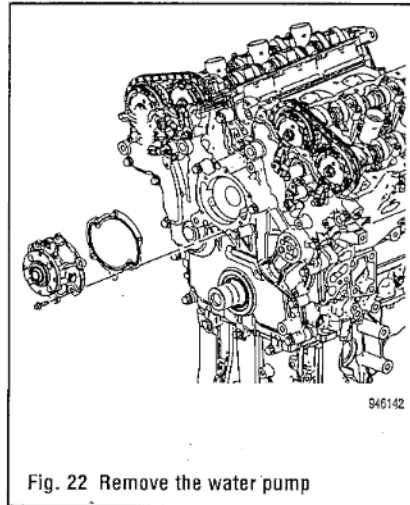


Fig. 22 Remove the water pump

3. Disconnect the negative battery cable.
4. Remove the alternator drive belt.
5. Use the EN 46104 or equivalent holding tool to secure the water pump pulley.
6. Remove the water pump pulley bolts.
7. Remove the water pump pulley.
8. Remove the water pump bolts.
9. Remove the water pump.
10. Remove and DISCARD the water pump seal.
11. Carefully clean the water pump sealing surfaces.

To install:

12. Install a NEW water pump seal.

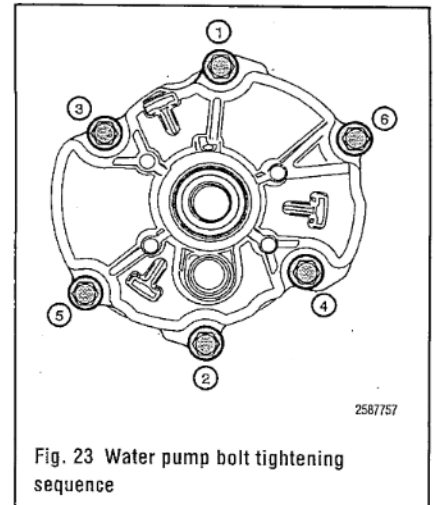


Fig. 23 Water pump bolt tightening sequence

13. Install the water pump.
14. Hand tighten the water pump bolts.
15. Tighten the water pump bolts in sequence to 106 inch lbs. (12 Nm).
16. Tighten the water pump bolts a second pass in sequence to 106 inch lbs. (12 Nm).
17. Install the water pump pulley and the water pump pulley bolts.
18. Use the holding tool to secure the water pump pulley.
19. Tighten water pump pulley bolts to 106 inch lbs. (12 Nm).
20. Install the alternator drive belt.
21. Fill the cooling system.
22. Connect the negative battery cable.

ENGINE ELECTRICAL

BATTERY

REMOVAL & INSTALLATION

1. Before servicing the vehicle, refer to the Precautions Section.
2. Remove the battery cover/Engine Control Module (ECM).

3. Disconnect the negative battery cable.
4. Open the battery fuse block cover and remove the battery positive fuse block cable.
5. Remove the fuse block nuts, the body harness terminal nut, and the fuse block.
6. Remove the battery retainer.
7. Remove the battery.

BATTERY SYSTEM

To install:

8. Installation is the reverse of removal, noting the following:
 - a. Tighten the battery retainer bolt to 89 inch lbs. (10 Nm).
 - b. Tighten the fuse block nuts to 106 inch lbs. (12 Nm).

ENGINE ELECTRICAL

ALTERNATOR

REMOVAL & INSTALLATION

See Figure 24.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Disconnect the battery negative cable.
3. Reposition the positive battery cable boot at the alternator terminal.
4. Remove the drive belt.
5. Disconnect the engine harness electrical connector from the alternator.
6. Remove the positive battery cable nut at the alternator.
7. Remove the positive battery cable terminal from the alternator.
8. Remove the idler pulley bolt and idler pulley.

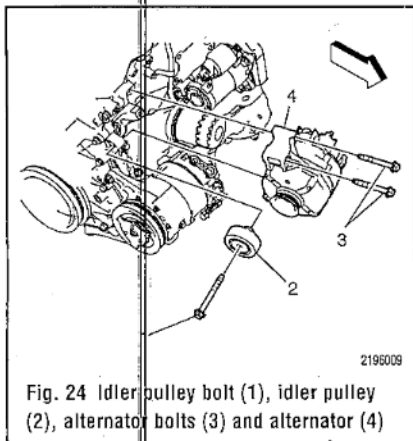


Fig. 24 Idler pulley bolt (1), idler pulley (2), alternator bolts (3) and alternator (4)

9. Remove the alternator bolts.
10. Remove the alternator.

ENGINE ELECTRICAL

FIRING ORDER

2.8L and 3.0L Engines: 1-2-3-4-5-6

IGNITION COIL

REMOVAL & INSTALLATION

See Figure 25:

1. Before servicing the vehicle, refer to the Precautions Section.
2. Disconnect the negative battery cable.
3. For Bank 1 ignition coils, remove the intake manifold.
4. For Bank 2 ignition coils, remove the intake manifold cover.
5. Disconnect the engine wiring harness electrical connectors from the ignition coils.
6. Remove the ignition coil bolts.
7. Remove the ignition coils.

To install:

8. Install the ignition coils.
9. Install the ignition coil bolts and tighten to 89 inch lbs. (10 Nm).
10. Connect the engine wiring harness electrical connectors to the ignition coils.
11. For Bank 1 ignition coils, install the intake manifold.
12. For Bank 2 ignition coils, install the intake manifold cover.
 - a. Press the fuel injector sight shield down firmly on the ball stud at the right front corner.
 - b. Install the oil fill cap.

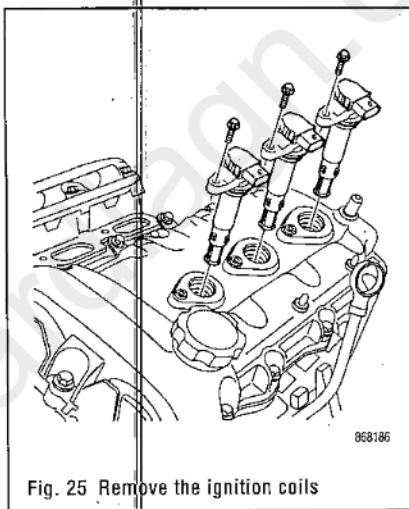


Fig. 25 Remove the ignition coils

13. Connect the negative battery cable.

IGNITION TIMING

ADJUSTMENT

The ignition timing is controlled by the Engine Control Module (ECM). No adjustment is necessary or possible.

SPARK PLUGS

REMOVAL & INSTALLATION

1. Before servicing the vehicle, refer to the Precautions Section.
2. Turn the ignition OFF.
3. Disconnect the negative battery cable.
4. Remove the ignition coils.

CHARGING SYSTEM

To install:

11. Position the alternator to the engine.
12. Loosely install the alternator bolts.
13. Install the idler pulley.
14. Tighten the alternator bolts in the sequence shown to:
 - 2.8L Engines: 43 ft. lbs. (58 Nm)
 - 3.0L Engines: 37 ft. lbs. (50 Nm)
15. Install the drive belt.
16. Connect the engine harness electrical connector to the alternator.
17. Install the positive battery cable terminal to the alternator.
18. Install the positive battery cable nut at the alternator and tighten to 11 ft. lbs. (15 Nm).
19. Position the positive battery cable boot at the alternator terminal.
20. Connect the negative battery cable.

IGNITION SYSTEM

** WARNING

Allow the engine to cool before removing the spark plugs. Attempting to remove the spark plugs from a hot engine may cause damage to cylinder head threads. Clean the spark plug recess area before removing the spark plug. Failure to do so could result in engine damage.

5. Use compressed air in order to remove debris from the spark plug cavity.
6. Remove the spark plug.

To install:

** WARNING

Use only the spark plugs specified for use in the vehicle. Failure to do so could result in severe engine damage. Check the gap of all new and reconditioned spark plugs before installation.

7. Ensure that the spark plug gap is equivalent to the specification. Specified gap: 0.043 in. (1.1 mm).
8. Install the spark plug and tighten to 13 ft. lbs. (18 Nm). Be sure that the spark plug threads smoothly into the cylinder head and the spark plug is fully seated. Use a thread chaser, if necessary, to clean threads in the cylinder head.
9. Install the ignition coil.
10. Connect the negative battery cable.

ENGINE ELECTRICAL

STARTER

REMOVAL & INSTALLATION

2.8L Engines

See Figure 26.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Turn the ignition OFF.
3. Disconnect the negative battery cable.
4. Remove the secondary air injection pump.
5. Remove the battery positive cable nut and terminal from the starter.
6. Remove the engine wiring harness nut and the engine harness terminal from the starter solenoid.

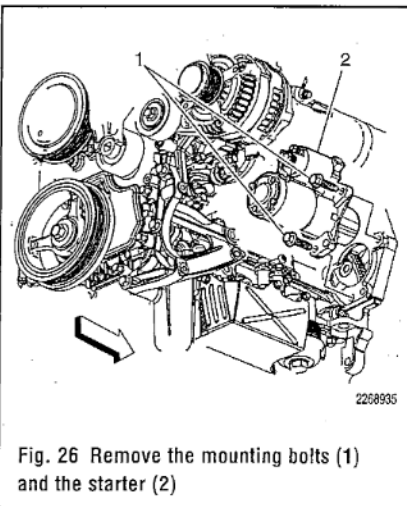


Fig. 26 Remove the mounting bolts (1) and the starter (2)

7. Remove the starter mounting bolts.
8. Remove the starter from the engine.

To install:

9. Install the starter motor.
10. Install the starter motor mounting bolts and tighten to 43 ft. lbs. (58 Nm).
11. Install the battery positive cable terminal and nut to the starter solenoid and tighten to 9 ft. lbs. (15 Nm).
12. Install the engine harness terminal and nut to the starter solenoid and tighten to 53 inch lbs. (6 Nm).
13. Reposition and install the secondary air injection pump and bracket.
14. Connect the battery negative cable.

3.0L Engines

See Figure 27.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Turn the ignition OFF.
3. Disconnect the negative battery cable.
4. Remove the starter heat shield.
5. Remove the left catalytic converter head nuts and reposition catalytic converter away from cylinder head.
6. Raise and support the vehicle.
7. Disconnect the knock sensor connector.
8. Remove the battery positive nut and the engine harness connector from the starter solenoid.
9. Remove the starter motor mounting bolts.
10. Remove the starter motor.

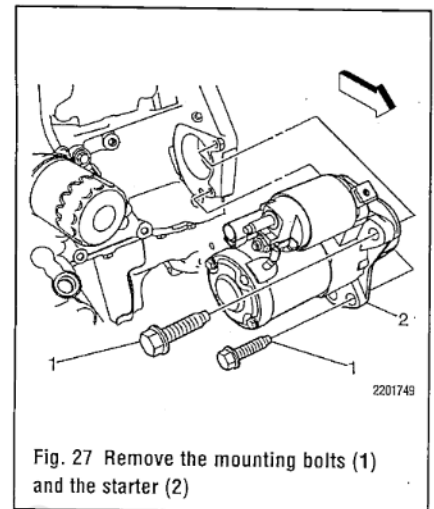


Fig. 27 Remove the mounting bolts (1) and the starter (2)

To install:

11. Install the starter motor and tighten the mounting bolts to 43 ft. lbs. (58 Nm).
12. Install the battery positive cable and engine harness connector to the starter. Tighten the battery positive cable nut to 9 ft. lbs. (15 Nm).
13. Install the engine harness connector to the starter solenoid.
14. Install the starter heat shield and tighten the bolt to 62 inch lbs. (7 Nm).
15. Connect the knock sensor connector.
16. Install the left catalytic converter to the cylinder head. Tighten:
 - First Pass: 15 ft. lbs. (20 Nm)
 - Final Pass: 34 ft. lbs. (46 Nm)
17. Connect the negative battery cable.

ENGINE MECHANICAL

—Disconnecting the negative battery cable may interfere with the functions of the on board computer systems and may require the computer to undergo a relearning process, once the negative battery cable is reconnected.

ACCESSORY DRIVE BELTS

ACCESSORY BELT ROUTING

See Figure 28.

Refer to the accompanying illustration.

INSPECTION

Inspect the drive belt for signs of glazing or cracking. A glazed belt will be perfectly smooth from slippage, while a good belt will have a slight texture of fabric visible. Cracks will usually start at the inner edge of the belt

and run outward. All worn or damaged drive belts should be replaced immediately.

ADJUSTMENT

Tension is automatically adjusted by the belt tensioner.

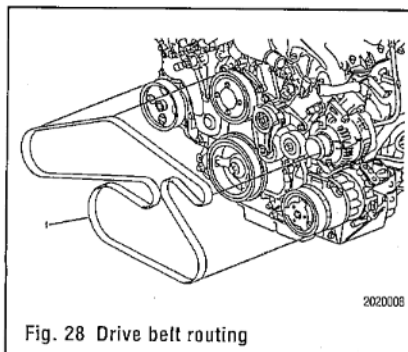


Fig. 28 Drive belt routing

REMOVAL & INSTALLATION

1. Before servicing the vehicle, refer to the Precautions Section.
2. Disconnect the negative battery cable.
3. Remove the engine mount bracket.
4. Rotate the drive belt tensioner clockwise to release the drive belt tension.
5. Slide the drive belt off the belt idler pulley.
6. Slowly release the drive belt tensioner.
7. Remove the drive belt.

To install:

8. Installation is the reverse of removal.

AIR CLEANER

REMOVAL & INSTALLATION

1. Before servicing the vehicle, refer to the Precautions Section.

22-28 CADILLAC SRX

2. Disconnect the negative battery cable.
3. Disconnect the air cleaner outlet duct from the air cleaner assembly.
4. For 2.8L engines, remove the mass airflow sensor and disconnect the secondary air injection hose from the air cleaner.
5. Disengage the air cleaner housing grommets from the studs, while guiding the housing out of the inlet duct.
6. If replacing the air cleaner assembly, transfer parts as necessary.
7. Disconnect the electrical connectors.

To install:

8. Installation is the reverse of removal.

FILTER/ELEMENT REPLACEMENT

1. Before servicing the vehicle, refer to the Precautions Section.
2. Disconnect the negative battery cable.
3. Disconnect the air cleaner outlet duct from the air cleaner.
4. For 2.8L engines, disconnect the secondary air injection hose from the air cleaner assembly.
5. Disconnect the mass airflow sensor electrical connector.
6. For 3.0L engines, disconnect the throttle inlet absolute pressure sensor electrical connector.
7. Release the air cleaner retaining clips and remove the element.

To install:

8. Installation is the reverse of removal.

CAMSHAFT AND VALVE LIFTERS

INSPECTION

See Figures 29 through 32.

1. Inspect the camshaft oil feed holes to the camshaft position actuator for dirt, debris or blockage.
2. Inspect the threaded hole for damage.
3. Inspect the camshaft position actuator locating notch for damage or wear.
4. Inspect the camshaft sealing grooves for damage.
5. Inspect the camshaft thrust surface for damage.
6. Inspect the camshaft lobes and journals for the following conditions:
 - Excessive scoring or pitting
 - Discoloration from overheating
 - Deformation from excessive wear, especially the camshaft lobes
7. If any of the above conditions exist on the camshaft, replace the camshaft.
8. With the camshaft in a suitable fixture, measure the camshaft for wear.

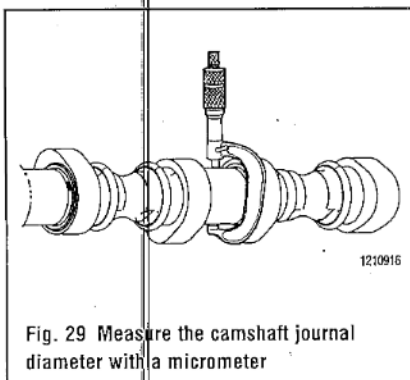


Fig. 29 Measure the camshaft journal diameter with a micrometer

9. Measure the camshaft journals for diameter and out-of-round using an outside micrometer.

- a. If the diameter is smaller than specifications, replace the camshaft.
- b. If the out-of-round exceeds specifications, replace the camshaft.

10. Measure the camshaft runout using a dial indicator (GE 7872 or equivalent tool).

11. Measure the camshaft thrust width for wear using a depth micrometer.

12. Measure the camshaft thrust wall surface for runout using a dial indicator (GE 7872 or equivalent tool). If the camshaft is damaged or worn beyond specifications, replace the camshaft. No machining of the camshaft is allowed.

13. Measure the camshaft lobes for wear using a dial indicator (GE 7872 or equivalent tool).

14. Place the dial indicator (GE 7872 or equivalent tool) with the indicator tip on the base circle of the camshaft lobe.

- a. Place the indicator tool at zero.
- b. Rotate the camshaft until the indicator tip is at the highest point on the lobe. This reading is the lift of the camshaft lobe.

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

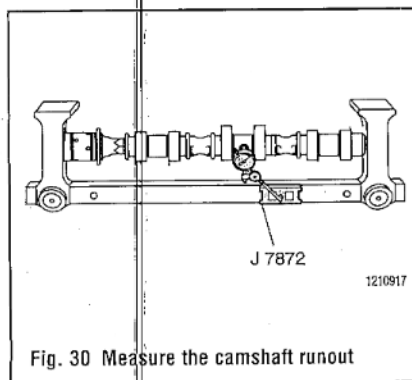


Fig. 30 Measure the camshaft runout

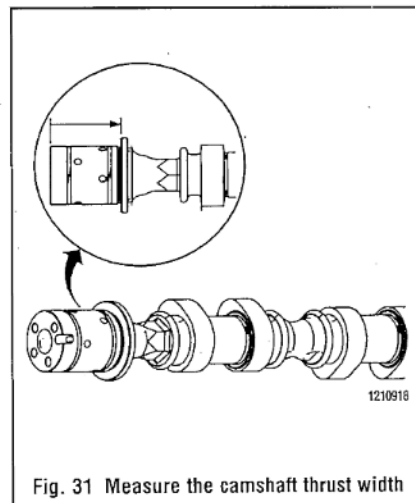


Fig. 31 Measure the camshaft thrust width

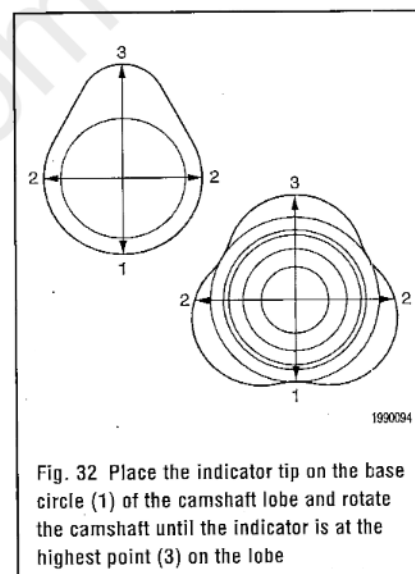


Fig. 32 Place the indicator tip on the base circle (1) of the camshaft lobe and rotate the camshaft until the indicator is at the highest point (3) on the lobe

15. Inspect the valve lifters:

- a. Inspect the Stationary Hydraulic Lash Adjuster (SHLA) in the following areas:
 - A plugged oil passage
 - A scored or worn camshaft follower pivot area
 - A damaged or broken retainer
 - A severely scuffed or worn SHLA body
- b. Replace the SHLA or as necessary.

REMOVAL & INSTALLATION

See Figures 33 through 41.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Disconnect the negative battery cable.
3. Remove the intake manifold.
4. Remove the fuel pump from the cylinder head.

5. Remove the valve covers.
6. Remove the camshaft sensors.
7. Remove the camshaft position actuator solenoids.
8. Remove the camshaft position actuator.
9. Remove the crankshaft balancer.
10. Rotate the crankshaft with a crankshaft rotation socket (EN-46111 or equivalent) until the camshafts are in a neutral (low tension) position. The camshaft flats will be parallel with the camshaft cover rail.
11. Loosen the camshaft position actuator bolt. Use an open-end wrench at the camshaft hex to prevent camshaft/engine rotation. **DO NOT** remove the camshaft position actuator bolt at this time.

** WARNING

A wrench must be used on the hex of the camshaft when loosening or tightening in order to prevent component damage. Failure to prevent the torque reaction against the timing drive chain can lead to timing drive chain failure.

12. Install the timing chain retention tool (EN-48313 or equivalent) and secure the timing chain. Ensure that the tips of the retention tool are fully engaged into the timing chain. Firmly tighten the retention tool nuts.

13. Matchmark the timing chain and the respective locations on the camshaft position actuators.

14. Remove the camshaft position actuator bolt.

15. Remove the camshaft bearing cap bolts.

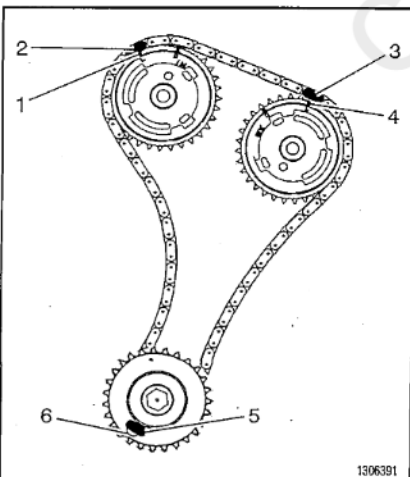


Fig. 33 Matchmark the timing chain and the respective locations on the camshaft position actuators (1-4)—left side

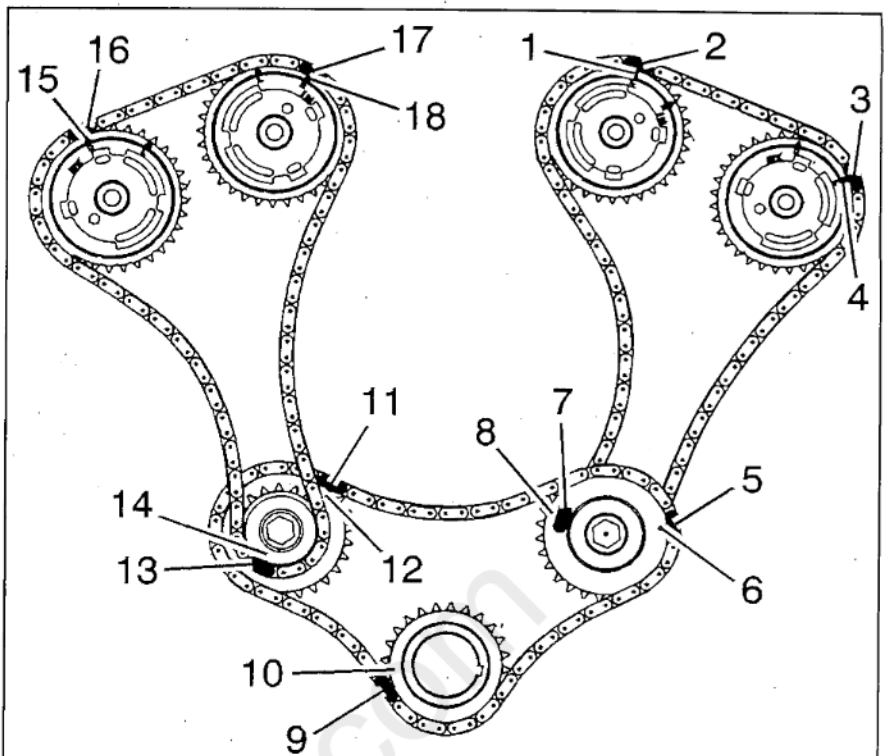


Fig. 34 Matchmark the timing chain and the respective locations on the camshaft position actuators (15-18)—right side

16. Remove the camshaft bearing caps.

17. Remove the camshafts. Matchmark the camshafts upon removal to ensure installation is in the correct position.

To install:

18. Position the camshafts to the cylinder head and assemble the camshaft actuators to the camshafts. Ensure that the marks on the camshaft position actuator and the timing chain are aligned. **DO NOT** tighten

the camshaft position actuator bolt at this time.

19. Ensure that the camshaft sealing rings are in place in the camshaft grooves. Camshaft sealing rings must be in place below the surface of the camshaft journal in order to avoid being pinched between the cylinder head and the camshaft caps.

20. Apply a liberal amount of lubricant to the camshaft journals and the cylinder head camshaft carriers.

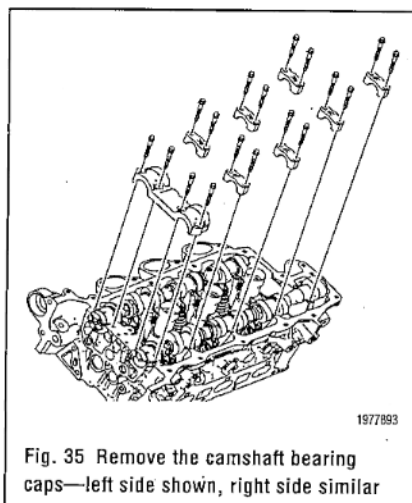


Fig. 35 Remove the camshaft bearing caps—left side shown, right side similar

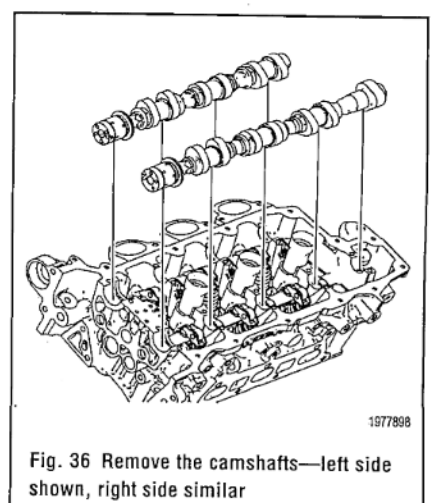


Fig. 36 Remove the camshafts—left side shown, right side similar

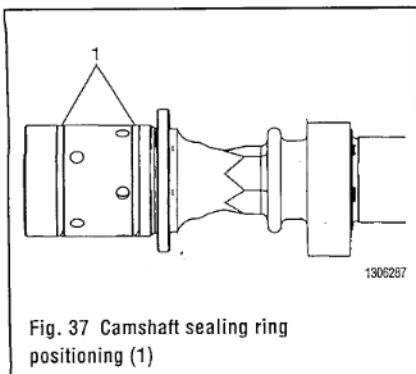


Fig. 37 Camshaft sealing ring positioning (1)

21. Place the camshafts in position in the cylinder head.

22. Position the camshaft lobes in a neutral position with the flats on the back of the camshafts up and parallel with the cylinder head camshaft cover rail.

23. Observe the markings on the cylinder head camshaft bearing caps. Each bearing cap is marked in order to identify its location. The markings have the following meanings:

a. The raised feature must always be oriented toward the center of the cylinder head.

b. The I indicates the intake camshaft.

c. The E indicates the exhaust camshaft.

d. The number indicates the cylinder position from the front of the engine.

24. Apply a liberal amount of lubricant to the camshaft bearing caps.

25. There are first design and second design camshaft front bearing caps. For vehicles that have a second design camshaft bearing cap, apply a liberal amount of lubricant to the camshaft bearing cap and camshaft thrust surface.

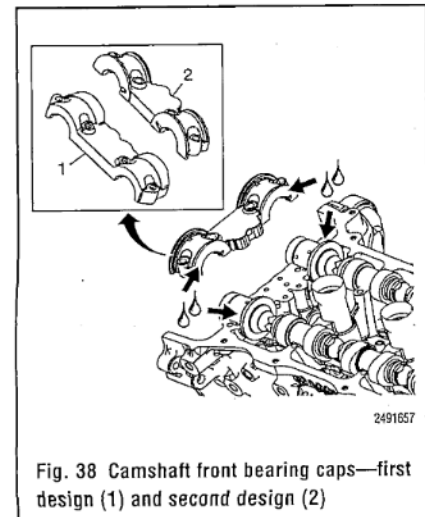


Fig. 38 Camshaft front bearing caps—first design (1) and second design (2)

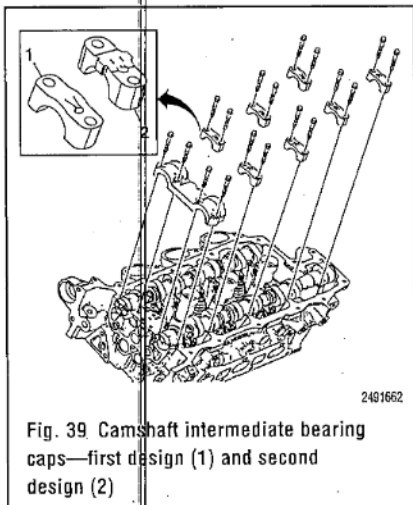


Fig. 39 Camshaft intermediate bearing caps—first design (1) and second design (2)

26. Install the camshaft bearing thrust caps in the first journal of the cylinder head. There are also first design and second design camshaft intermediate bearing caps.

27. Install the remaining bearing caps with their orientation mark toward the center of the cylinder head.

28. Hand start all the camshaft bearing cap bolts.

29. Tighten the camshaft bearing cap bolts in the sequence shown to 89 lb in. (10 Nm).

30. Loosen the center intake camshaft bearing cap bolts 1, 2 and the center exhaust camshaft bearing cap bolts 3, 4.

31. Retighten the center camshaft bearing cap bolts 1, 2, 3, 4 and retighten the camshaft bearing cap bolts to 89 lb in. (10 Nm).

32. Remove the retention tool.

33. Install and tighten the camshaft position actuators. Use an open-end wrench at the camshaft hex to prevent camshaft/engine rotation.

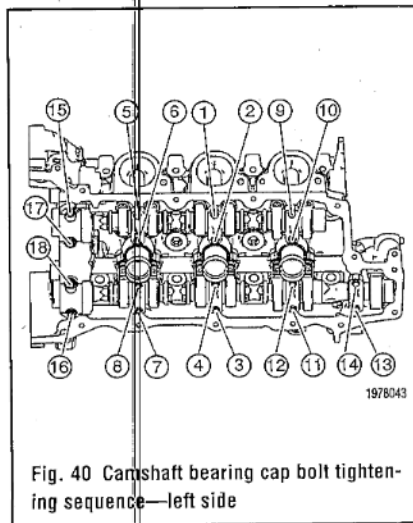


Fig. 40 Camshaft bearing cap bolt tightening sequence—left side

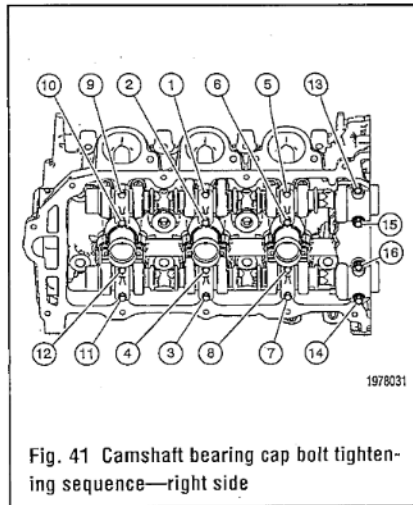


Fig. 41 Camshaft bearing cap bolt tightening sequence—right side

34. Install the intake camshaft position actuator solenoid.

35. Install the camshaft sensors.

36. Install the crankshaft balancer.

37. Install the valve cover.

38. Install the fuel pump to the cylinder head.

39. Install the intake manifold.

CATALYTIC CONVERTER/ EXHAUST MANIFOLD

REMOVAL & INSTALLATION

2.8L Engine

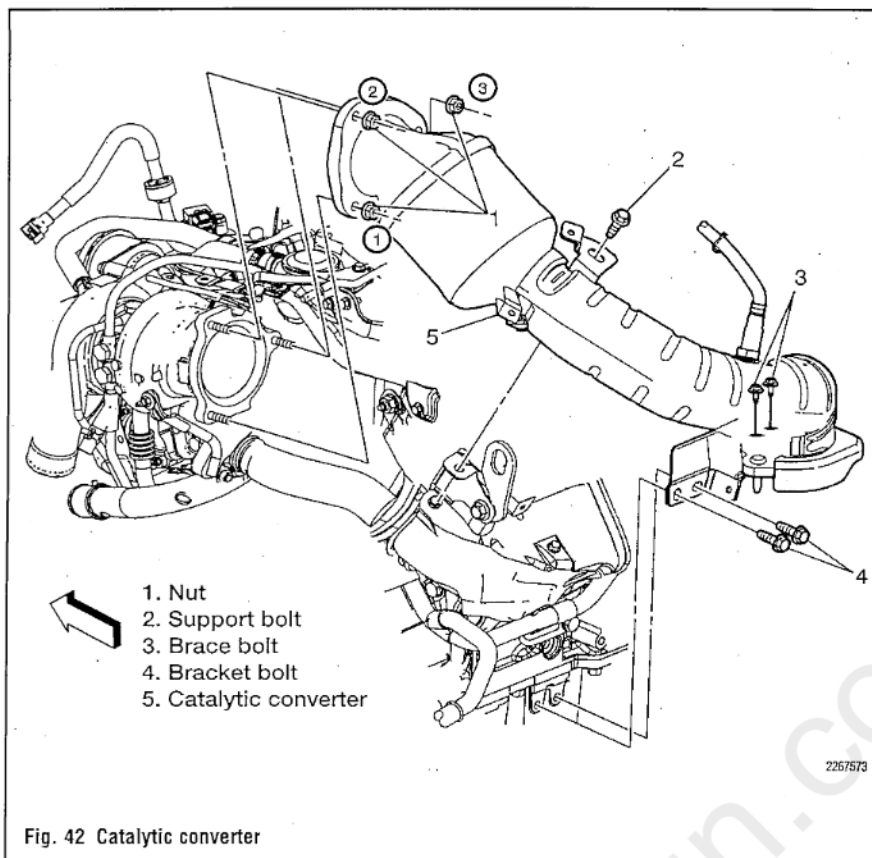
See Figure 42.

- Before servicing the vehicle, refer to the Precautions Section.
- Disconnect the negative battery cable.
- Remove the battery tray.
- Remove the radiator surge tank engine and inlet hoses at the surge tank.
- Remove the catalytic converter heat shield.
- Remove the transmission heat shield.
- Remove the master cylinder heat shield.
- Remove the oxygen sensors.
- Remove the exhaust flexible pipe.
- Remove the catalytic converter.

To install:

11. Installation is the reverse of removal, noting the following:

- Apply lubricant to the turbocharger stud bolts.
- Tighten the catalytic converter bolts in the following sequence. Tighten:
 - Tighten "1" to 11 ft. lbs (15 Nm). Turn 270 degrees counterclockwise.
 - Tighten "2" to 11 ft. lbs (15 Nm). Turn 270 degrees counterclockwise.
 - Tighten "3" to 15 ft. lbs (20 Nm).



9. Replace the left catalytic converter-to-cylinder head nuts and gaskets with new ones; tighten nuts in a criss-cross pattern. Tighten:

- First Pass: 15 ft. lbs (20 Nm)
- Final Pass: 34 ft. lbs (46 Nm)

10. Attach left catalytic converter to insulator hanger bracket.

11. Install the left catalytic converter nuts to the rear muffler assembly. Tighten to 34 ft. lbs (46 Nm).

12. Install the nuts to the right catalytic converter. Tighten to 34 ft. lbs (46 Nm).

13. Connect the heated oxygen sensor.

** WARNING

Improperly installed and/or leaking exhaust manifold gaskets may affect vehicle emissions and/or On-Board Diagnostics (OBD) II system performance.

14. Inspect the exhaust system for leaks.

Right Side

See Figure 44.

1. Before servicing the vehicle, refer to the Precautions Section.

2. Remove the left side catalytic converter.

3. Disconnect the heated oxygen sensors before and after the right catalytic converter.

4. Remove the right exhaust manifold nuts.

5. Remove the right exhaust manifold studs on the right cylinder head, if necessary.

6. Remove the right side catalytic converter.

To install:

7. Installation is the reverse of removal, noting the following:

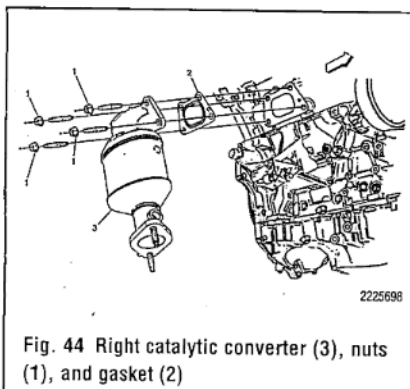
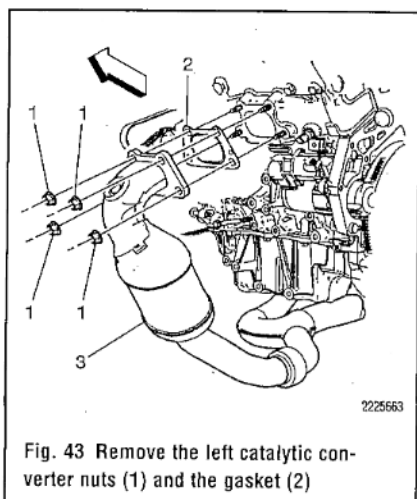
7. Carefully lower the catalytic converter to the floor.

8. Transfer oxygen sensors if replacing catalytic converter.

To install:

** WARNING

To prevent damage to the exhaust manifold flange or stud, make sure the flange is fully seated before tightening.



- Tighten "1" to 18 ft. lbs (25 Nm).
- Tighten "2" to 18 ft. lbs (25 Nm).
- c. Tighten the catalytic converter bracket bolts to 15 ft. lbs (20 Nm).
- d. Tighten the catalytic converter brace bolts to 15 ft. lbs (20 Nm).
- e. Tighten the catalytic support bolt to 16 ft. lbs (22 Nm).

3.0L Engine

Left Side

See Figure 43.

1. Before servicing the vehicle, refer to the Precautions Section.

2. Disconnect the heated oxygen sensor before and after the left catalytic converter.

3. Remove the left catalytic converter nuts to left cylinder head. Replace gasket with a new one.

4. Remove the nuts to the rear muffler assembly.

5. Remove the nuts from the right catalytic converter.

It may be easier to remove catalytic converter by removing the left cylinder studs.

6. Remove the exhaust bracket insulator from the hanger and lower catalytic converter.

a. Clean and inspect the studs on the engine cylinder head. Replace as necessary.

b. To prevent damage to the exhaust manifold flange or stud, make sure the flange is fully seated before tightening.

c. Verify that the studs are fully seated. Stud collar should touch the surface of the engine cylinder head.

d. Replace the nuts and gasket. Tighten the nuts in a criss-cross pattern. Tighten:

- First Pass: 15 ft. lbs. (20 Nm)
- Final Pass: 34 ft. lbs. (46 Nm)

➔ Improperly installed and/or leaking exhaust manifold gaskets may affect vehicle emissions and/or On-Board Diagnostics (OBD) II system performance.

CRANKSHAFT FRONT SEAL

REMOVAL & INSTALLATION

See Figures 45 and 46.

1. Before servicing the vehicle, refer to the Precautions Section.

2. Remove the crankshaft balancer:

- a. Remove the drive belt.
- b. Install the engine support fixture.

c. Remove the starter.

d. Install the flywheel holding tool (EN-46106 or equivalent) through the starter mounting hole.

e. Using engine support fixture, lower engine approximately two inches.

f. Remove the crankshaft balancer bolt. Discard the bolt.

g. Install the crankshaft button (EN-38416-2) in the nose of the crankshaft.

h. Install the removal tool (EN-41816 or equivalent) in order to remove the crankshaft balancer.

i. Tighten the center bolt of the removal tool in order to pull the crankshaft balancer off of the crankshaft.

j. Remove the removal tool from the crankshaft balancer.

3. Using a seal removal tool (EN-45000 or equivalent), remove the crankshaft front oil seal.

To install:

4. Using a seal installer (J-29184 or equivalent), install the crankshaft front oil seal.

5. Install the crankshaft balancer:

- a. The flywheel holding tool must be installed onto the flywheel.

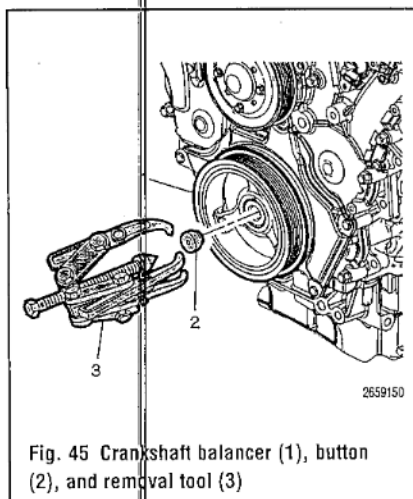


Fig. 45 Crankshaft balancer (1), button (2), and removal tool (3)

b. Using the installer (EN-41998-B), nut, bearing and washer, install the crankshaft balancer.

➔ Do not lubricate the crankshaft front oil seal or crankshaft balancer sealing surfaces. The crankshaft balancer is installed into a dry seal.

c. Apply lubricant to the inside of the crankshaft balancer hub bore.

d. Place the crankshaft balancer in position on the crankshaft.

e. Thread the installer in the crankshaft. Ensure you engage at least 10 threads of the installer before pressing the crankshaft balancer in place.

f. Push the crankshaft balancer into position by tightening the nut on the installer until the large washer bottoms out on the crankshaft end.

g. Remove the installer.

➔ Always install a new crankshaft balancer retaining bolt and washer.

h. Install the NEW crankshaft balancer bolt.

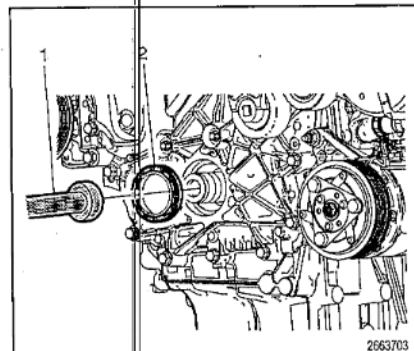


Fig. 46 Using a seal installer (1), install the crankshaft oil seal (2)

i. Tighten the crankshaft balancer bolt to 74 ft. lbs (100 Nm) and an additional 150 degrees using an angle meter (EN-45059).

j. Remove the angle meter.

k. Install the starter.

l. Install the drive belt.

m. Remove the engine support fixture.

6. Start the engine and check for leaks.

CYLINDER HEAD

REMOVAL & INSTALLATION

2.8L Engine

Left Side

See Figure 47.

1. Before servicing the vehicle, refer to the Precautions Section.

2. Disconnect the negative battery cable.

3. Remove the camshaft cover.

4. Remove the left bank secondary timing chain.

5. Remove the exhaust manifold.

6. Remove the oil level indicator tube.

7. Remove the turbocharger bracket.

8. Remove the 2 front M8 left cylinder head bolts.

9. Remove the left cylinder head bolts.

10. Remove the left cylinder head.

11. Remove and discard the left cylinder head gasket.

12. Clean and inspect the cylinder head and the engine block sealing surfaces.

To install:

13. Ensure the cylinder head locating pins are securely mounted in the cylinder block deck face.

14. Install a new left cylinder head gasket using the deck face locating pins for retention.

15. Align the left cylinder head with the deck face locating pins.

16. Place the left cylinder head in position on the deck face.

➔ Do not allow oil on the cylinder head bolt bosses. Do not reuse the old cylinder head bolts.

17. Install new M11 cylinder head bolts:

- a. Tighten the M11 cylinder head bolts a first pass in sequence to 22 ft. lbs. (30 Nm).

- b. Tighten the M11 cylinder head bolts a second pass in sequence an addi-

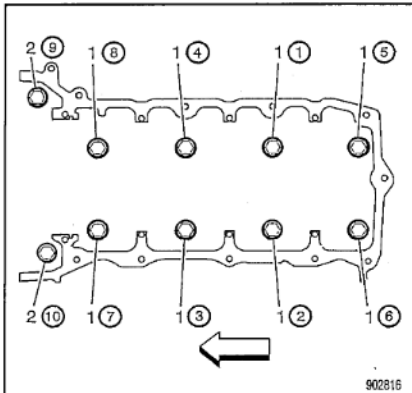


Fig. 47 M11 cylinder head bolts (1), M8 cylinder head bolts (2), and cylinder head bolt tightening sequence

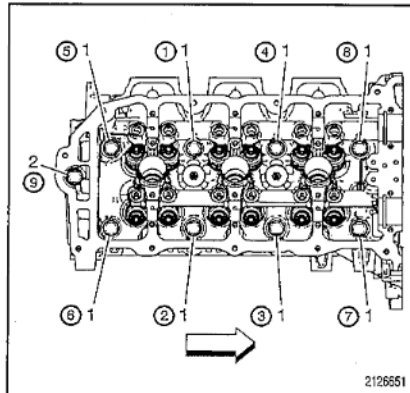


Fig. 48 M11 cylinder head bolts (1), M8 cylinder head bolts (2), and cylinder head bolt tightening sequence

tional 150 degrees using the J-45059 angle meter, or equivalent tool.

18. Install 2 new front M8 left cylinder head bolts:

- a. Tighten the M8 cylinder head bolts a first pass to 11 ft. lbs. (15 Nm).
- b. Tighten the M8 cylinder head bolts a second pass in sequence an additional 75 degrees using the J-45059 angle meter, or equivalent tool.
19. Install the turbocharger bracket.
20. Install the left bank secondary timing chain.
21. Install the camshaft cover.
22. Install the exhaust manifold.
23. Install the oil level indicator tube.

Right Side

See Figure 48.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Disconnect the negative battery cable.
3. Remove the camshaft cover.
4. Remove the right bank secondary timing chain.
5. Remove the exhaust manifold.
6. Remove the right engine lift bracket at the rear of the right cylinder head.
7. Remove the right cylinder head bolts.
8. Remove the right cylinder head.
9. Remove and discard the cylinder head gasket.
10. Clean and inspect the cylinder head and the engine block sealing surfaces.
11. Disassemble the cylinder head if needed.

To install:

12. Ensure the cylinder head locating pins are securely mounted in the cylinder block deck face.

13. Install a new right cylinder head gasket using the deck face locating pins for retention.

14. Align the right cylinder head with the deck face locating pins.

15. Place the right cylinder head in position on the deck face.

Do not allow oil on the cylinder head bolt bosses. Do not reuse the old cylinder head bolts.

16. Install new M11 cylinder head bolts.

- a. Tighten the M11 cylinder head bolts a first pass in sequence to 22 ft. lbs. (30 Nm).
- b. Tighten the M11 cylinder head bolts a second pass in sequence an additional 150 degrees using the J 45059 angle meter, or equivalent tool.
17. Install a new M8 cylinder head bolt.

- a. Tighten the M8 cylinder head bolt a first pass to 11 ft. lbs. (15 Nm).
- b. Tighten the M8 cylinder head bolt a second pass an additional 75 degrees using the J 45059 angle meter, or equivalent tool.
18. Install the right bank secondary timing chain.
19. Install the right engine lift bracket.
20. Install the exhaust manifold.
21. Install the camshaft cover.

3.0L Engine

Left Side

See Figure 47.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Disconnect the negative battery cable.
3. Remove the camshaft cover.

4. Remove the alternator.
5. Remove the left bank secondary timing chain.
6. Remove the fuel pump.
7. Remove the catalytic converter/exhaust manifold.
8. Remove the oil level indicator tube.
9. Remove the 2 front M8 left cylinder head bolts.
10. Remove the left cylinder head bolts.
11. Remove the left cylinder head.
12. Remove the ground wire bolt and ground wire.
13. Disconnect and reposition harness as necessary.
14. Remove and discard the left cylinder head gasket.
15. Clean and inspect the cylinder head and the engine block sealing surfaces.
16. Transfer parts as needed.

To install:

17. Ensure the cylinder head locating pins are securely mounted in the cylinder block deck face.
18. Install a new left cylinder head gasket using the deck face locating pins for retention.
19. Align the left cylinder head with the deck face locating pins.
20. Place the left cylinder head in position on the deck face.

Do not allow oil on the cylinder head bolt bosses. Do not reuse the old cylinder head bolts.

21. Install new M11 cylinder head bolts:

- a. Tighten the M11 cylinder head bolts a first pass in sequence to 22 ft. lbs. (30 Nm).
- b. Tighten the M11 cylinder head bolts a second pass in sequence an additional 150 degrees using the J-45059 angle meter, or equivalent tool.
22. Install 2 new front M8 left cylinder head bolts:
- a. Tighten the M8 cylinder head bolts a first pass to 11 ft. lbs. (15 Nm).
- b. Tighten the M8 cylinder head bolts a second pass in sequence an additional 75 degrees using the J-45059 angle meter, or equivalent tool.
23. Install the left bank secondary timing chain.
24. Install the fuel pump.
25. Install the alternator.
26. Install the catalytic converter/exhaust manifold.
27. Install the oil level indicator tube.

28. Install the camshaft cover.
29. Connect the negative battery cable.

Right Side

See Figure 49.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Disconnect the negative battery cable.
3. Remove the camshaft cover.
4. Remove the right bank secondary timing chain.
5. Position the power brake booster pump aside.
6. Remove the catalytic converter/exhaust manifold.
7. Remove the right cylinder head bolts.
8. Remove the right cylinder head.
9. Remove ground wire and harness and position aside.
10. Remove and discard the cylinder head gasket.
11. Clean and inspect the cylinder head and the engine block sealing surfaces.
12. Transfer parts as needed.

To install:

13. Ensure the cylinder head locating pins are securely mounted in the cylinder block deck face.
14. Install a new right cylinder head gasket using the deck face locating pins for retention.
15. Align the right cylinder head with the deck face locating pins.
16. Place the right cylinder head in position on the deck face.

→ Do not allow oil on the cylinder head bolt bosses. Do not reuse the old cylinder head bolts.

17. Install new M11 cylinder head bolts.
 - a. Tighten the M11 cylinder head bolts a first pass in sequence to 22 ft. lbs. (30 Nm).

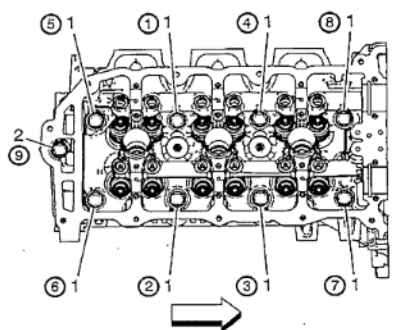


Fig. 49 M11 cylinder head bolts (1), M8 cylinder head bolts (2), and cylinder head bolt tightening sequence

- b. Tighten the M11 cylinder head bolts a second pass in sequence an additional 150 degrees using the J 45059 angle meter or equivalent tool.
18. Install new M8 cylinder head bolt.
 - a. Tighten the M8 cylinder head bolt a first pass to 11 ft. lbs. (15 Nm).
 - b. Tighten the M8 cylinder head bolt a second pass an additional 75 degrees using the J 45059 angle meter, or equivalent tool.
19. Install the right bank secondary timing chain.
20. Install the catalytic converter/exhaust manifold.
21. Install the camshaft cover.
22. Connect the negative battery cable.

ENGINE OIL & FILTER

REPLACEMENT

2.8L Engine

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and support the vehicle.
3. Place a drain pan under the oil drain plug.
4. Remove the oil pan drain plug.
5. Allow the oil to drain completely.
6. Install the oil pan drain plug and tighten to 18 ft. lbs. (25 Nm).
7. Use a 1 1/4 in. (32 mm) socket on the hex on top of the oil filter cap, or an oil filter wrench on the outside diameter of the oil filter cap. DO NOT use an open end wrench on the hex on top of the oil filter cap.
8. Remove the oil filter cap and filter.
9. Remove the filter from the cap.

To install:

10. Install the NEW oil filter to the cap.
11. Install the oil filter cap and filter.
12. Use a 1 1/4 in. (32 mm) socket on the hex on top of the oil filter cap, or an oil filter wrench on the outside diameter of the oil filter cap. Tighten the oil filter cap until fully seated. DO NOT exceed 18 ft. lbs. (25 Nm).

** WARNING

Over tightening the oil filter cap may cause damage to the oil filter cap resulting in an oil leak.

13. Refill the engine oil.
14. Start the engine and inspect for leaks.

3.0L Engine

1. Before servicing the vehicle, refer to the Precautions Section.

2. Raise and support the vehicle.
3. Place a drain pan under the oil drain plug.
4. Remove the oil pan drain plug.
5. Allow the oil to drain completely.
6. Install the oil pan drain plug and tighten to 18 ft. lbs. (25 Nm).
7. Place the drain pan under the oil filter.
8. Remove the oil filter. Allow the oil to drain completely.

To install:

9. Lubricate a NEW oil filter gasket with clean engine oil.
10. Install the oil filter and tighten to 18 ft. lbs. (25 Nm).
11. Lower the vehicle.
12. Refill the engine oil.
13. Start the engine and inspect for leaks.

EXHAUST MANIFOLD

REMOVAL & INSTALLATION

2.8L Engine

Left Side

See Figure 50.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Remove the secondary air injection pump pipe:
 - a. Remove the intake manifold cover. Remove the oil cap before removing the intake manifold cover.
 - b. Remove the secondary injection shutoff valve pressure sensor.
 - c. Disconnect the air pump connectors.
3. Remove the secondary air injection pump hose.
4. Remove the oil level indicator tube.
5. Remove the harness bracket bolt above the exhaust manifold heat shield and reposition the engine harness.

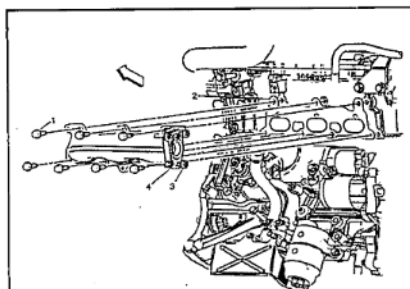


Fig. 50 Exhaust manifold (4), nuts (1), and gasket (2); exhaust turbocharger inlet pipe nuts (3)—left side

6. Remove the bolts and the left exhaust manifold heat shield.
7. Remove the secondary air injection pipe bolts from the manifold.
8. Raise and support the vehicle.
9. Remove the exhaust manifold nuts.
10. Remove the exhaust turbocharger inlet pipe nuts.
11. Remove the exhaust manifold and gasket. Discard the gasket.
12. Clean any gasket debris from the cylinder head and exhaust manifold.

To install:

13. Installation is the reverse of removal, noting the following:

- a. Tighten the exhaust manifold nuts to 15 ft. lbs. (20 Nm), working from the center out.
- b. Tighten the exhaust turbocharger inlet pipe nuts to 15 ft. lbs. (20 Nm).
- c. Tighten the exhaust manifold heat shield bolts to 84 inch lbs. (10 Nm).

Right Side

See Figure 51.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and support the vehicle.
3. Remove the catalytic converter.
4. Remove the right catalytic converter heat shield.
5. Disconnect the exhaust turbocharger inlet pipe, Bank 2.
6. Remove the exhaust manifold nuts.
7. Remove the exhaust manifold and gasket. Discard the gasket.
8. Clean any exhaust manifold gasket debris from the cylinder head and exhaust manifold.

To install:

9. Installation is the reverse of removal, noting the following:

- a. Tighten the exhaust manifold nuts to 15 ft. lbs. (20 Nm), working from the center out.
- b. Tighten the exhaust turbocharger inlet pipe nuts to 15 ft. lbs. (20 Nm).
- c. Tighten the exhaust manifold heat shield bolts to 84 inch lbs. (10 Nm).

3.0L Engine

See Catalytic Converter/Exhaust Manifold Removal & Installation.

INTAKE MANIFOLD

REMOVAL & INSTALLATION

See Figures 52 and 53.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Remove the power steering fluid reservoir upper bracket only.
3. Remove the power brake booster vacuum check valve and hose.
4. Remove the coolant air bleed pipe.
5. Remove the intake manifold cover.
6. Disconnect and remove the Positive Crankcase Ventilation (PCV) tube (1) from the intake manifold and right camshaft cover.
7. Remove the Evaporative Emission (EVAP) hose from the intake manifold and EVAP solenoid.
8. Remove the fuel pipe shield.
9. Unclip wire harnesses as necessary.
10. Remove the intake manifold bolts.
11. Remove the intake manifold assembly.
12. Remove and discard the intake manifold gasket.

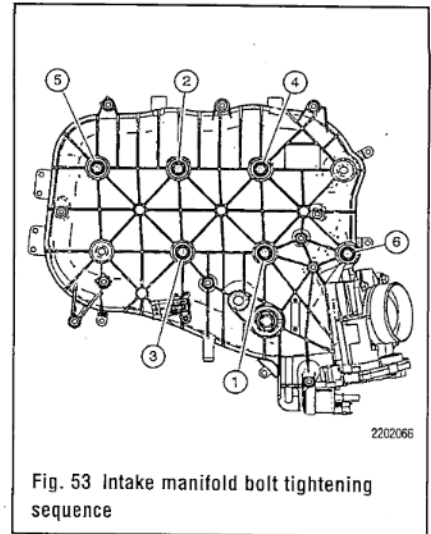


Fig. 53 Intake manifold bolt tightening sequence

To install:

13. Assemble the intake manifold if needed.
14. Install the NEW intake manifold gasket.
15. Install the intake manifold assembly.
16. Install the intake manifold bolts.
17. Tighten the intake manifold bolts in the sequence shown.
18. Tighten the intake manifold bolts in sequence to 18 ft. lbs. (25 Nm).
19. Tighten the intake manifold bolts a second pass in sequence to 18 ft. lbs. (25 Nm).
20. Remove the fuel pipe shield.
21. Connect the EVAP hose to the upper intake manifold and EVAP solenoid.
22. Connect the PCV tube assembly to the upper intake manifold and the right camshaft cover.
23. Install coolant hose.
24. Install intake manifold cover.
25. Install the coolant air bleed pipe.
26. Install the power steering fluid reservoir upper bracket.
27. Install the power brake booster vacuum check valve and hose.

OIL PAN

REMOVAL & INSTALLATION

See Figures 54 and 55.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Drain the engine oil and remove the oil filter.
3. Remove the catalytic converter.
4. Remove the air conditioning (A/C) compressor bolts and reposition.

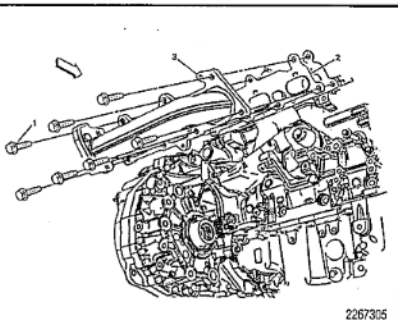


Fig. 51 Exhaust manifold (3), nuts (1), and gasket (2)—right side

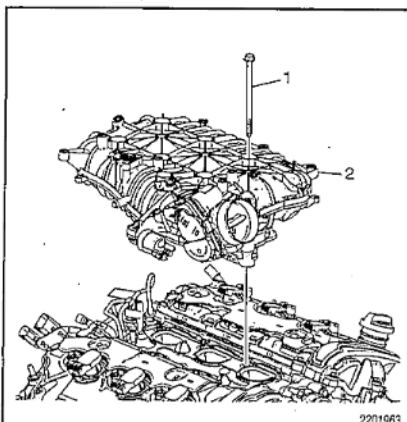


Fig. 52 Remove the intake manifold (2) and bolts (1)

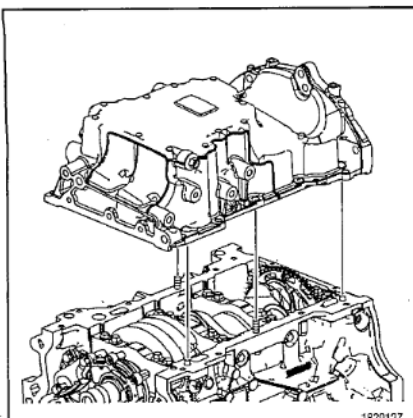


Fig. 54 Oil pan positioning

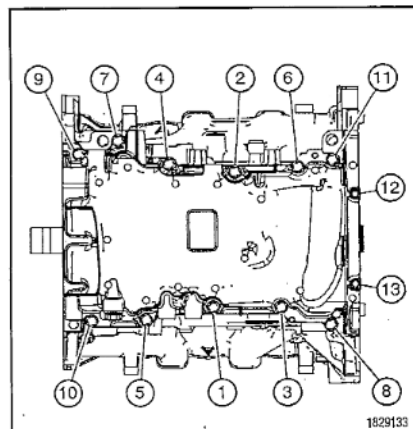


Fig. 55 Oil pan bolt tightening sequence

5. Remove the front cover.
6. Remove the oil pan to transmission bolts.
7. Remove the oil pan bolts.
8. Remove the oil pan.
9. Clean the oil pan and the engine block gasket surface.

To install:

10. Install the 8 mm guides from the EN 46109 or equivalent guide pin set into the center oil pan rail bolt hole on each side of the engine block.
11. Place a 0.118 in. (3 mm) bead of RTV sealant on the block pan rail and the crankshaft rear oil seal housing.
12. Position the oil pan onto the block.
13. Remove the guide pins from the engine block.
14. Loosely install the oil pan bolts.
15. Tighten the oil pan bolts in sequence as follows:

- a. Tighten the 8mm bolts (1-11) to 18 ft. lbs. (25 Nm).

- b. Tighten the 6mm bolts (12-13) to 89 inch lbs. (10 Nm).
16. Install the front cover.
17. Install the A/C compressor.
18. Install the catalytic converter.
19. Lower the vehicle.
20. Refill the engine oil.
21. Start the engine and check for leaks.

OIL PUMP

REMOVAL & INSTALLATION

See Figure 56.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Removing the primary timing chain and crankshaft sprocket.
3. Remove the oil pump and bolts.

To install:

4. Align the oil pump drive gear with the crankshaft flats and install the oil pump to the engine block.
5. Align the pump body with the mounting holes in the cylinder block.
6. Install the oil pump mounting bolts and tighten to 18 ft. lbs. (25 Nm).
7. Install the crankshaft sprocket and timing chain.
8. Refill the engine with oil to the correct level.
9. Start the engine and check for leaks.

INSPECTION

There are no serviceable components within the oil pump. Disassemble the pump only to diagnose an oiling concern. A disassembled oil pump must be replaced. Inspect the oil pump housing, cover, relief valve components, primary camshaft drive chain lower guide, and the inner and outer drives gears for damage. If inner diameter damage

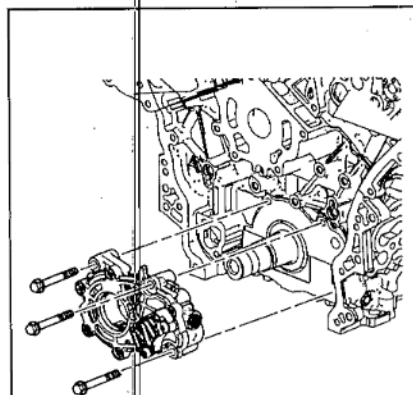


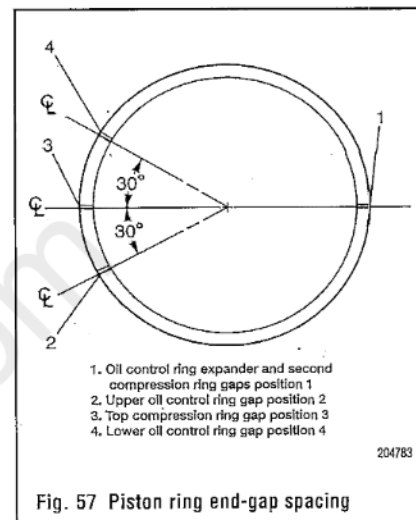
Fig. 56 Remove the oil pump and bolts

is found, ensure the crankshaft is also inspected. If debris or damage is present within the oil pump, further inspection of all of the engine components is necessary.

PISTON AND RING

POSITIONING

See Figure 57.



1. Oil control ring expander and second compression ring gaps position 1
2. Upper oil control ring gap position 2
3. Top compression ring gap position 3
4. Lower oil control ring gap position 4

Fig. 57 Piston ring end-gap spacing

REAR MAIN SEAL

REMOVAL & INSTALLATION

See Figures 58 through 60.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Remove the flywheel.
3. Remove the oil pan, if necessary.
4. Remove the rear oil seal housing bolts.
5. Using the pry points located at the edge of the crankshaft rear main seal housing, separate the RTV sealant.
6. Remove the rear main oil seal. Discard the rear main seal housing.

To install:

7. Install guide pins into the two crankshaft rear oil seal housing corner bolt hoses of the engine block.
8. Install the crankshaft rear seal installation tool (EN-47839 tool with the EN 42183 handle, or equivalent) onto the rear of the crankshaft flange.
9. Apply a 0.118 in. (3 mm) bead of RTV sealant to the new crankshaft rear oil seal housing. There are first design and second design crankshaft rear oil seal housings. Second design oil seal housings include additional grooves for RTV sealant near the oil seal housing to oil pan interface.

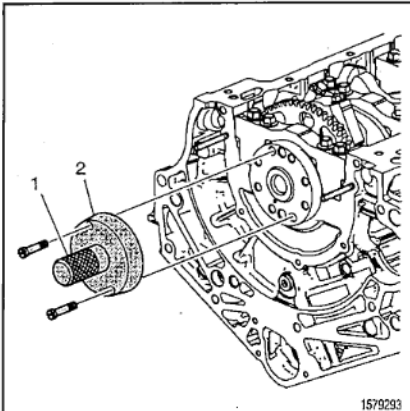


Fig. 58 Crankshaft rear seal installation tool (2) and handle (1)

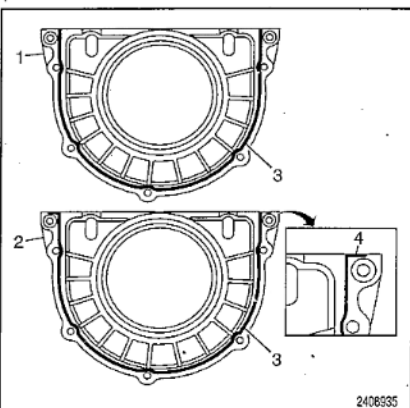


Fig. 59 First design (1) and second design (2) sealant application (3), showing additional grooves (4)

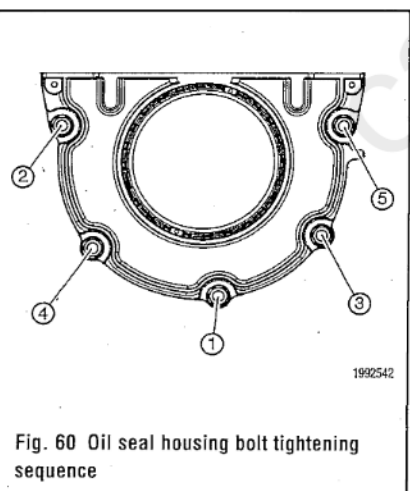


Fig. 60 Oil seal housing bolt tightening sequence

Do not allow any engine oil on the area where the crankshaft rear oil seal housing is to be installed.

10. Install the rear seal housing to the engine block.

11. Remove the guide pins and install the housing bolts. Tighten the bolts in the sequence shown to 89 inch lbs. (10 Nm).
12. Remove the rear seal installation tool from the crankshaft flange.
13. Install the oil pan, as applicable.
14. Install the flywheel.
15. Start the engine and check for leaks.

TIMING CHAIN FRONT COVER

REMOVAL & INSTALLATION

2.8L Engine

See Figures 61 through 66.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Remove the intake manifold.
3. Remove the camshaft covers.
4. Drain the cooling system.
5. Remove the water outlet with the radiator hose and reposition aside.
6. Remove the alternator.

Do not disconnect the power steering pipes or drain the power steering fluid.

7. Remove the power steering fluid reservoir and reposition the power steering fluid reservoir in order to provide access. Do not disconnect the power steering pipes or drain the power steering fluid.
8. Remove the crankshaft balancer.
9. Remove the camshaft position sensors.
10. Remove the camshaft position actuator valves from the front cover.
11. Remove the engine front cover bolts that hold the engine front cover deadener into position, and remove front cover deadener.
12. Remove the remaining engine front cover bolts. There are a total of 22 M8 bolts that must be removed and 3 optional M12

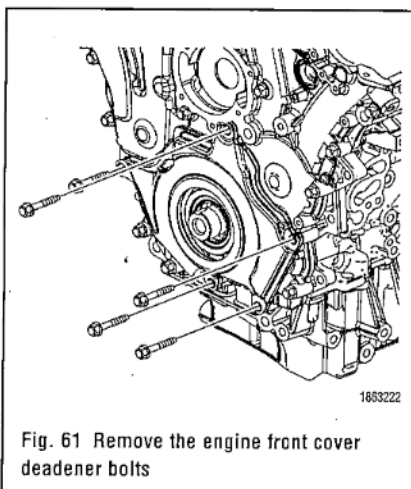


Fig. 61 Remove the engine front cover deadener bolts

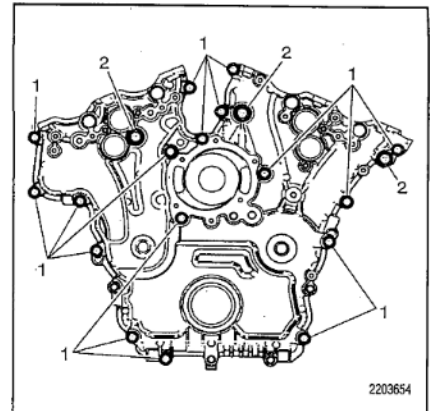


Fig. 62 Remove the remaining engine front cover bolts (1) and (2)

bolts that may need to be removed before the front cover will separate from the engine block. Engine front cover bolts in the number 2 location are model dependent and may have already been removed.

** WARNING

Do not use the jackscrew hole without first removing all engine front cover bolts. Failure to remove all engine front cover bolts before using the jackscrew hole could result in damage to components. Do not pry between the engine front cover and the camshaft position sensors or the camshaft position actuators in order to separate the RTV. Use the pry points and a bolt in the jackscrew hole in order to remove the engine front cover. Damage to the camshaft position sensors or the camshaft position actuators may occur if the camshaft position sensors or the camshaft position actuators are used to pry against in order to remove the engine front cover.

13. Loosely install a 10 x 1.5 mm bolt in the jackscrew hole.
14. Using the pry points located at the edge of the front cover and the jackscrew, separate the room temperature vulcanizing (RTV) sealant.
15. Remove the engine front cover.

To install:

16. Use the installation guide pins (EN-46109) in order to install the engine front cover:
 - a. Install the 0.315 in. (8 mm) guide from the installation guide pins into the cylinder block positions as shown.
 - b. Install the NEW engine front cover-to-cylinder block seal.

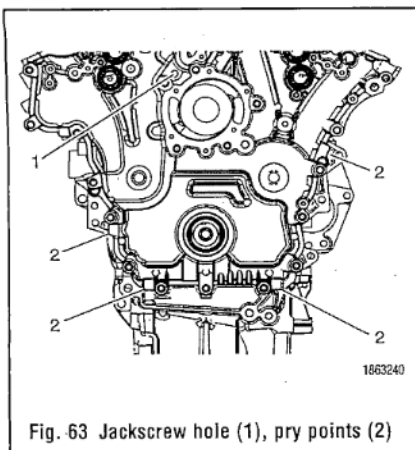


Fig. 63 Jackscrew hole (1), pry points (2)

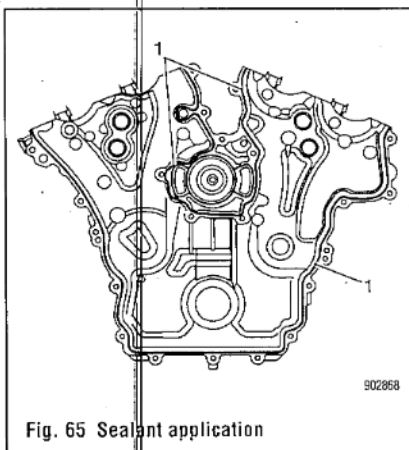


Fig. 65 Sealant application

c. Place a 0.118 in. (3 mm) bead of RTV sealant on the engine front cover as shown.

d. Place the engine front cover onto the installation guide pins and slide into position.

e. Remove the pins from the cylinder block.

f. Install the engine front cover deadener.

g. Loosely install the engine front cover bolts to hold the engine front cover deadener into position.

h. Loosely install the remaining engine front cover bolts. Engine front cover bolts in the number 23 location are model dependent and may not apply.

i. Tighten the engine front cover bolts (1-22) in sequence shown to 14 ft. lbs. (20 Nm).

j. Tighten the engine front cover bolts (1-22) a second pass in sequence an additional 60 degrees.

k. Tighten the engine front cover bolts (23) to 48 ft. lbs. (65 Nm).

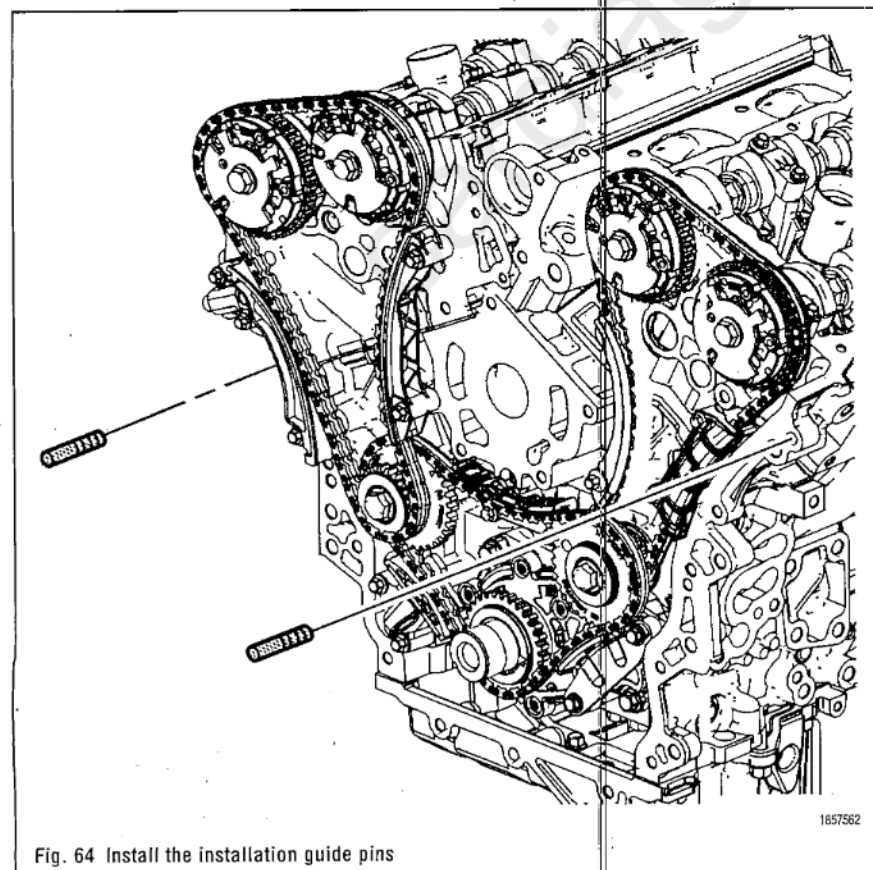


Fig. 64 Install the installation guide pins

17. Place the camshaft position actuator valves in position on the front cover.

18. Install the camshaft position actuator valve bolts and tighten to 89 inch lbs. (10 Nm).

19. Install NEW O-rings on the camshaft position sensor.

20. Place the camshaft position sensors in position on the front cover.

21. Install the camshaft position sensor bolts and tighten to 89 inch lbs. (10 Nm).

22. Install the camshaft position actuator solenoid valves to the front cover.

23. Install the camshaft position sensors.

24. Install the crankshaft balancer.

25. Install the power steering pump.

26. Install the power steering pump pulley.

27. Install the power steering fluid reservoir.

28. Install the alternator bracket with the generator and the belt tensioner.

29. Install the water outlet.

30. Install the purge vent hose to the water outlet.

31. Fill the cooling system.

32. Install the camshaft covers.

33. Install the intake manifold.

34. Install the drive belt tensioner.

35. Fill the cooling system.

3.0L Engine

See Figures 67 through 71.

1. Before servicing the vehicle, refer to the Precautions Section.

2. Remove the intake manifold.

3. Remove the camshaft covers.

4. Drain the cooling system.

5. Remove the water outlet with the radiator hose and reposition aside.

6. Remove the alternator.

Do not disconnect the power steering pipes or drain the power steering fluid.

7. Remove the power steering fluid reservoir and reposition the power steering fluid reservoir in order to provide access. Do not disconnect the power steering pipes or drain the power steering fluid.

8. Remove the crankshaft balancer.

9. Remove the camshaft position sensors.

10. Remove the belt tensioner.

11. Remove the air cleaner assembly.

12. Remove the engine mounting bracket.

13. Remove the camshaft position actuator solenoid valves from the front cover.

14. Remove the engine front cover with the water pump:

a. Remove the engine front cover bolts. There are a total of 23 M8 bolts and 2 M6 bolts that must be removed, and 3 optional M12 bolts that may need

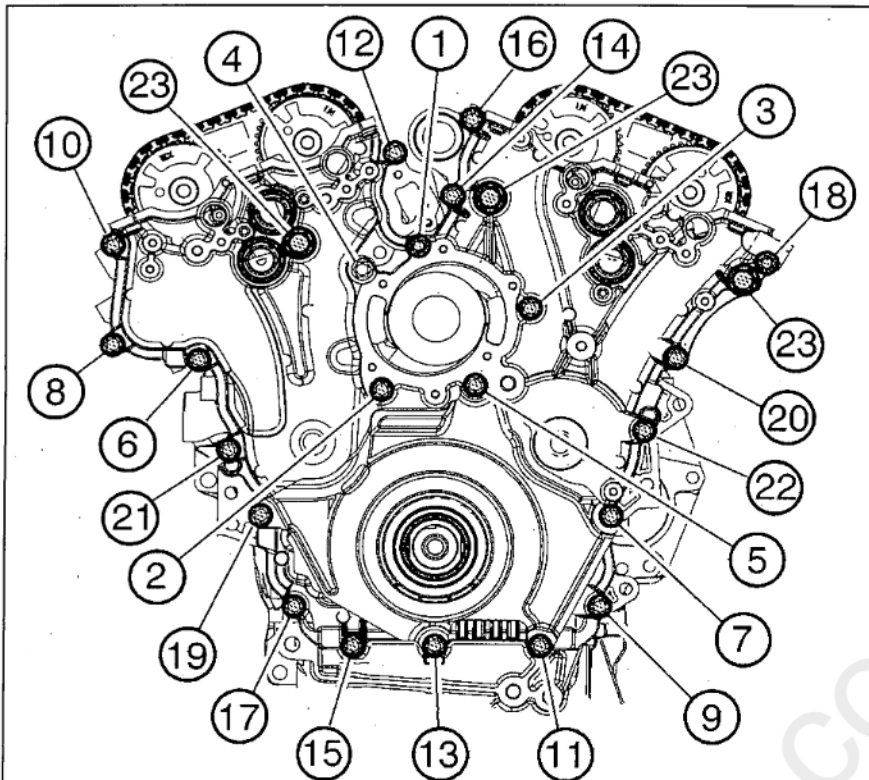


Fig. 66 Engine front cover bolt tightening sequence

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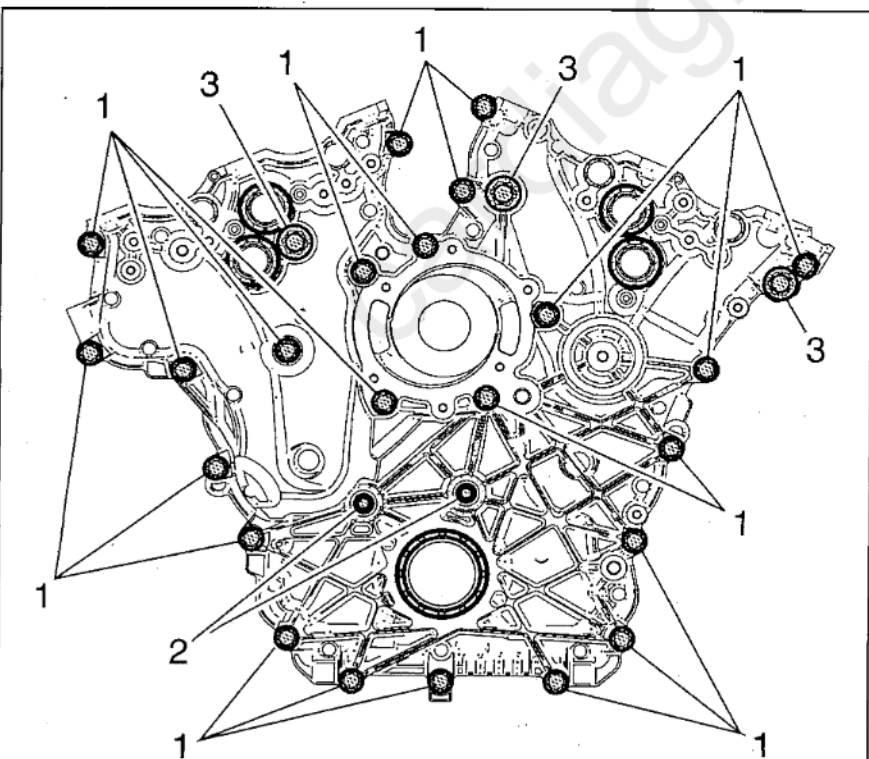


Fig. 67 Engine front cover M8 bolts (1) and M6 bolts (2); M12 bolts (3) are model dependent and may have already been removed

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to be removed before the front cover will separate from the engine block. Engine front cover bolts in the number 3 location are model dependent and may have already been removed.

** WARNING

Do not use the jackscrew hole without first removing all engine front cover bolts. Failure to remove all engine front cover bolts before using the jackscrew hole could result in damage to components. Do not pry between the engine front cover and the camshaft position sensors or the camshaft position actuators in order to separate the RTV. Use the pry points and a bolt in the jackscrew hole in order to remove the engine front cover. Damage to the camshaft position sensors or the camshaft position actuators may occur if the camshaft position sensors or the camshaft position actuators are used to pry against in order to remove the engine front cover.

15. Loosely install a 10 x 1.5 mm bolt in the jackscrew hole.

16. Using the pry points located at the edge of the front cover and the jackscrew, separate the room temperature vulcanizing (RTV) sealant.

17. Remove the engine front cover.

To install:

18. Use the installation guide pins (EN-46109) in order to install the engine front cover:

- a. Install the 0.315 in. (8 mm) guide from the installation guide pins into the cylinder block positions as shown.

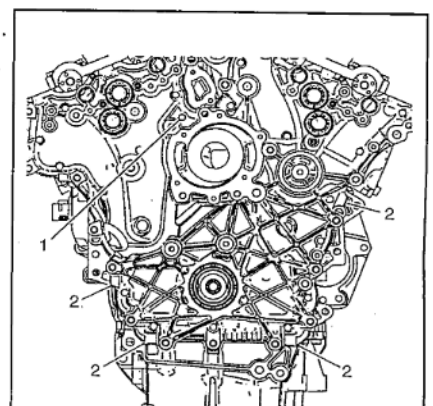


Fig. 68 Jackscrew hole (1), pry points (2)

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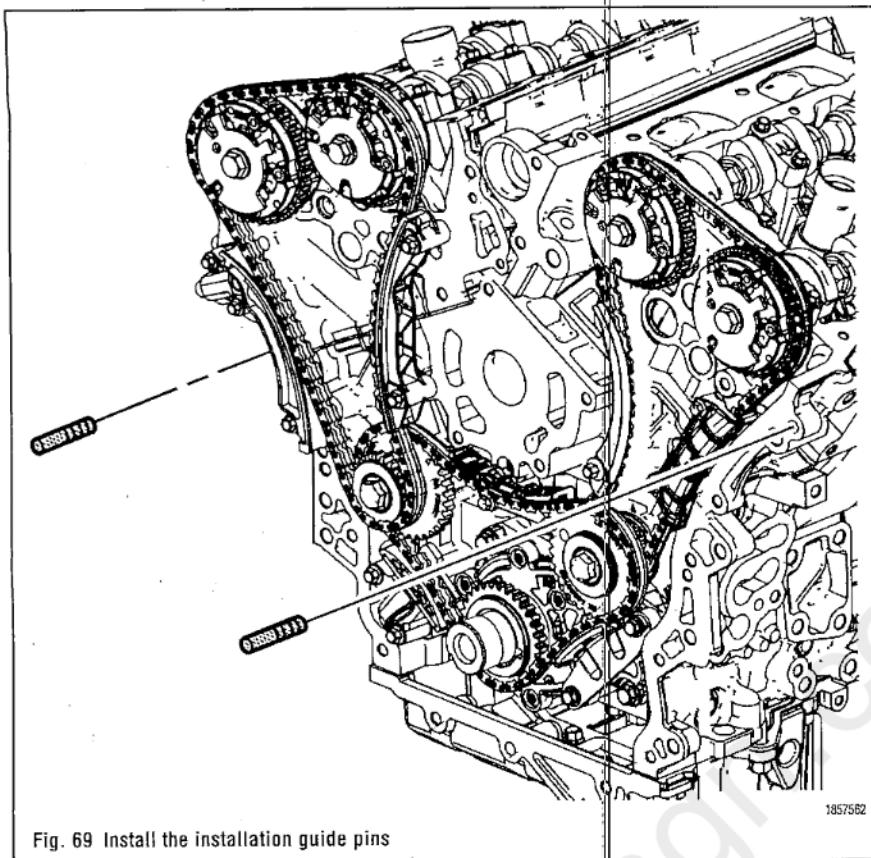


Fig. 69 Install the installation guide pins

- b. Install the NEW engine front cover-to-cylinder block seal.
- c. Place a 0.118 in. (3 mm) bead of RTV sealant on the engine front cover as shown.
- d. Place the engine front cover onto the installation guide pins and slide into position.
- e. Remove the pins from the cylinder block.
- f. Hand start all of the engine front cover bolts.
- g. Tighten the engine front cover bolts (1-23) in the sequence shown to 14 ft.

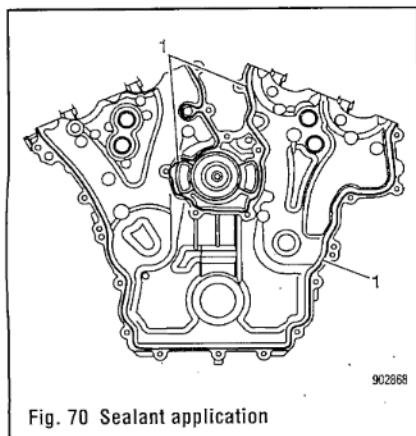


Fig. 70 Sealant application

lbs. (20 Nm). (Engine front cover bolts in the number 25 location are model dependent and may not apply.)

- h. Tighten the engine front cover bolts (1-23) a second pass in sequence to 14 ft. lbs. (20 Nm).
- i. Tighten the engine front cover bolts (1-23) a third pass in sequence an additional 60 degrees.
- j. Tighten the engine front cover bolts (24) to 48 ft. lbs. (65 Nm).
- k. Tighten the engine front cover bolts (25) to 48 ft. lbs. (65 Nm).
19. Place the camshaft position actuator valves in position on the front cover.
20. Install the camshaft position actuator valve bolts and tighten to 89 inch lbs. (10 Nm).
21. Install new O-rings on the camshaft position sensor.
22. Place the camshaft position sensors in position on the front cover.
23. Install the camshaft position sensor bolts and tighten to 89 inch lbs. (10 Nm).
24. Install the crankshaft balancer.
25. Install the power steering pump.
26. Install the power steering pump pulley.
27. Install the power steering fluid reservoir.

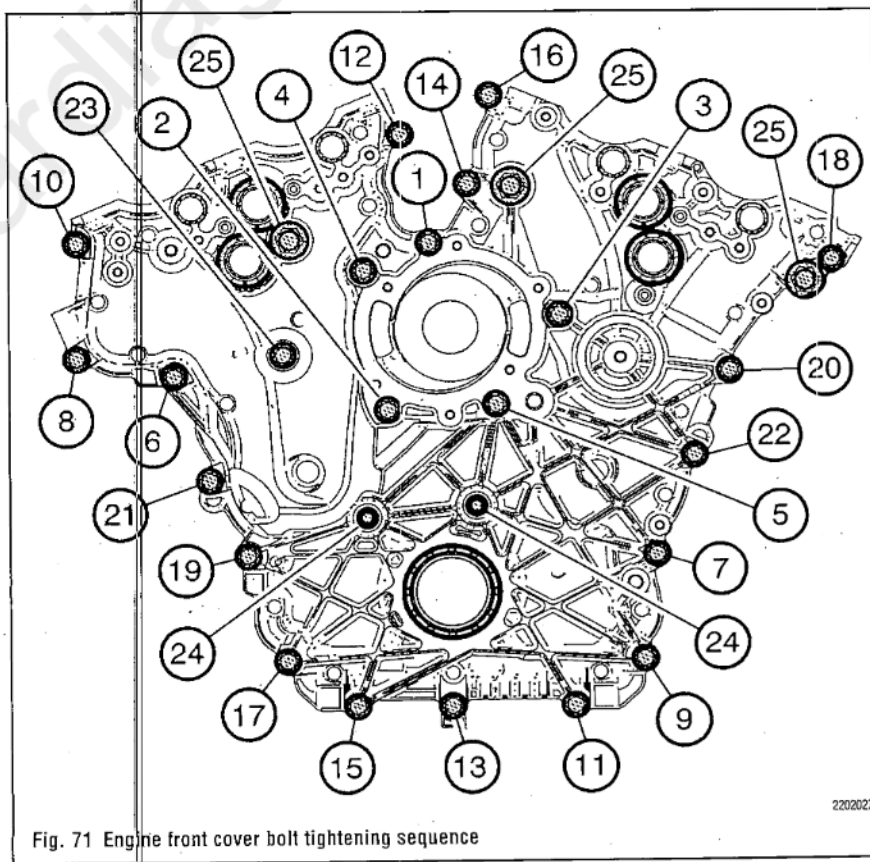


Fig. 71 Engine front cover bolt tightening sequence

28. Install the alternator bracket with the alternator and the belt tensioner.
29. Install the A/C compressor and power steering belt tensioner.
30. Install the accessory drive belts.
31. Install the water outlet.
32. Install the purge vent hose to the water outlet.
33. Refill the engine cooling system to the correct level.
34. Install the camshaft covers.
35. Install the intake manifold.
36. Install the engine cover.
37. Start the engine and check for leaks.

TIMING CHAIN & SPROCKETS

REMOVAL & INSTALLATION

See Figures 72 through 82.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Remove the timing chain front cover.
3. Remove the right secondary camshaft drive chain tensioner bolts and remove the tensioner. Remove and discard the gasket.
4. Remove the right secondary camshaft drive chain shoe bolt and remove the drive chain shoe.
5. Remove the right secondary camshaft drive chain guide bolts and remove the right secondary drive chain guide.
6. Remove the right secondary camshaft drive chain from the right camshaft position actuators and the right camshaft intermediate drive chain idler sprocket.
7. Remove the primary camshaft drive chain tensioner bolts and remove the primary drive chain tensioner. Remove and discard the gasket.

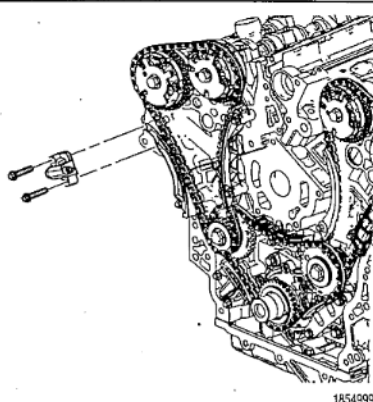


Fig. 72 Remove the right secondary camshaft drive chain tensioner

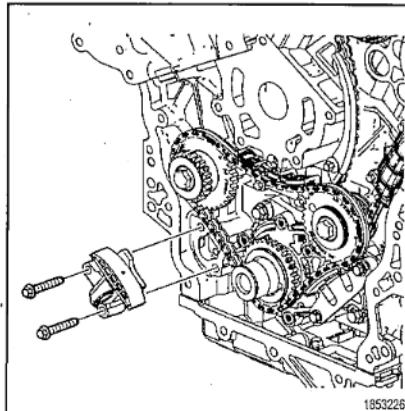


Fig. 73 Remove the primary camshaft drive chain tensioner

8. Remove the primary camshaft drive chain upper guide bolts and remove the upper guides.
9. Remove the primary camshaft timing chain.

To install:

10. Ensure that the crankshaft is in the stage one timing drive assembly position.
11. Install the primary timing chain.
 - a. Wrap the primary camshaft drive chain around the large sprockets of each camshaft intermediate drive chain idler and the crankshaft sprocket.
 - b. The left camshaft intermediate drive chain idler timing mark will align with a timing camshaft drive chain link.
 - c. The right camshaft intermediate drive chain idler timing mark will align with a timing camshaft drive chain link.
 - d. The crankshaft sprocket timing mark will align with a timing camshaft drive chain link.
 - e. Ensure all the timing marks are

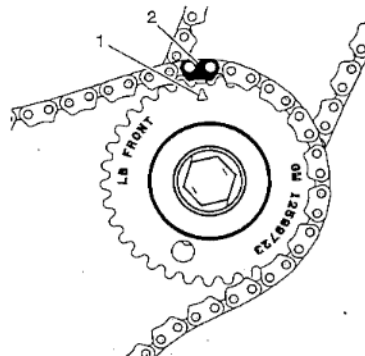


Fig. 74 The left camshaft intermediate drive chain idler timing mark (1) will align with a timing camshaft drive chain link (2)

properly aligned with the timing camshaft drive chain links.

12. Install the upper primary camshaft drive chain guides. Tighten the bolts to 18 ft. lbs. (25 Nm).
13. Install the primary camshaft drive chain tensioner as follows:
 - a. Use the tensioner tool (J-45027 or equivalent) to reset the primary camshaft drive chain tensioner plunger.
 - b. Install the plunger into the tensioner body.
 - c. Compress the plunger into the body and lock the tensioner by inserting the retraction pins (EN-46112 or equivalent) into the access hole in the side of the tensioner body.
 - d. Slowly release pressure on the tensioner. The tensioner should remain compressed.
 - e. Install a new gasket to the drive chain tensioner.
 - f. Place the primary camshaft drive chain tensioner into position and loosely install the bolts to the block.
 - g. Verify the proper placement of the tensioner gasket tab.
 - h. Tighten the tensioner bolts to 44 inch lbs. (5 Nm) and then retighten to 18 ft. lbs. (25 Nm).
 - i. Release the tensioner by pulling out the retraction pins and unlocking the tensioner plunger.
 - j. Verify the primary and left secondary camshaft drive chain timing mark alignments.
 - k. Remove the camshaft retaining tool (EN 48383-1 or equivalent) from the rear of the left camshafts.
 - l. Using the crankshaft rotation socket (EN-48589 or equivalent), rotate the crankshaft and crankshaft sprocket from

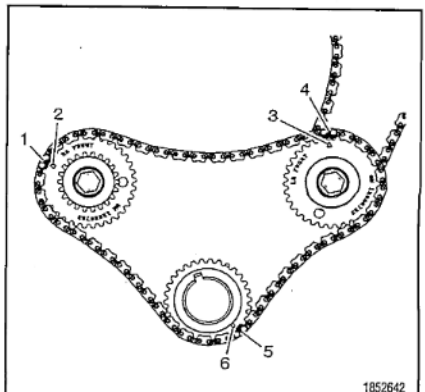


Fig. 75 Ensure all the timing marks (2, 3, and 6) are properly aligned with the timing camshaft drive chain links (1, 4, and 5)

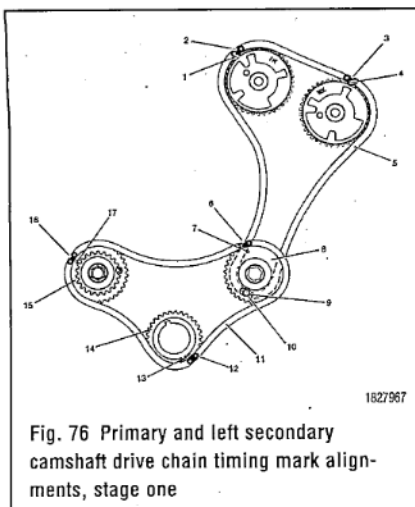


Fig. 76 Primary and left secondary camshaft drive chain timing mark alignments, stage one

the stage 1 alignment position to the stage 2 alignment position, 115 crankshaft degrees, in order to install the right secondary camshaft drive chain components.

m. Install the camshaft retaining tool (EN 48383-2 or equivalent) onto the rear of the left camshafts.

n. Install the camshaft retaining tool (EN 48383-3 or equivalent) onto the rear of the right camshafts.

14. Ensure that the crankshaft is in the stage 2 timing drive assembly position.

15. Install the right bank secondary camshaft drive chain.

a. Place the secondary camshaft drive chain around the right camshaft intermediate drive chain idler outer sprocket, aligning the timing camshaft drive chain link with the alignment access hole made in the right camshaft intermediate drive chain idler inner sprocket.

b. Wrap the secondary camshaft drive chain around both right actuator drive sprockets.

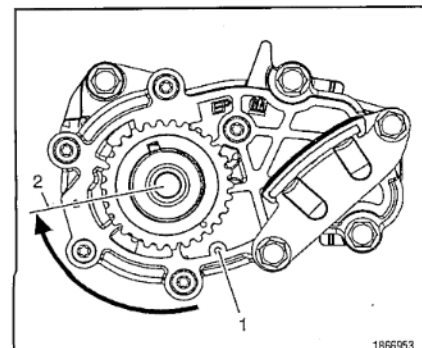


Fig. 77 Rotate the crankshaft and crankshaft sprocket from the stage 1 alignment position (1) to the stage 2 alignment position (2)

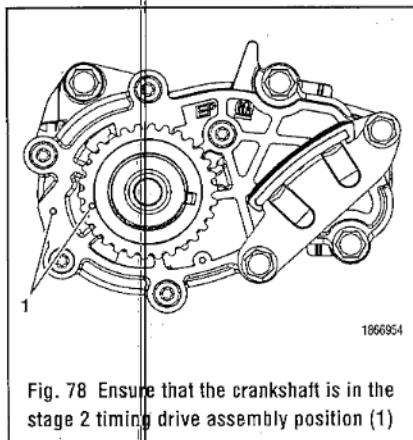


Fig. 78 Ensure that the crankshaft is in the stage 2 timing drive assembly position (1)

c. Ensure there are 10 links between the timing camshaft drive chain links for the camshaft position actuator sprockets.

d. Align the right exhaust camshaft position actuator sprocket alignment triangle mark with the timing camshaft drive chain link.

e. Align the right intake camshaft position actuator sprocket alignment triangle mark with the timing camshaft drive chain link.

f. There will be 22 links between the right camshaft intermediate drive chain idler timing camshaft drive chain link and each right camshaft position actuator sprocket timing camshaft drive chain link.

16. Install the right secondary camshaft drive chain guide. Tighten the bolts to 18 ft. lbs. (25 Nm).

17. Install the right secondary camshaft drive chain shape. Tighten the bolt to 18 ft. lbs. (25 Nm).

18. Install the right secondary camshaft drive chain tensioner as follows:

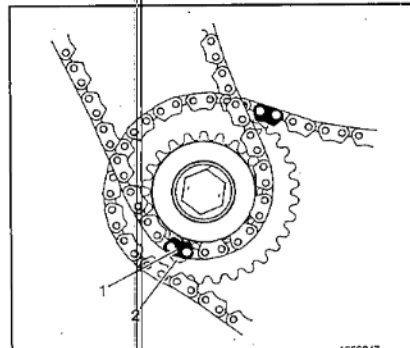


Fig. 79 Align the timing camshaft drive chain link (1) with the alignment access hole (2) made in the right camshaft intermediate drive chain idler inner sprocket

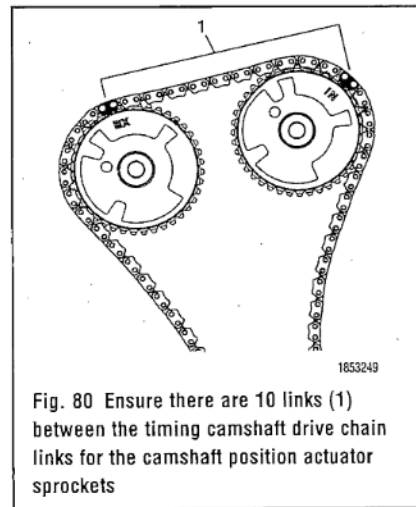


Fig. 80 Ensure there are 10 links (1) between the timing camshaft drive chain links for the camshaft position actuator sprockets

a. Use the tensioner tool (J-45027 or equivalent) to reset the primary camshaft drive chain tensioner plunger.

b. Install the plunger into the tensioner body

c. Compress the plunger into the body and lock the tensioner by inserting the retraction pins (EN-46112 or equivalent) into the access hole in the side of the tensioner body.

d. Slowly release pressure on the tensioner. The tensioner should remain compressed.

e. Install a new gasket to the drive chain tensioner.

f. Place the primary camshaft drive chain tensioner into position and loosely install the bolts to the block.

g. Verify the proper placement of the right secondary camshaft drive chain tensioner gasket tab.

h. Tighten the tensioner bolts to 44 inch lbs. (5 Nm) and then retighten to 18 ft. lbs. (25 Nm).

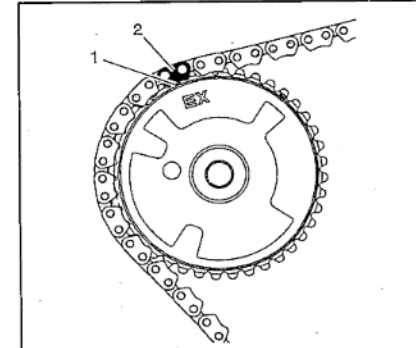


Fig. 81 Align the right exhaust camshaft position actuator sprocket alignment triangle mark (1) with the timing camshaft drive chain link (2)

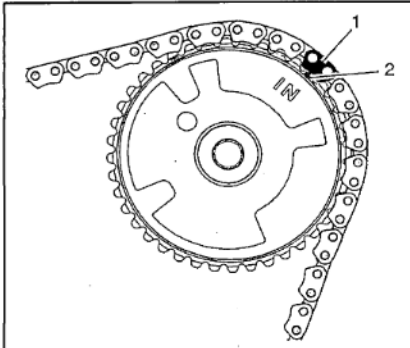


Fig. 82 Align the right intake camshaft position actuator sprocket alignment triangle mark (2) with the timing camshaft drive chain link (1)

i. Release the tensioner by pulling out the retraction pins and unlocking the tensioner plunger.

** WARNING

Ensure that all timing chain tensioners are completely released. A timing chain tensioner that is not properly released can lead to serious engine damage.

19. Install the timing chain front cover.

TURBOCHARGER

REMOVAL & INSTALLATION

2.8L Engines

See Figure 83.

** WARNING

If a turbocharger has failed, clean any turbocharger debris or excessive oil from the charge air cooler system before installing the new turbocharger. Failure to clean debris from the charge air cooler system will cause severe turbocharger and engine damage upon startup. Failure to clean excessive oil from the charge air cooler system may cause an engine runaway condition on startup, resulting in severe engine damage.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Disconnect the negative battery cable.
3. Remove the air cleaner outlet duct.
4. Disconnect the turbocharger oil feed pipe at the turbo.
5. Disconnect the turbocharger coolant return pipe at the turbo.

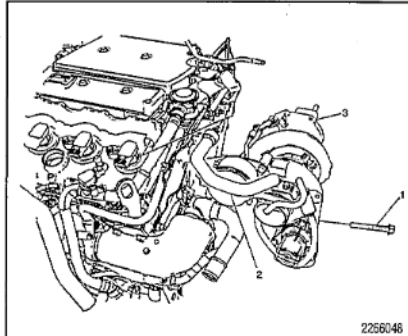


Fig. 83 Turbocharger (3), PVC hose (2), and bolt (1)

6. Disconnect the turbocharger coolant return pipe at the turbo.
7. Disconnect the turbocharger oil return pipe at the turbo.
8. Remove the radiator outlet pipe.
9. Remove the left side exhaust turbocharger inlet pipe:
 - a. Remove the radiator outlet pipe.
 - b. Remove the left side exhaust manifold heat shield.
10. Disconnect the right side exhaust turbocharger inlet pipe.
11. Remove the exhaust manifold/catalytic converter.
12. Disconnect PCV hose from the camshaft cover.
13. Disconnect vacuum hoses as necessary.
14. Transfer parts as necessary.

To install:

15. Installation is the reverse of removal, noting the following:
 - a. Tighten the turbocharger bolt to 48 ft. lbs. (65 Nm).
 - b. Tighten the left side exhaust turbocharger inlet pipe nuts to 15 ft. lbs. (20 Nm).
 - c. Install NEW engine oil and a NEW oil filter.

VALVE COVERS

REMOVAL & INSTALLATION

2.8L Engine

See Figures 84 and 85.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Disconnect the negative battery cable.
3. Remove the ignition coils.
4. Disconnect and remove the engine harness from the valve cover.
5. Remove the upper intake manifold.

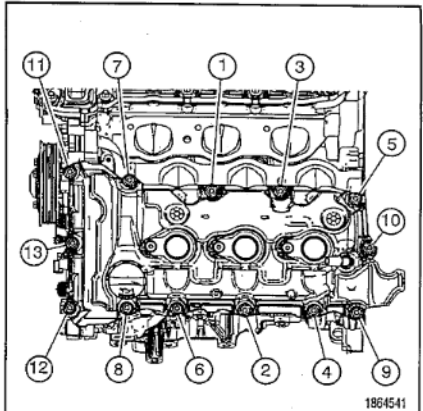


Fig. 84 Valve cover bolt tightening sequence—left-hand side

6. For the left valve cover, remove the secondary air injection pump hose and bracket; and the secondary air injection pump pipe.
7. Remove the positive crankcase ventilation tube (valve cover to turbocharger).
8. Remove the valve cover bolts.
9. Remove the valve cover from the cylinder head.
10. Clean the mating surfaces of the cylinder head and the valve cover.
11. Install the spark plug tube seal guide (EN-46101) onto the spark plug tubes.

To install:

12. Install new valve cover bolt grommets prior to installing the valve cover bolts.
13. Place a bead 0.3150 in. (8 mm) in diameter by 0.1575 in. (4 mm) in height of RTV sealant, on the engine front cover split lines.
14. Place the valve cover into position onto the cylinder head.

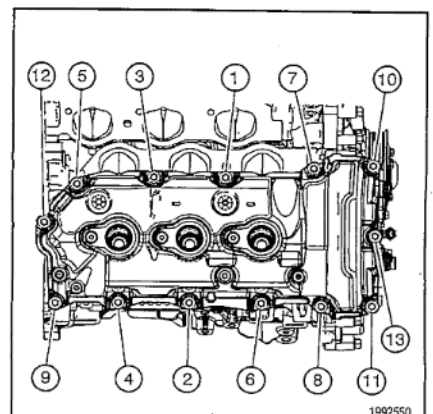


Fig. 85 Valve cover bolt tightening sequence—right-hand side

15. Loosely install the valve cover bolts.

16. Tighten the valve cover bolts in the sequence shown to 89 inch lbs. (10 Nm).

17. Connect and install the engine harness to the valve cover.

18. Remove the EN-46101 guide from the spark plug tubes.

19. Install the upper intake manifold.

20. For the left valve cover, install the secondary air injection pump hose and bracket, and the secondary air injection pump pipe.

21. Install the ignition coils.

22. Install the positive crankcase ventilation hose/pipe/tube.

3.0L Engine

See Figures 86 and 87.

1. Before servicing the vehicle, refer to the Precautions Section.

2. Disconnect the negative battery cable.

3. Remove the ignition coils.

4. Disconnect and remove the engine harness from the valve cover.

5. Remove the intake manifold.

6. Remove the valve cover bolts.

7. Remove the valve cover from the cylinder head.

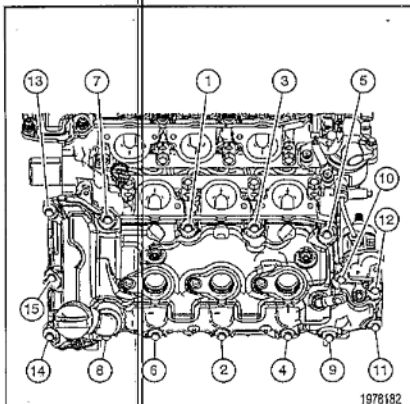


Fig. 86 Valve cover bolt tightening sequence—left-hand side

8. Clean the mating surfaces of the cylinder head and the valve cover.

9. Install the spark plug tube seal guide (EN-46101) onto the spark plug tubes.

To install:

10. Install new valve cover bolt grommets prior to installing the valve cover bolts.

11. Place a bead 0.3150 in. (8 mm) in diameter by 0.1575 in. (4 mm) in height of RTV sealant, on the engine front cover split lines.

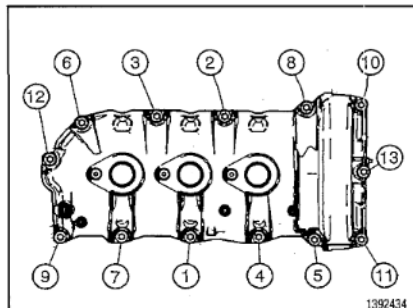


Fig. 87 Valve cover bolt tightening sequence—right-hand side

12. Place the valve cover into position onto the cylinder head.

13. Loosely install the valve cover bolts.

14. Tighten the valve cover bolts in the sequence shown to 89 inch lbs. (10 Nm).

15. Connect and install the engine harness to the valve cover.

16. Remove the EN-46101 guide from the spark plug tubes.

17. Install the ignition coils.

VALVE LASH

ADJUSTMENT

The valve lash is not adjustable.

ENGINE PERFORMANCE & EMISSION CONTROLS

CAMSHAFT POSITION (CMP) SENSOR

LOCATION

See Figures 88 through 91.

1. Refer to the accompanying illustrations.

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.

2. For Bank 1 sensors, remove the air cleaner assembly.

3. For Bank 2 sensors, remove engine mounting bracket.

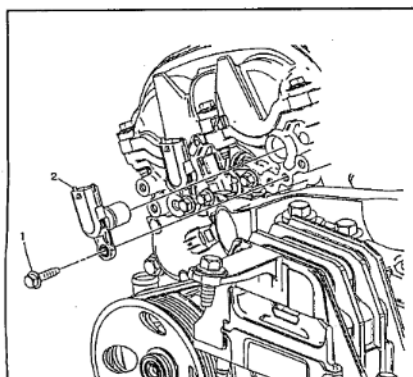


Fig. 88 Camshaft Position (CMP) Sensor—Bank 1, Intake

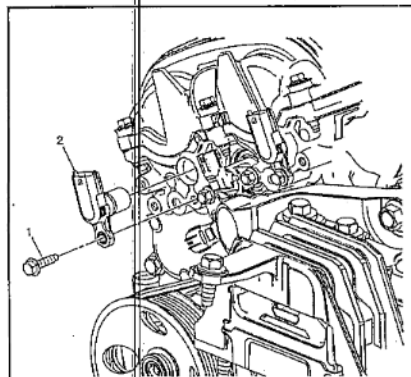


Fig. 89 Camshaft Position (CMP) Sensor—Bank 1, Exhaust

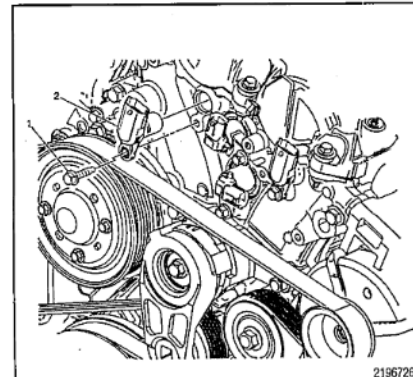


Fig. 90 Camshaft Position (CMP) Sensor—Bank 2, Intake

4. Disconnect the electrical connector.
5. Remove the CMP sensor bolt.
6. Remove the CMP sensor.

To install:

7. Installation is the reverse of removal. Tighten the mounting bolt to 89 inch lbs. (10 Nm).

**** WARNING**

In order to prevent any possible electrostatic discharge damage to the ECM, do not touch the connector pins.

4. Unlock and disconnect the engine wiring harness electrical connectors from the ECM.

5. Remove the ECM.

To install:

6. Install the ECM.
7. Connect the negative battery cable.
8. Using a scan tool, program the ECM, if required.
9. Turn OFF the Ignition for at least 5 seconds after the programming event is complete.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

LOCATION

See Figures 94 and 95.

1. Refer to the accompanying illustrations.

REMOVAL & INSTALLATION

2.8L Engine

1. Turn the ignition to the OFF position.
2. Disconnect the negative battery cable.
3. Remove the intake manifold cover.
4. Remove the oil level indicator tube.
5. Partially drain the cooling system.
6. Disconnect the ECT sensor harness connector.
7. Remove the coolant temperature sensor.

To install:

8. Installation is the reverse order of removal. Tighten the retaining bolt to 16 ft. lbs. (22 Nm).

3.0L Engine

1. Turn the ignition to the OFF position.
2. Disconnect the negative battery cable.
3. Reposition the sensor heat shield.
4. Disconnect the ECT sensor harness connector.
5. Remove the coolant temperature sensor.

To install:

6. Installation is the reverse order of removal. Tighten the retaining bolt to 15 ft. lbs. (20 Nm).

HEATED OXYGEN SENSOR (HO2S)

LOCATION

See Figures 96 through 101.

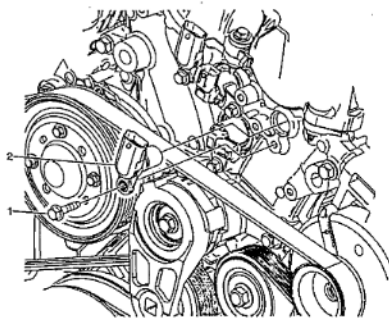


Fig. 91 Camshaft Position (CMP) Sensor—Bank 2, Exhaust

CRANKSHAFT POSITION (CKP) SENSOR

LOCATION

See Figure 92.

1. Refer to the accompanying illustration.

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Raise and safely support the vehicle.
3. Remove the exhaust manifold lower heat shield, as necessary.
4. Disconnect the crankshaft position (CKP) electrical connector.
5. Remove the crankshaft sensor bolt.
6. Remove the crankshaft sensor.

To install:

7. Install the Crankshaft Position (CKP)

sensor and tighten the bolt to 89 inch lbs. (10 Nm).

8. Connect the CKP electrical connector.

9. Install the exhaust manifold lower heat shield, as applicable.

10. Lower the vehicle.

ELECTRONIC CONTROL MODULE (ECM)

LOCATION

See Figure 93.

1. Refer to the accompanying illustration.

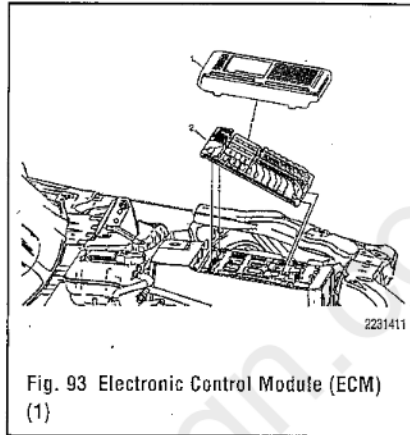


Fig. 93 Electronic Control Module (ECM) (1)

REMOVAL & INSTALLATION

1. Using a scan tool, retrieve the percentage of remaining engine oil and automatic transmission fluid life. Record the remaining engine oil and automatic transmission fluid life.
2. Turn the Ignition OFF.
3. Disconnect the negative battery cable.

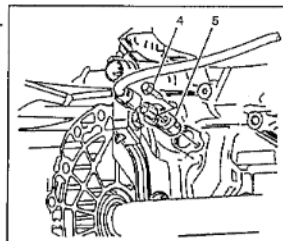
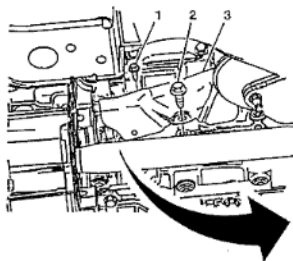


Fig. 92 Crankshaft Position (CKP) Sensor (5), bolts (1, 2, 4), and exhaust manifold lower heat shield (3)

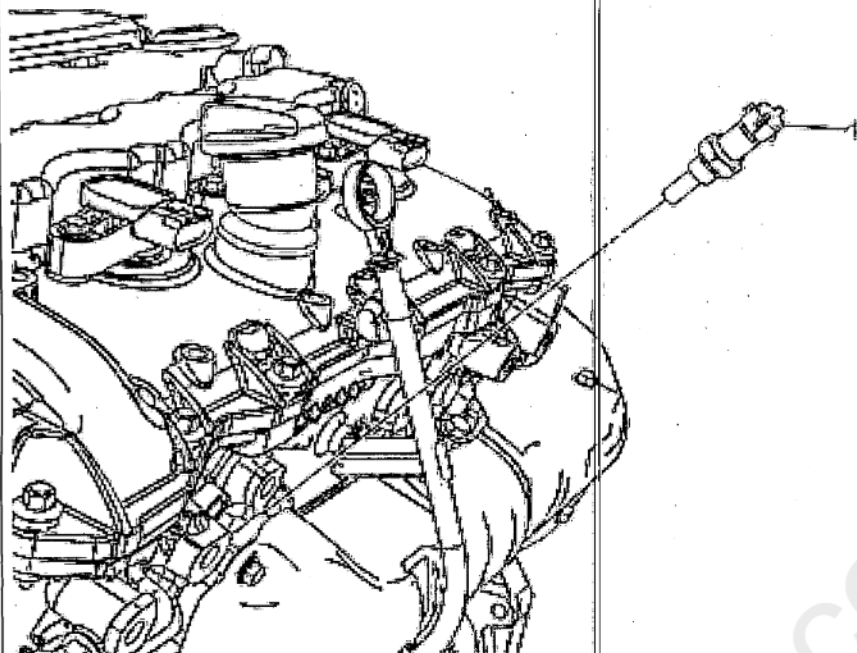


Fig. 94 Engine Coolant Temperature (ECT) Sensor—2.8L engines

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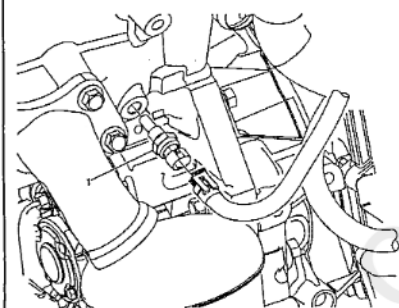


Fig. 95 Engine Coolant Temperature (ECT) Sensor—3.0L engines

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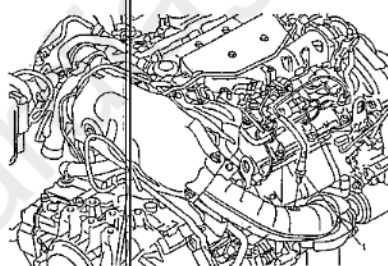


Fig. 97 Heated Oxygen (HO2S) Sensor—2.8L engine, Sensor 2

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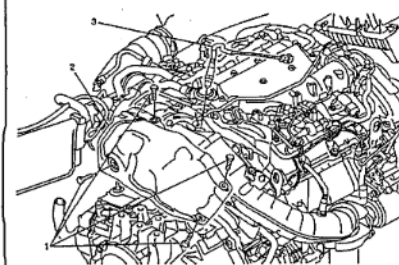


Fig. 96 Heated Oxygen (HO2S) Sensor—2.8L engine, Sensor 1

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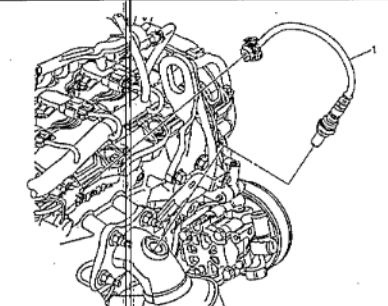
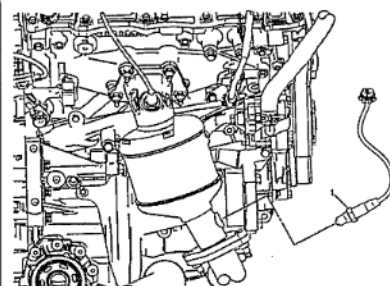


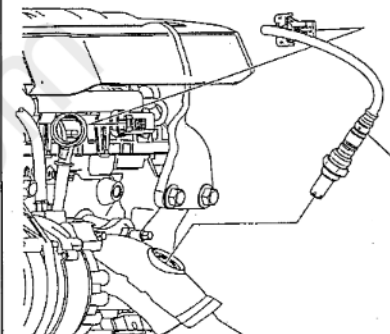
Fig. 98 Heated Oxygen (HO2S) Sensor—3.0L engine, Bank 1, Sensor 1

2197495



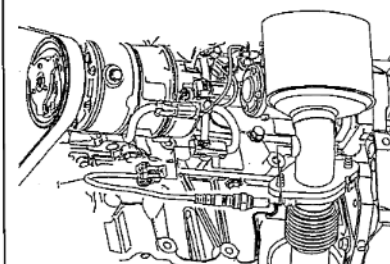
2231004

Fig. 99 Heated Oxygen (HO2S) Sensor—3.0L engine, Bank 1, Sensor 2



2197495

Fig. 100 Heated Oxygen (HO2S) Sensor—3.0L engine, Bank 2, Sensor 1



2197497

Fig. 101 Heated Oxygen (HO2S) Sensor—3.0L engine, Bank 2, Sensor 2

1. Refer to the accompanying illustrations.

REMOVAL & INSTALLATION

1. Turn the ignition OFF.
2. Disconnect the negative battery cable.
3. For Sensor 1, remove the catalytic converter front heat shield.
4. For Sensor 2, remove the intake manifold cover.
5. Disconnect the Heated Oxygen Sensor (HO2S) electrical connector.

6. Remove any wire harness retainers and note the wire harness routing for reassembly.

7. Remove the right side catalytic converter, if necessary.

8. Remove the HO2S.

To install:

➔ A special anti-seize compound is used in the HO2S threads. The compound consists of liquid graphite and glass beads. The graphite tends to burn away, but the glass beads remain, making the sensor easier to remove. New, or service replacement sensors already have the compound applied to the threads. If the sensor is removed from an exhaust component and if for any reason the sensor is to be reinstalled, the threads must have anti-seize compound applied before reinstallation.

9. Installation is the reverse order of removal. If reinstalling the old sensor, coat the threads with anti-seize compound. Tighten the HO2S to 31 ft. lbs. (42 Nm).

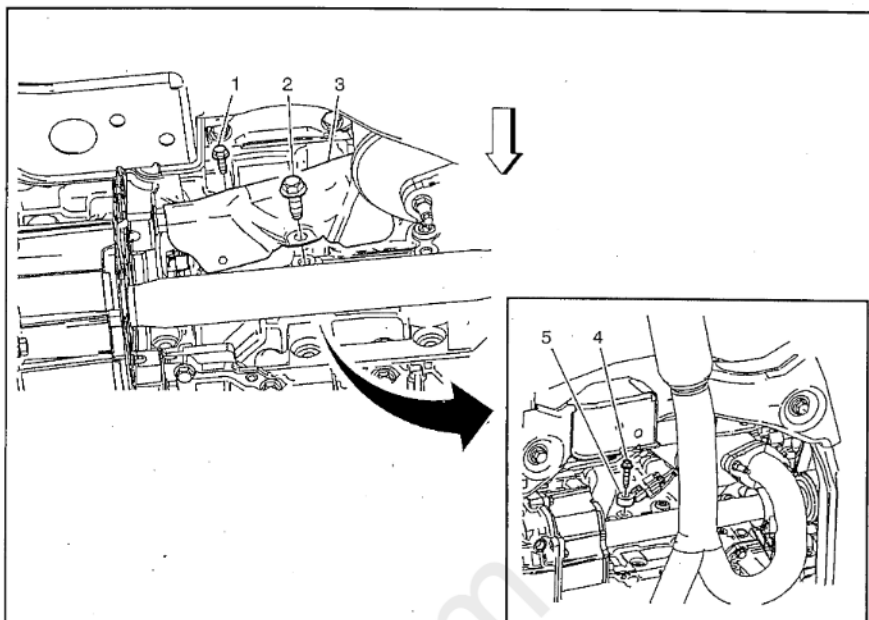


Fig. 102 Knock Sensor (5), bolts (1, 2, 4), and exhaust manifold lower heat shield (3)—Bank 1

INTAKE AIR TEMPERATURE (IAT) SENSOR

LOCATION

See Mass Air Flow (MAF) Sensor.

REMOVAL & INSTALLATION

See Mass Air Flow (MAF) Sensor.

KNOCK SENSOR (KS)

LOCATION

See Figures 102 and 103.

1. Refer to the accompanying illustrations.

REMOVAL & INSTALLATION

Bank 1

1. Before servicing the vehicle, refer to the Precautions Section.

2. Disconnect the negative battery cable.

3. If equipped with AWD, remove the right side catalytic converter.

4. Raise and safely support the vehicle.

5. Remove the exhaust manifold lower heat shield.

6. Remove the Knock Sensor (KS) electrical connector.

7. Remove the KS bolt.

8. Remove the KS.

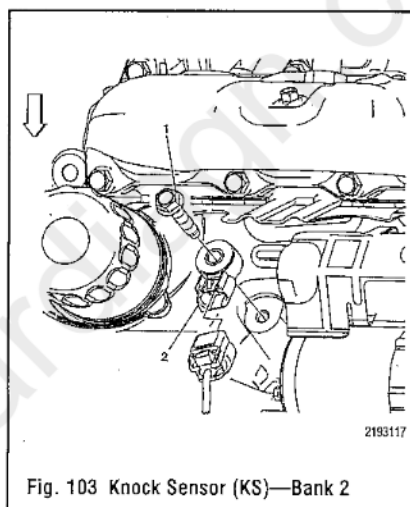


Fig. 103 Knock Sensor (KS)—Bank 2

To install:

9. Installation is the reverse order of removal. Tighten the KS bolts to 17 ft. lbs. (23 Nm).

Bank 2

1. Before servicing the vehicle, refer to the Precautions Section.

2. Disconnect the negative battery cable.

3. Remove the Knock Sensor (KS) electrical connector.

4. Remove the KS bolt.

5. Remove the KS.

To install:

6. Installation is the reverse order of removal. Tighten to 17 ft. lbs. (23 Nm).

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

LOCATION

See Figure 104.

1. Refer to the accompanying illustration.

REMOVAL & INSTALLATION

3.0L Engine

1. Before servicing the vehicle, refer to the Precautions Section.

2. Disconnect the negative battery cable.

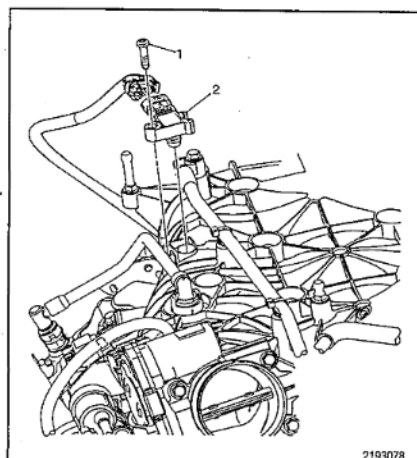


Fig. 104 Manifold Absolute Pressure (MAP) Sensor (2)—3.0L engines

3. Remove the intake manifold cover.
4. Disconnect the MAP sensor harness connector.
5. Remove the mounting bolt and the MAP sensor. Discard the O-ring.

To install:

6. Installation is the reverse order of removal. Install a new O-ring. Tighten the mounting bolt to 44 inch lbs. (5 Nm).

MASS AIR FLOW (MAF) SENSOR

LOCATION

See Figures 105 and 106.

1. Refer to the accompanying illustrations.

REMOVAL & INSTALLATION

1. Before servicing the vehicle, refer to the Precautions Section.
2. Disconnect the negative battery cable.

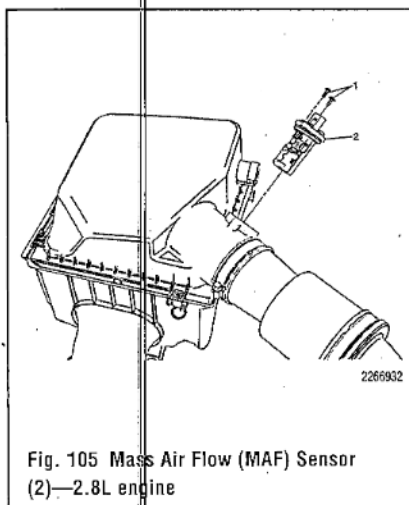


Fig. 105 Mass Air Flow (MAF) Sensor (2)—2.8L engine

3. Disconnect the MAF harness connector.
4. Remove the MAF sensor bolts.
5. Remove the MAF sensor.

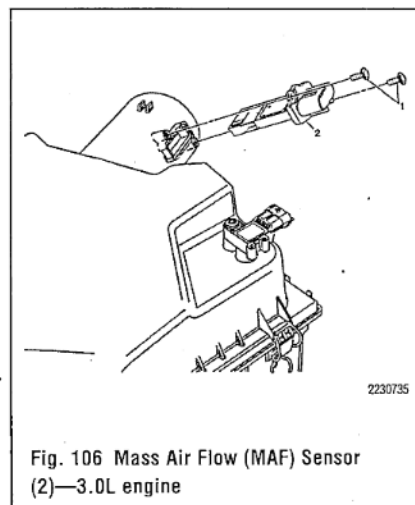


Fig. 106 Mass Air Flow (MAF) Sensor (2)—3.0L engine

To install:

6. Installation is the reverse order of removal. Tighten the mounting bolts to 27 inch lbs. (3 Nm).

FUEL

FUEL SYSTEM SERVICE PRECAUTIONS

Safety is the most important factor when performing not only fuel system maintenance but any type of maintenance. Failure to conduct maintenance and repairs in a safe manner may result in serious personal injury or death. Maintenance and testing of the vehicle's fuel system components can be accomplished safely and effectively by adhering to the following rules and guidelines.

- To avoid the possibility of fire and personal injury, always disconnect the negative battery cable unless the repair or test procedure requires that battery voltage be applied.

- Always relieve the fuel system pressure prior to disconnecting any fuel system component (injector, fuel rail, pressure regulator, etc.), fitting or fuel line connection. Exercise extreme caution whenever relieving fuel system pressure to avoid exposing skin, face and eyes to fuel spray. Please be advised that fuel under pressure may penetrate the skin or any part of the body that it contacts.

- Always place a shop towel or cloth around the fitting or connection prior to loosening to absorb any excess fuel due to spillage. Ensure that all fuel spillage (should it occur) is quickly removed from engine surfaces. Ensure that all fuel soaked cloths or towels are deposited into a suitable waste container.

- Always keep a dry chemical (Class B) fire extinguisher near the work area.
- Do not allow fuel spray or fuel vapors to come into contact with a spark or open flame.
- Always use a back-up wrench when loosening and tightening fuel line connection fittings. This will prevent unnecessary stress and torsion to fuel line piping.

- Always replace worn fuel fitting O-rings with new. Do not substitute fuel hose or equivalent where fuel pipe is installed.

Before servicing the vehicle, make sure to also refer to the precautions in the beginning of this section as well.

RELIEVING FUEL SYSTEM PRESSURE

** CAUTION

Fuel that flows out at high pressure can cause serious injury to the skin and eyes. ALWAYS depressurize the fuel system before removing components that are under high fuel pressure.

** CAUTION

If a scan tool is not available, WAIT at LEAST 2 hours after the engine has been run, before removing the high pressure fuel line.

GASOLINE FUEL INJECTION SYSTEM

1. Before servicing the vehicle, refer to the Precautions Section.

2. Remove the fuel pump module 20A fuse from the underhood electrical center.

3. Start the vehicle and allow the engine to idle until the engine stops. The engine will stop in approximately 20–30 seconds.

4. Turn the ignition OFF.

FUEL FILTER

REMOVAL & INSTALLATION

The fuel filter is located in the primary fuel tank module. It is designed to last the life of the vehicle and is not serviceable.

FUEL INJECTORS

REMOVAL & INSTALLATION

3.0L Engine

See Figures 107 through 109.

** WARNING

Remove the fuel rail assembly carefully to prevent damage to the injector electrical connector terminals and spray tips. Support the fuel rail after it is removed in order to avoid damaging the fuel rail components. Cap the fittings and plug the holes when servicing the fuel system to prevent debris from entering open ports.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Properly relieve the fuel system pressure.
3. Remove the fuel pipe shield.
4. Remove the intake manifold.
5. Remove the fuel feed intermediate pipe.
6. Remove the foam insulator from the fuel rails.
7. Cut the plastic tie strap.
8. Disconnect the fuel pressure sensor electrical connector.
9. Remove the fuel pressure sensor.
10. Remove the left side fuel rail fasteners.
11. Remove the right side fuel rail fasteners for clearance purposes.
12. Using the EN-49248-4 hook, raise the fuel rail as an assembly.
13. Once the fuel rail is free, remove the EN-49248 special tool.
14. For Bank 1 fuel rail assembly, slide the fuel rail toward the front of the engine approximately 1 in. (25.4 mm), in order to clear the center injector bore.
15. For Bank 2 fuel rail assembly, slide the fuel rail toward the rear of the engine approximately 1 in. (25.4 mm), in order to clear the center injector bore.

➔ **The direct fuel injectors must be rebuilt whenever the injector has been released from the fuel rail or cylinder head.**

16. Once the fuel rail is removed, remove the fuel injectors and rebuild them.

To install:

17. For Bank 1 fuel rail assembly, slide the fuel rail toward the rear of the engine approximately 1 in. (25.4 mm), in order to align the center injector bore.
18. For Bank 2 fuel rail assembly, slide the fuel rail toward the front of the engine approximately 1 in. (25.4 mm), in order to align the center injector bore.
19. Hand tighten the two outer fuel rail fasteners to seat the injectors.
20. Start and hand tighten the remaining fuel rail fasteners.
21. Tighten the fuel rail fasteners in the sequence shown:
 - a. First pass 106 inch lbs. (12 Nm).
 - b. Final pass 17 ft. lbs. (23 Nm).
22. Tighten the fuel pressure sensor to 25 ft. lbs. (33 Nm).
23. Connect the fuel pressure sensor electrical connector and secure it with a new plastic zip tie.
24. Install a new fuel feed intermediate pipe. Lubricate the pipes with silicon free

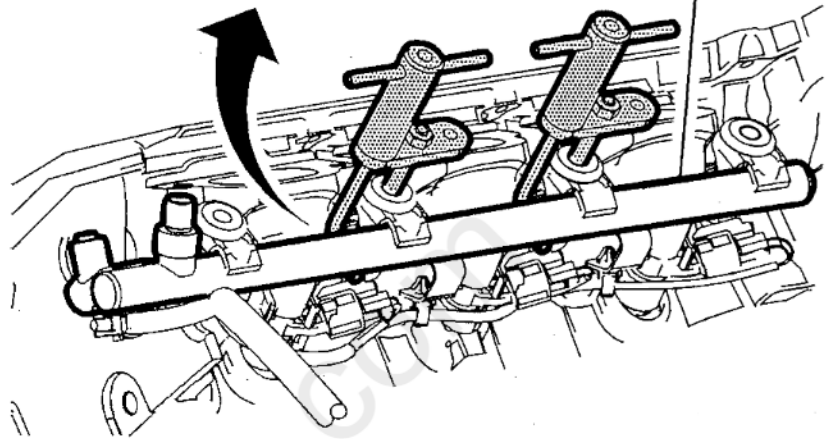
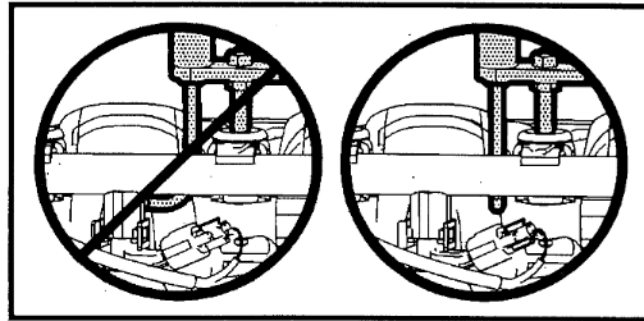


Fig. 107 Using the injector rail assembly remover hook, raise the fuel rail (1)

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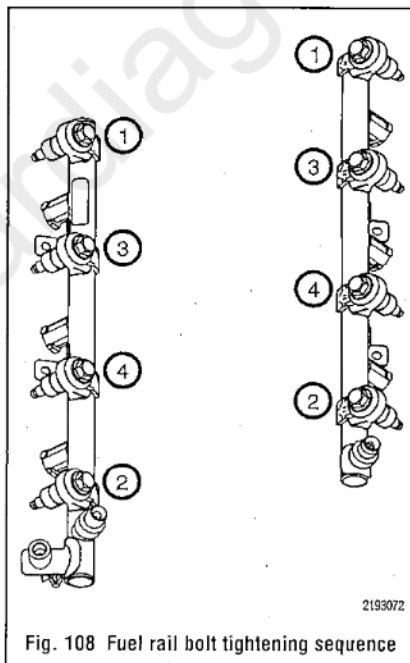


Fig. 108 Fuel rail bolt tightening sequence

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engine oil. Tighten the fittings in sequence as numbered (1, 2, 3):

- a. First Pass 11 ft. lbs. (15 Nm).
- b. Second Pass 22 ft. lbs. (30 Nm).
25. Inspect for fuel leaks using the following procedure:

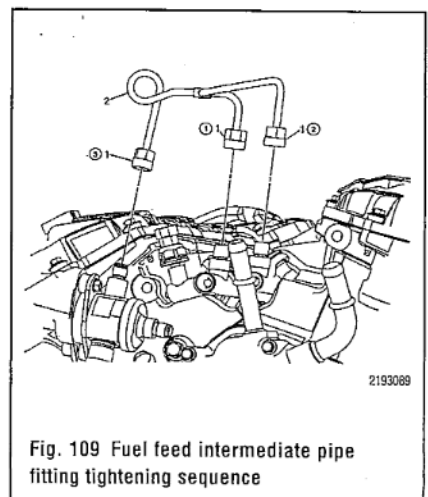


Fig. 109 Fuel feed intermediate pipe fitting tightening sequence

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- a. Turn ON the ignition, with the engine OFF for 2 seconds.
- b. Turn OFF the ignition, for 10 seconds.
- c. Turn ON the ignition, with the engine OFF.
- d. Inspect for fuel leaks.
26. Install the foam insulator to the fuel rails.
27. Install the intake manifold.
28. Install the fuel pipe shield and tighten the bolts to 80 inch lbs. (9 Nm).

29. Install the low side fuel pressure service port cap.

30. Install the fuel tank cap.

FUEL PUMP

REMOVAL & INSTALLATION

See Figure 110.

1. Before servicing the vehicle, refer to the Precautions Section.

2. Relieve the low and high side fuel system pressure.

3. Remove the high pressure fuel pump shield.

4. Disconnect the engine wiring harness electrical connector from the high pressure fuel pump.

5. Remove the low pressure feed pipe.

6. Remove the high pressure pipe. Discard the pipe.

7. Remove and discard the high pressure fuel pump bolts.

8. Remove the high pressure fuel pump.

9. Remove and discard the high pressure fuel pump O-ring.

10. Remove and discard the high pressure fuel pump gasket.

11. Remove the high pressure fuel pump roller lifter.

To install:

➔The camshaft must be in the base circle position before the high pressure fuel pump is installed.

12. Use the fuel pump alignment gauge (EN-48896 or equivalent) to ensure that the camshaft lobe is in the base circle position. At base circle the tool will be flush with the head.

13. Lubricate the high pressure fuel pump cylinder head bore and roller lifter with camshaft prelube.

➔The high pressure fuel pump gasket has a retaining feature to hold the pump retaining bolts in place.

14. Install the high pressure fuel pump roller lifter.

15. Install a new high pressure fuel pump O-ring.

16. Position the new high pressure fuel pump gasket and bolts to the fuel pump.

17. Install the high pressure fuel pump. Force will be required while hand tightening the bolts.

18. Tighten the high pressure fuel pump retaining bolts to 11 ft. lbs. (15 Nm).

19. Ensure the high pressure fuel pump and fuel rail fittings are clean prior to assembly.

20. Install a new high pressure fuel pipe.

21. Install the fuel feed pipe to the high pressure fuel pump.

22. Connect the high pressure fuel pump wiring harness.

23. Install the fuel tank cap.

➔If a fuel leak accrues at the fuel rail, the fuel rail will need to be replaced.

24. Inspect for leaks using the following procedure:

a. Turn ON the ignition, with the engine OFF for 2 seconds.

b. Turn OFF the ignition, for 10 seconds.

c. Turn ON the ignition, with the engine OFF.

d. Inspect for fuel leaks.

25. Install the pressure relief cap to the fuel feed pipe.

26. Install the high pressure fuel pump shield.

4. Loosen the fuel fill pipe hose clamps and slide the fill pipe hose up the filler pipe.

5. Insert the fuel tank drain hose (CH-45004 or equivalent) fuel tank drain hose into the fuel tank until the hose reaches the bottom of the fuel tank.

6. Use an hand or air operated pump device in order to drain as much fuel as possible.

REMOVAL & INSTALLATION

1. Before servicing the vehicle, refer to the Precautions Section.

2. Drain the fuel tank.

3. Relieve the fuel system pressure.

4. Remove the exhaust system.

5. Remove the rear driveshaft, if necessary.

6. Disconnect the evaporative emission line.

7. Loosen the upper fill pipe clamp and hose clamp and slide the hose up the filler pipe.

8. Disconnect the fuel tank electrical connector.

9. Disconnect the fuel line and evaporative emission line connectors.

10. Disconnect the evaporative emission line from the canister.

11. Support the fuel tank with a suitable jack.

12. Remove the fuel tank strap bolts and reposition the straps downward toward the front of the vehicle.

13. Using a suitable jack, lower the fuel tank.

14. Remove the following components if replacing just the fuel tank:

- The primary fuel tank pump module
- The secondary fuel tank pump module

To install:

15. Install the following components if fuel tank replacement was necessary:

- The primary fuel tank pump module
- The secondary fuel tank pump module

16. Raise the fuel tank to the vehicle.

17. Ensure the fuel tank straps are seated properly. Install the fuel tank straps and bolts and tighten to 33 ft. lbs. (45 Nm).

18. Connect the evaporative emission line to the canister.

19. Connect the fuel tank electrical connector.

20. Connect the fuel line and evaporative emission line connectors.

21. Connect the evaporative emission line.

22. Install the filler tube and tighten the hose both clamp to 44 inch lbs. (5 Nm).

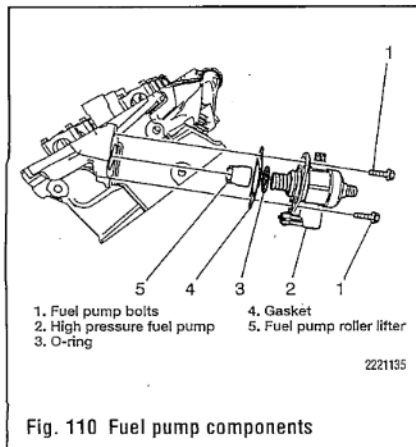


Fig. 110 Fuel pump components

FUEL TANK

DRAINING

** CAUTION

Never drain or store fuel in an open container. Always use an approved fuel storage container in order to reduce the chance of fire or explosion. Place a dry chemical (Class B) fire extinguisher nearby before performing any on-vehicle service procedures. Failure to follow these precautions may result in personal injury.

1. Before servicing the vehicle, refer to the Precautions Section.

2. Remove the fuel fill cap.

3. Raise and suitably support the vehicle.

23. Perform a leak down test.
24. Install the driveshaft, if removed.
25. Install the exhaust system.
26. Refill the fuel tank.
27. Inspect for fuel leaks.

IDLE SPEED

ADJUSTMENT

Idle speed is maintained by the Engine Control Module (ECM). No adjustment is necessary or possible.

THROTTLE BODY

REMOVAL & INSTALLATION

See Figures 111 and 112.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Turn the ignition to the OFF position.
3. For 2.8L engines, remove the charge air cooler outlet duct and support bracket.
4. For 3.0L engines, remove the air cleaner outlet duct.
5. Remove the throttle body mounting bolts.
6. Disconnect the electrical connector and remove the throttle assembly and gasket. Discard the gasket.

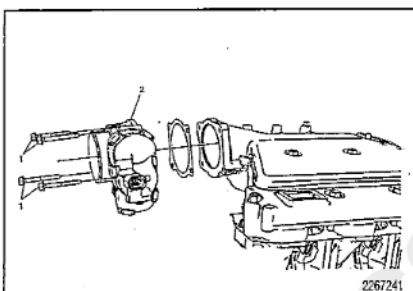


Fig. 111 Remove the mounting bolts (1) and the throttle body (2)—2.8L engine

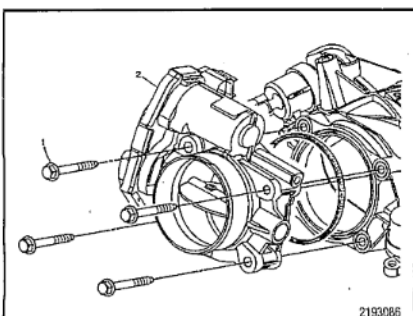


Fig. 112 Remove the mounting bolts (1) and the throttle body (2)—3.0L engine

To install:

7. Installation is the reverse order of removal. Install a new throttle body gasket. Tighten the mounting bolts to 89 inch lbs. (10 Nm).

THROTTLE LEARN/RESET PROCEDURE

2.8L Engine

1. Perform the procedure under the following conditions:
 - DTCs P0121, P0122, P0123, P0221, P0222, P0223, P0638, P2100, P2101, P2105, and P2119 are not set
 - The engine speed is less than 40 RPM
 - The vehicle speed is 0 mph (0 km/h)
 - The accelerator pedal position is less than 14.9 percent
 - The ignition 1 voltage is more than 10 volts
 - The engine coolant temperature is between 41–185°F (5–85°C)
 - The intake air temperature is between 41–140°F (5–60°C)

** WARNING

Ensure the above conditions are met before performing with this procedure. Do not perform this procedure if a throttle position sensor or other Throttle Actuator Control (TAC) system DTCs are set other than P2176. The ECM will not perform the idle learn procedure with a DTC set.

2. Turn OFF the ignition for 30 seconds.
3. Turn ON the ignition, with the engine OFF for 60 seconds.
4. Turn OFF the ignition.
5. Turn ON the ignition, with the engine OFF.
6. Clear the DTCs with a scan tool.

3.0L Engine

1. Perform the reset procedure under the following conditions:
 - DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0120, P0122, P0123, P0128, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0220, P0222, P0223, P0300, P0351, P0352, P0353, P0496, P0601, P0604, P0606, P060D, P0641, P0651, P1516, P2101, P2119, P2120, P2122,

P2123, P2125, P2127, P2128, P2135, P2138, or P2176 are not set

- Ignition ON, engine OFF
 - The vehicle speed is 0 mph (0 km/h)
2. Perform the reset procedure as follows (Performed after the throttle body is cleaned or replaced):
 - a. Ignition ON, engine OFF, perform the Idle Learn Reset in Module Setup with a scan tool.
 - b. Start the engine and monitor the TB Idle Airflow Compensation parameter. The TB Idle Airflow Compensation value should equal 0 percent and the engine should be idling at a normal idle speed.
 - c. Clear the DTCs.
 3. Perform the learn procedure under the following conditions:
 - DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0120, P0122, P0123, P0128, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0220, P0222, P0223, P0300, P0351, P0352, P0353, P0496, P0601, P0604, P0606, P060D, P0641, P0651, P1516, P2101, P2119, P2120, P2122, P2123, P2125, P2127, P2128, P2135, P2138, or P2176 are not set
 - The engine speed is between 450–4,000 RPM
 - The manifold absolute pressure (MAP) is greater than 5 kPa
 - The Mass Air Flow (MAF) is greater than 2 g/s
 - The ignition voltage is greater than 10 volts
 4. Perform the learn procedure as follows (Performed after the ECM is flashed or replaced):

** WARNING

Do NOT perform this procedure if DTCs are set.

- a. Start and idle the engine for 3 minutes.
- b. With a scan tool, monitor the Desired Idle Speed and the actual Engine Speed.
- c. The ECM will start to learn the new idle cells and Desired Idle Speed should start to decrease.
- d. Ignition OFF for 60 seconds.
- e. Start and idle the engine for 3 minutes.

f. After the 3 minute run time the engine should be idling normal. If the engine idle speed has not been learned the vehicle will need to be driven at speeds above 44 mph (70 km/h) with several decelerations and extended idles.

During the drive cycle the check engine light may come on with idle speed DTCs. If idle speed codes are set, clear codes so the ECM can continue to learn.

g. After the drive cycle, the engine

should be idling normally. If the engine idle speed has not been learned, turn OFF the ignition for 60 seconds and repeat the previous step.

h. Once the engine speed has returned to normal, clear DTCs.

HEATING & AIR CONDITIONING SYSTEM

BLOWER MOTOR

REMOVAL & INSTALLATION

See Figure 113.

** CAUTION

Before servicing components near or affected by the SRS (air bag) system, read and observe all SRS Service Precautions. Refer to Supplemental Restraint System (SRS), in the Chassis Electrical section. Failure to observe all precautions may result in accidental airbag deployment, personal injury, or death. Refer to Airbag Removal & Installation.

1. Disable the SIR system.
2. Remove the right instrument panel insulator panel.
3. Disconnect the blower motor electrical connector.
4. Remove the blower motor mounting bolts.
5. Remove the blower motor.

To install:

6. Installation is the reverse of removal. Tighten the mounting bolts to 15 inch lbs. (2 Nm).

HEATER CORE

REMOVAL & INSTALLATION

See Figure 114.

** CAUTION

Before servicing components near or affected by the SRS (air bag) system, read and observe all SRS Service Precautions. Refer to Supplemental Restraint System (SRS), in the Chassis Electrical section. Failure to observe all precautions may result in accidental airbag deployment, personal injury, or death. Refer to Airbag Removal & Installation.

1. Disable the SIR system.
2. Recover the refrigerant.
3. Drain the cooling system.

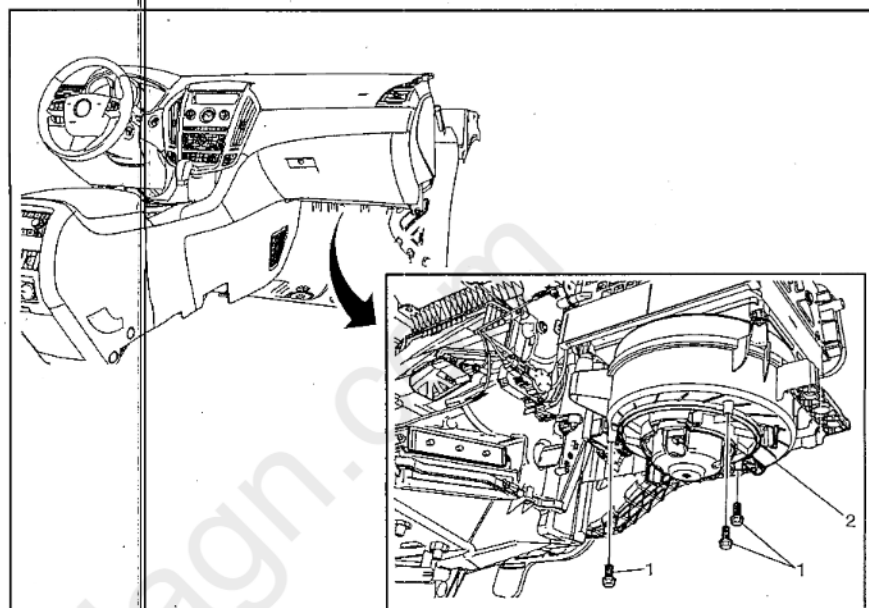


Fig. 113 Blower motor (2) and mounting bolts (1)

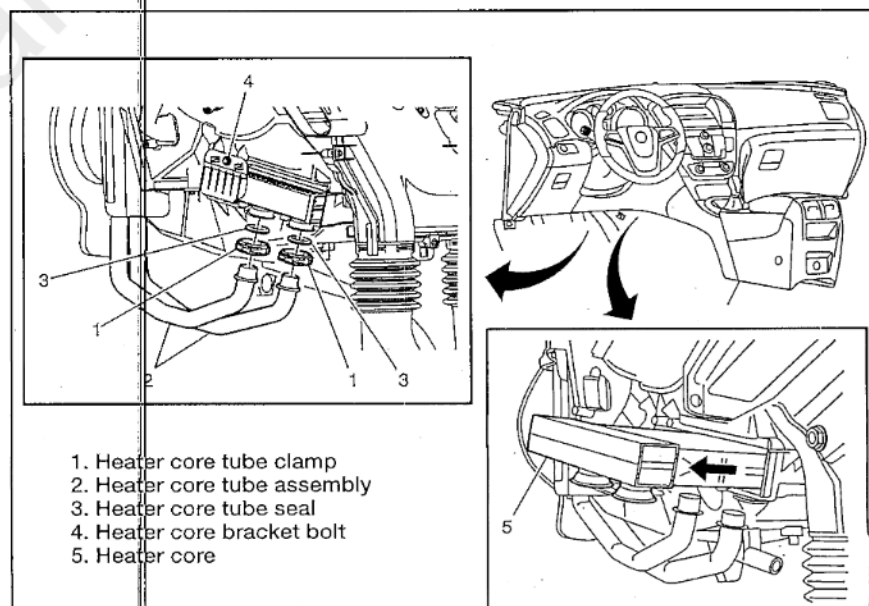


Fig. 114 Heater core components

4. Remove the instrument panel insulator panel, left side.
5. Remove the instrument panel lower trim panel.
6. Disconnect the heater inlet and outlet hoses from the heater core tube.

7. Remove the heater core tube.
8. Remove the heater core bracket.
9. Remove the heater core.

To install:

10. Installation is the reverse of removal.

Tighten the heater core bracket bolt to 12 inch lbs. (1 Nm).

11. Fill the coolant.
12. Evacuate and recharge the AC system.

STEERING

POWER STEERING GEAR

REMOVAL & INSTALLATION

See Figures 115 and 116.

*** CAUTION

Before servicing components near or affected by the SRS (air bag) system, read and observe all SRS Service Precautions. Refer to Supplemental Restraint System (SRS), in the Chassis Electrical section. Failure to observe all precautions may result in accidental airbag deployment, personal injury, or death. Refer to Airbag Removal & Installation.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Disable the SIR system.
3. With wheels of the vehicle facing straight ahead, secure the steering wheel utilizing steering column anti-rotation pin, steering column lock, or a strap to prevent rotation. Locking of the steering column will prevent damage and a possible malfunction of the SIR system.

*** WARNING

After disconnecting components, do not rotate the steering wheel or move the front tires and wheels. Failure to follow this procedure may cause the SIR coil assembly to become un-centered and cause possible damage to

the SIR coil. If you think the SIR coil has become un-centered, refer to your specific SIR coil's centering procedure to re-center SIR Coil.

4. With the wheels of the vehicle in the straight ahead position, lock the steering column.
5. Disconnect the intermediate steering shaft from the steering gear.
6. Place drain pans under the vehicle.
7. Remove as much power steering fluid from the reservoir as possible.
8. Disconnect the front stabilizer shaft from the 2 stabilizer shaft links. Rotate the front stabilizer shaft as necessary for access.
9. Disconnect the 2 steering linkage outer tie rods from the steering knuckles.
10. Disconnect the power steering gear inlet hose from the steering gear.
11. Disconnect the power steering gear outlet hose and the outlet hose bracket from the steering gear.
12. Perform the following steps:
 - a. Support the front frame with a jack.
 - b. If equipped with all wheel drive, remove the driveshaft.
 - c. Remove the rear transmission mount through bolt.
 - d. Remove the rear frame-to-body bolts.
 - e. Lower the rear part of the frame a maximum of 2 inches in order to gain clearance for the steering gear.

13. If equipped with variable effort steering, disconnect the electrical connector
14. Remove the steering gear nuts and bolts.

15. Remove the steering gear from the frame.

To install:

16. Installation is the reverse of removal, noting the following:
 - a. Hold the steering gear bolt with a wrench and tighten the steering gear nut to 44 ft. lbs. (60 Nm), plus 120 degrees.
 - b. Fill and bleed the power steering system.
 - c. Measure and adjust the front toe.

POWER STEERING PUMP

REMOVAL & INSTALLATION

See Figure 117.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Place drain pans under the vehicle.
3. Remove as much power steering fluid from the power steering fluid reservoir as possible.
4. Remove the drive belt from the power steering pump pulley only.
5. Remove the right front tire and wheel assembly.
6. Disconnect the power steering fluid reservoir outlet hose from the power steering pump.
7. Disconnect the power steering gear inlet hose from the power steering pump.

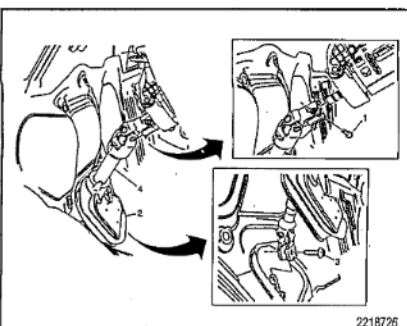


Fig. 115 Intermediate steering shaft (4), bolts (1, 3), and seal (2)

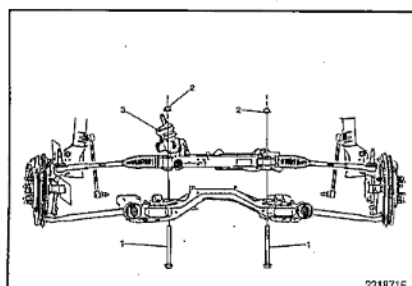


Fig. 116 Steering gear (3), bolt (1), and nut (2)

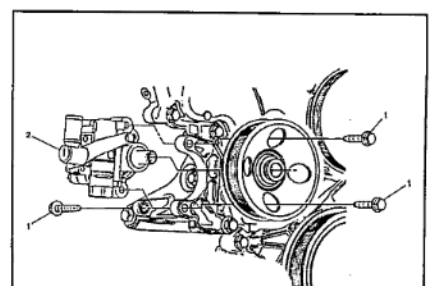


Fig. 117 Power steering pump (2) and bolts (1)

8. Remove the power steering pump bolts. Note the routing for installation.

9. Remove the power steering pump through the right front wheel well opening.

To install:

10. Installation is the reverse of removal, noting the following:

a. Install the power steering pump bolts in the reverse order of removal and tighten to 16 ft. lbs. (22 Nm).

b. Fill and bleed the power steering system.

c. Clean any excess power steering fluid from the vehicle.

BLEEDING

➔ Use clean, new power steering fluid only. Hoses touching the frame, body or engine may cause system noise. Ensure the hoses do not touch any other part of the vehicle. Loose connections may not leak, but could allow air into the steering system. Ensure all connections are tight. Maintain the power steering fluid level throughout the bleeding procedure.

1. Fill pump reservoir with fluid to minimum system level, FULL COLD level, or middle of hash mark on cap stick fluid level indicator.

2. Raise the vehicle until the front wheels are off the ground.

3. With the key in the ON position and the engine OFF, turn the steering wheel from stop to stop 12 times. Vehicles equipped with longer length power steering hoses may require turns up to 15 to 20 stop to stops.

4. Verify power steering fluid level.

5. Start the engine. Rotate steering wheel from left to right. Check for sign of cavitation or fluid aeration (pump noise/whining).

7. Verify the fluid level. Repeat the bleed procedure, if necessary.

6. Lower the vehicle.

FLUID FILL PROCEDURE

1. Run the engine until the power steering fluid reaches about 170°F (80°C).

2. Turn the engine OFF.

3. For 3.0L engines, remove the intake manifold cover.

4. Clean the power steering fluid reservoir and the reservoir cap.

5. Remove the reservoir cap.

➔ Inspect the power steering pump fluid level at regular intervals.

6. Inspect the power steering fluid level on the cap stick. Ensure that the fluid level is at the MAX mark on the cap stick.

** WARNING

When adding fluid or making a complete fluid change, always use the proper power steering fluid. Failure to use the proper fluid will cause hose and seal damage and fluid leaks.

➔ If the power steering fluid color is red or pink, use GM DEXRON®-VI Automatic Transmission Fluid. If the power steering fluid color is amber or brown, use GM Power Steering Fluid.

7. Add the proper fluid to the reservoir, if necessary.

8. Install the reservoir cap.

9. For 3.0L engines, install the intake manifold cover.

SUSPENSION

CONTROL LINKS

REMOVAL & INSTALLATION

See Figure 118.

1. Before servicing the vehicle, refer to the Precautions Section.

2. Raise and support the vehicle.

3. Remove the tire and wheel.

4. Remove the stabilizer shaft link nuts.

5. Remove the stabilizer shaft links.

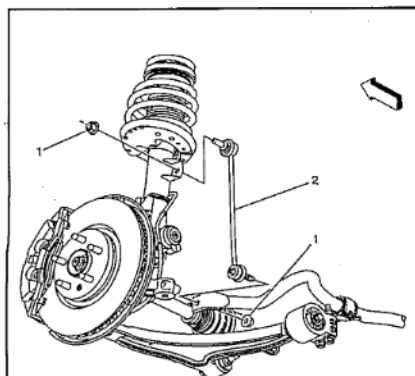


Fig. 118 Stabilizer shaft link (2) and nuts (1)

To install:

6. Installation is the reverse of removal. Tighten the stabilizer shaft link nuts to 55 ft. lbs. (75 Nm).

LOWER BALL JOINT

REMOVAL & INSTALLATION

The lower control arm must be replaced. The ball joint is not serviced separately.

LOWER CONTROL ARM

REMOVAL AND & INSTALLATION

See Figures 119 through 122.

1. Before servicing the vehicle, refer to the Precautions Section.

2. Raise and support the vehicle.

3. Remove the tire and wheel.

4. Support the steering knuckle with a suitable stand.

5. Disconnect the electric front suspension accelerometer link from the lower control arm, if equipped.

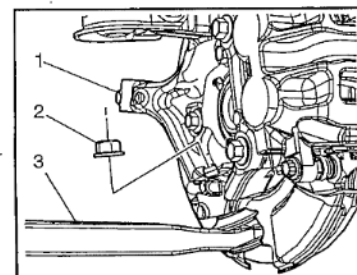
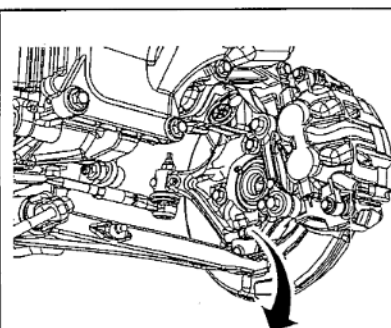
6. Loosen the front lower control arm ball stud nut from the ball joint.

7. Using a ball joint removal tool (CH 47975-A or equivalent), separate the front lower control arm from the steering knuckle.

8. Remove the ball joint removal tool.

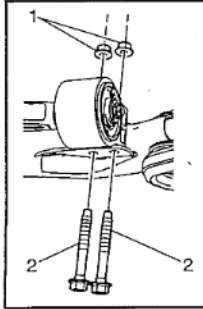
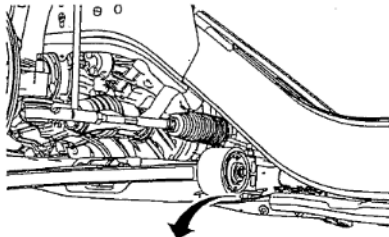
FRONT SUSPENSION

9. Remove the front lower control arm rear nuts and the front lower control arm rear bolts.



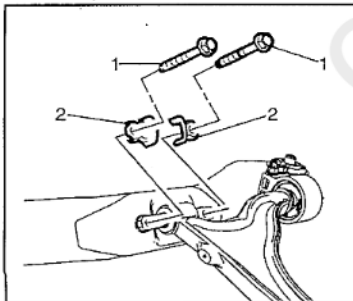
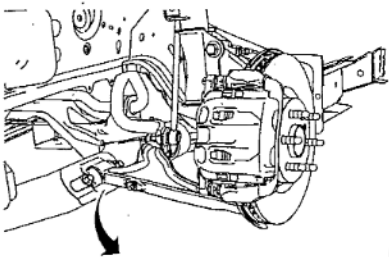
2223060

Fig. 119 Loosen the front lower control arm ball stud nut (2) and separate the front lower control arm (3) from the steering knuckle (1)



2218035

Fig. 120 Remove the front lower control arm rear nuts (1) and the front lower control arm rear bolts (2)

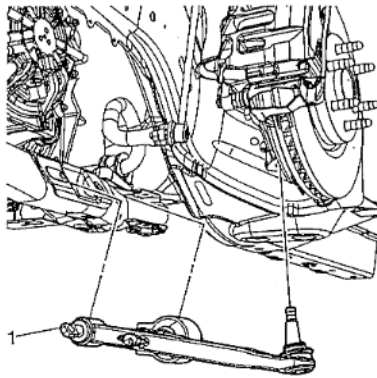


2218034

Fig. 121 Remove front lower control arm front bolts (1) and the brackets (2)

10. Remove front lower control arm front bolts and the brackets. Note the position of the brackets.

11. Remove the front lower control arm from the vehicle.



2223013

Fig. 122 Remove the front lower control arm (1)

To install:

12. Position the front lower control arm in the frame.

**** WARNING**

Failure to replace the front lower control brackets will cause premature wear and damage to the front lower control arm bushings.

13. Install the front lower control arm front mounting brackets bolts and tighten to 74 ft. lbs. (100 Nm) plus an additional 90 degrees.

14. Install the front lower control arm rear bolts and the front lower control arm rear nuts.

15. Tighten the front lower control arm rear bolts to 81 ft. lbs. (110 Nm).

16. Install the front lower control arm ball stud nut to the ball joint and tighten to 22 ft. lbs. (30 Nm) plus an additional 130 degrees.

17. Reconnect the electric front suspension accelerometer link to the lower control arm, if equipped.

18. Remove the support from the steering knuckle.

19. Install the tire and wheel assembly.

20. Remove the support and lower the vehicle.

STABILIZER BAR

REMOVAL & INSTALLATION

See Figures 123 and 124.

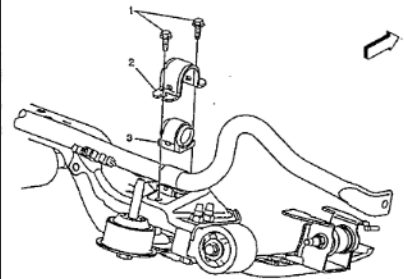
1. Before servicing the vehicle, refer to the Precautions Section.

2. Raise and support the vehicle.

3. Remove the tire and wheel.

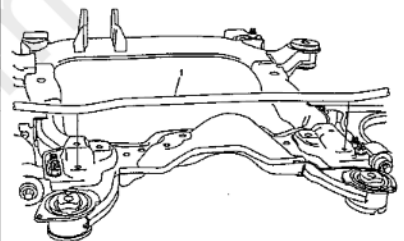
4. Remove the stabilizer shaft links.

5. Remove the rear bolts of the front dri-



2018548

Fig. 123 Front stabilizer shaft insulator (3), bolts (1), and clamp (2)



2221125

Fig. 124 Remove the front stabilizer shaft (1)

vetrain and front suspension frame and lower to gain access to the stabilizer shaft insulators.

6. Remove the stabilizer shaft insulators.

7. Remove the stabilizer shaft. It may be necessary to maneuver the stabilizer shaft in such a way as to remove it from the vehicle.

To install:

8. Installation is the reverse of removal, noting the following:

a. Install the stabilizer bar insulator so that the chamfer edge is facing toward the outside of the vehicle. This will put the slits in the bushing facing opposite directions.

b. Tighten stabilizer shaft insulator bolts to 33 ft. lbs. (45 Nm)

STEERING KNUCKLE

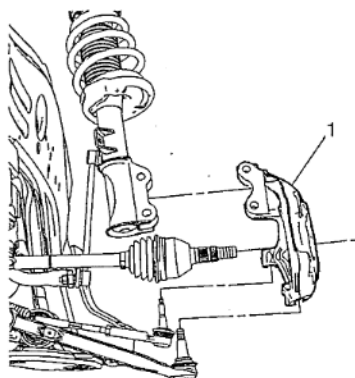
REMOVAL & INSTALLATION

See Figure 125.

1. Before servicing the vehicle, refer to the Precautions Section.

2. Raise and support the vehicle.

3. Remove the tire and wheel.



2217810

Fig. 125 Remove the front steering knuckle (1)

4. Separate the outer tie rod end from the steering knuckle.
5. Remove the wheel speed sensor.
6. Remove the front wheel bearing from the steering knuckle.
7. Separate the lower control arm from the steering knuckle.
8. Remove the front suspension strut mounting bolts from the steering knuckle.
9. Remove the steering knuckle.

To install:

10. Installation is the reverse of removal.
11. Check the front end alignment.

STEERING LINKAGE OUTER TIE ROD

REMOVAL & INSTALLATION

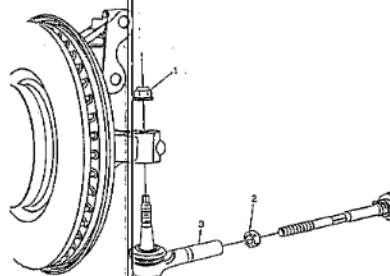
See Figure 126.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and safely support the vehicle.
3. Remove the tire and wheel.
4. Remove the steering linkage outer tie rod nut.
5. Remove the steering linkage inner tie rod nut. Use paint in order to place matchmarks on the steering linkage inner tie rod nut and on the steering linkage inner tie rod. Discard the nut.

**** WARNING**

Do not free the ball stud by using a pickle fork or a wedge-type tool. Damage to the seal or bushing may result.

6. Separate the steering linkage outer tie rod from the steering knuckle using a steering linkage/tie rod puller (J-24319-B or equivalent).



2322818

Fig. 126 Steering linkage outer tie rod (3), inner tie rod nut (2), and outer tie rod nut (1)

7. Clean the tapered surface of the steering knuckle.

To install:

8. Installation is the reverse of removal, noting the following:
 - a. Align the matchmarks on the inner tie rod and inner tie rod nut.
 - b. Do not tighten the inner tie rod nut during installation. Tighten the nut after adjusting the front toe.
 - c. Tighten the outer tie rod nut to 18 ft. lbs. (25 Nm), plus an additional 90 degrees.
 - d. After the installation is complete, measure and adjust the front toe.

STRUT & SPRING ASSEMBLY

REMOVAL & INSTALLATION

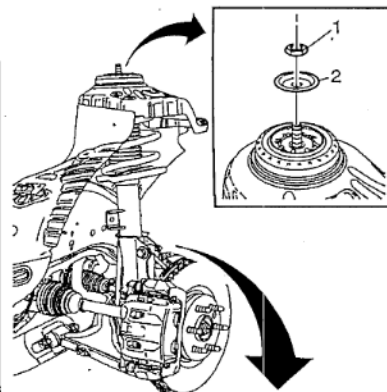
See Figure 127.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and safely support the vehicle.
3. Remove the tire and wheel.
4. Remove the stabilizer shaft link from the strut.
5. Disconnect the head lamp level sensor link from the lower control arm, if equipped.
6. Support the lower control arm and the steering knuckle.

**** WARNING**

DO NOT allow the lower control arm and the steering knuckle drop more than 2 inches when the strut assembly has been removed.

7. Disconnect the electrical harness/sensor from the strut, if equipped.
8. Remove the front compartment side sight shields.



2218164

Fig. 127 Remove the front suspension strut mount nut (1) and washer (2) and the strut bolts (4) and nuts (3)

9. Using the CH 49375 wrench, or equivalent tool, remove the front suspension strut mount nut and the strut mount washer.

10. Remove the front suspension strut bolts and nuts.

11. Remove the front suspension strut assembly from the vehicle.

To install:

12. Position the front suspension strut assembly in the vehicle.

13. Using the CH 49375 wrench, install front suspension strut mount washer and the front suspension strut mount nut, then tighten the front suspension strut mount nut to 52 ft. lbs. (70 Nm). Ensure that the strut rod does not turn while tightening the strut mount nut.

14. Install the front suspension strut bolts and the front suspension strut nuts.

15. Tighten the front suspension strut bolts to 140 ft. lbs. (190 Nm).

16. Re-connect the electrical harness/sensor from the strut, if equipped.

17. Reconnect the head lamp level sensor link to the lower control arm, if equipped.

18. Remove the support from the lower control arm and the steering knuckle.

19. Install the front stabilizer shaft link.

20. Install the tire and wheel assembly.

21. Install the front compartment side sight shields.

22. Remove the support and lower the vehicle.

WHEEL BEARINGS

REMOVAL & INSTALLATION

See Figure 128.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and safely support the vehicle.
3. Remove the tire and wheel.
4. Remove the front brake rotor.
5. Loosen the halfshaft from the wheel bearing/hub.

6. Remove the wheel bearing/hub mounting bolts. Discard the bolts.

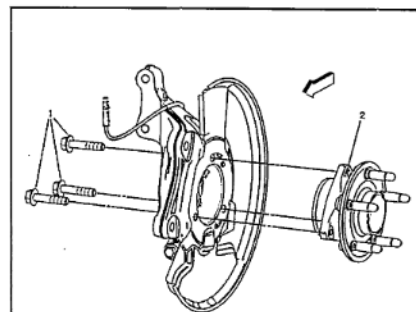
7. Remove the wheel bearing/hub assembly.

To install:

8. Install the wheel bearing/hub assembly. Tighten the new bolts to 81 ft. lbs. (110 Nm).
9. Install the halfshaft.
10. Install the brake rotor.
11. Install the tire and wheel.
12. Lower the vehicle.

ADJUSTMENT

The wheel bearings are not adjustable.



2018805

Fig. 128 Remove the front wheel bearing/hub assembly (2) and bolts (1)

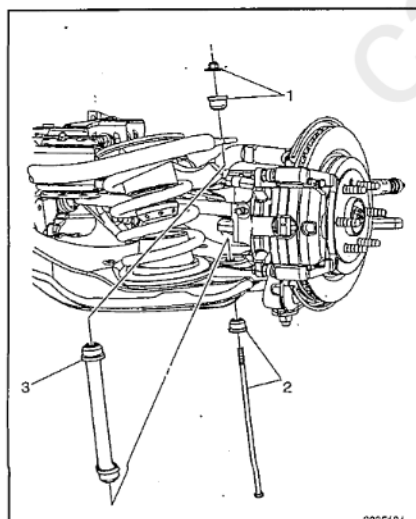
SUSPENSION

COIL SPRING

REMOVAL & INSTALLATION

See Figures 129 through 131.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and support the vehicle.
3. Remove the tire and wheel assembly.
4. Remove the stabilizer shaft link.
5. Remove the lower control arm from the knuckle.
6. Remove the lower shock absorber bolt from the lower control arm.
7. Remove the lower bolt for the rear suspension link upper to lower control arm.
8. Remove the rear wheel speed sensor wiring harness from the lower control arm.



2235184

Fig. 129 Stabilizer shaft link, nut (1), bolts (2), and spacers (3)

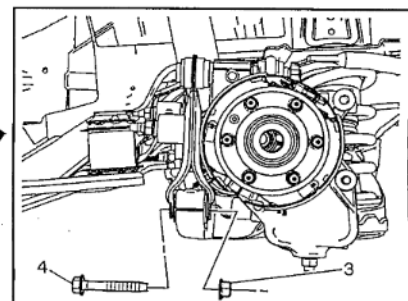
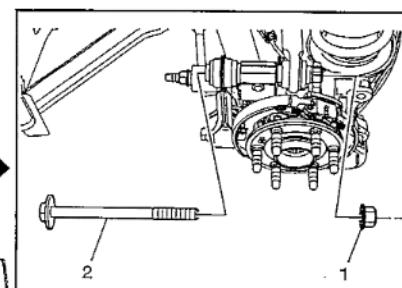
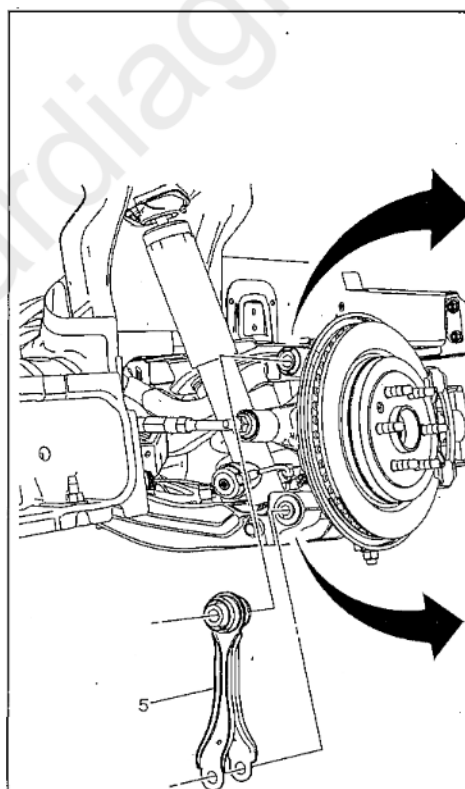
REAR SUSPENSION

KNUCKLE

REMOVAL & INSTALLATION

See Figures 132 and 133.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and support the vehicle.
3. Remove the tire and wheel.
4. Remove the rear disc brake backing plate.



2235596

Fig. 130 Rear suspension link lower control arm bolt (4)

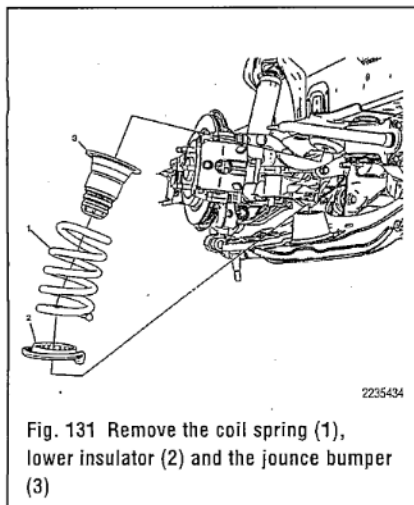


Fig. 131 Remove the coil spring (1), lower insulator (2) and the jounce bumper (3)

5. Remove the parking brake cable from the knuckle.
6. Separate the lower control arm from the knuckle.
7. Remove the upper control arm bolt.
8. Remove the adjust link nuts and bolts, and remove the adjust link from the knuckle. For AWD vehicles, remove the bolt from the upper control arm to the knuckle.
9. Remove the knuckle.

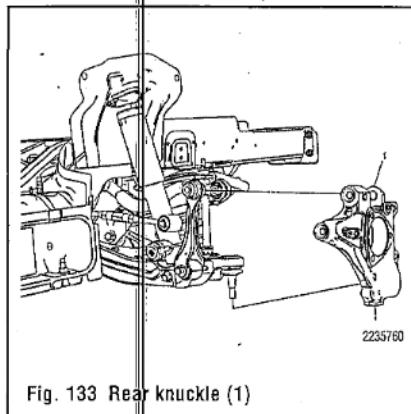


Fig. 133 Rear knuckle (1)

- To install:**
10. Installation is the reverse of removal.
 11. After the installation is complete, adjust the toe.

LOWER CONTROL ARM

REMOVAL & INSTALLATION

See Figure 134.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and support the vehicle.
3. Remove the tire and wheel.
4. Remove the rear spring.

5. Remove the lower control arm ball joint nut.

6. Remove the lower control arm nuts and bolts.

7. Using a ball joint removal tool (CH 43631 or equivalent), remove the lower control arm from the knuckle.

To install:

8. Installation is the reverse of removal, noting the following:

- a. Tighten the lower control arm bolts to 74 ft. lbs. (100 Nm), plus an additional 90 degrees.
- b. Tighten the lower control arm ball joint nut to 30 ft. lbs. (40 Nm), plus an additional 125 degrees.
- c. Align the rear suspension.

SHOCK ABSORBER

REMOVAL & INSTALLATION

See Figure 135.

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and support the vehicle.
3. Remove the tire and wheel.
4. Disconnect the electrical for the electronic suspension, if equipped.
5. Support the lower control arm with the proper jackstand.

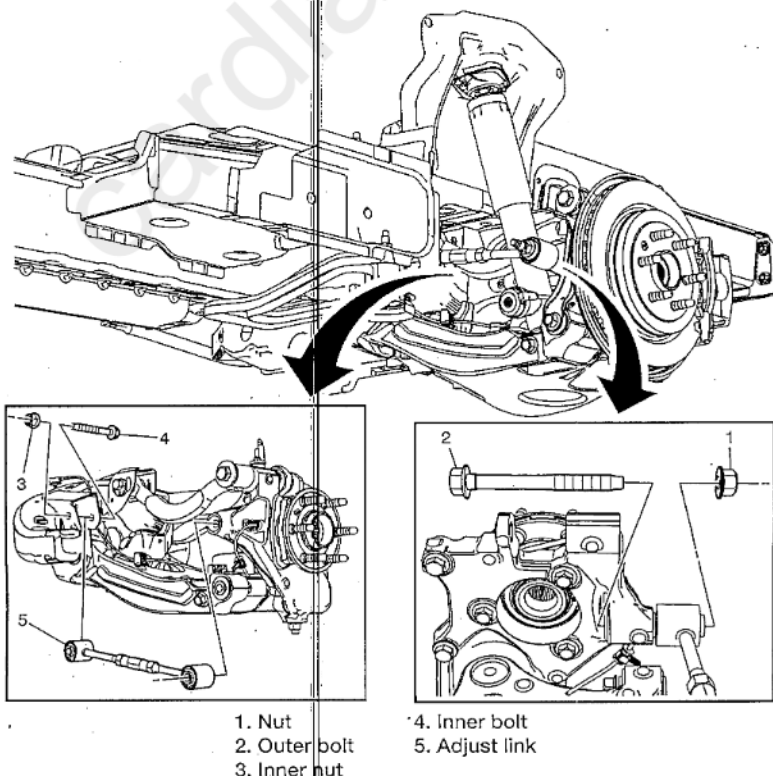


Fig. 132 Rear adjust link components

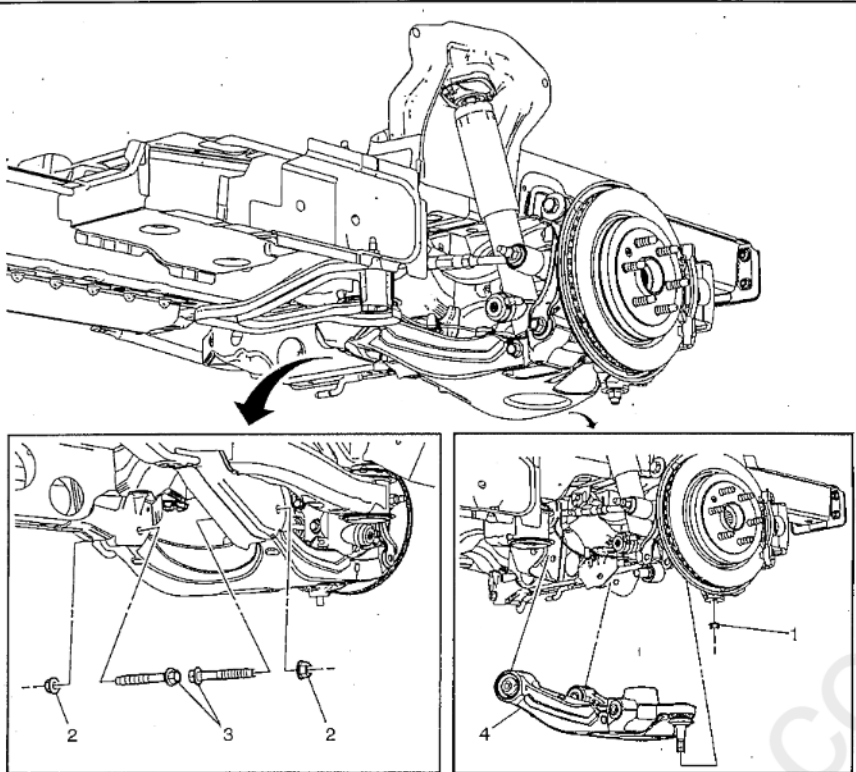


Fig. 134 Lower control arm (4), ball joint nut (1), control arm nuts (2), and bolts (3)

6. Remove the shock absorber mounting bolt and nuts.

7. Remove the shock absorber.

To install:

8. Installation is the reverse of removal, noting the following:

- Tighten the nuts to 13 ft. lbs. (17 Nm).
- Tighten the bolt to 13 ft. lbs. (17 Nm).

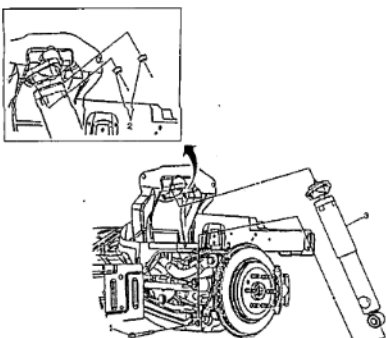


Fig. 135 Rear shock absorber (3), bolt (1), and nuts (2)

STABILIZER BAR

REMOVAL & INSTALLATION

See Figures 136 through 138.

- Before servicing the vehicle, refer to the Precautions Section.
- Raise and support the vehicle.
- Remove the tire and wheel.
- Remove the stabilizer shaft link mounting nuts and remove the stabilizer shaft link from the stabilizer shaft.

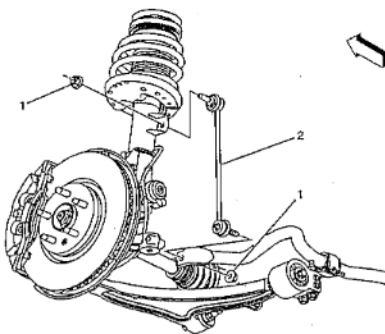


Fig. 136 Stabilizer shaft link (2) and nuts (1)

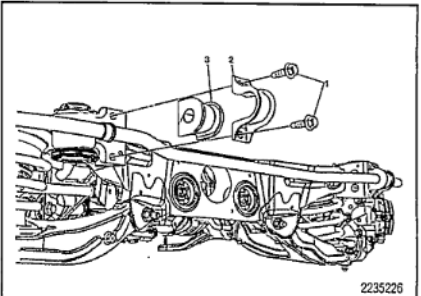


Fig. 137 Stabilizer shaft insulator (3), bracket (2), and bolts (1)

5. Remove the stabilizer shaft insulators.

6. Remove the rear stabilizer shaft insulators.

7. Remove the stabilizer shaft.

To install:

8. Installation is the reverse of removal, noting the following:

- Tighten the insulator bolts to 16 ft. lbs. (22 Nm), plus an additional 30 degrees. Install the insulator with the slit facing down.
- Tighten the stabilizer shaft link mounting nuts to 55 ft. lbs. (75 Nm).

UPPER CONTROL ARM

REMOVAL & INSTALLATION

See Figure 139.

- Before servicing the vehicle, refer to the Precautions Section.
- Raise and support the vehicle.
- Remove the tire and wheel.
- Support the rear lower control arm, if necessary.
- Remove the upper control arm nuts and bolts.
- Remove the upper control arm from the vehicle.

To install:

7. Installation is the reverse of removal, noting the following:

- Tighten the upper control arm mounting bolt to 111 ft. lbs. (150 Nm), plus an additional 90 degrees.
- Tighten the upper control arm adjuster bolt to 52 ft. lbs. (70 Nm), plus an additional 60 degrees.
- Check and adjust the rear camber.

WHEEL BEARINGS

REMOVAL & INSTALLATION

See Figure 140.

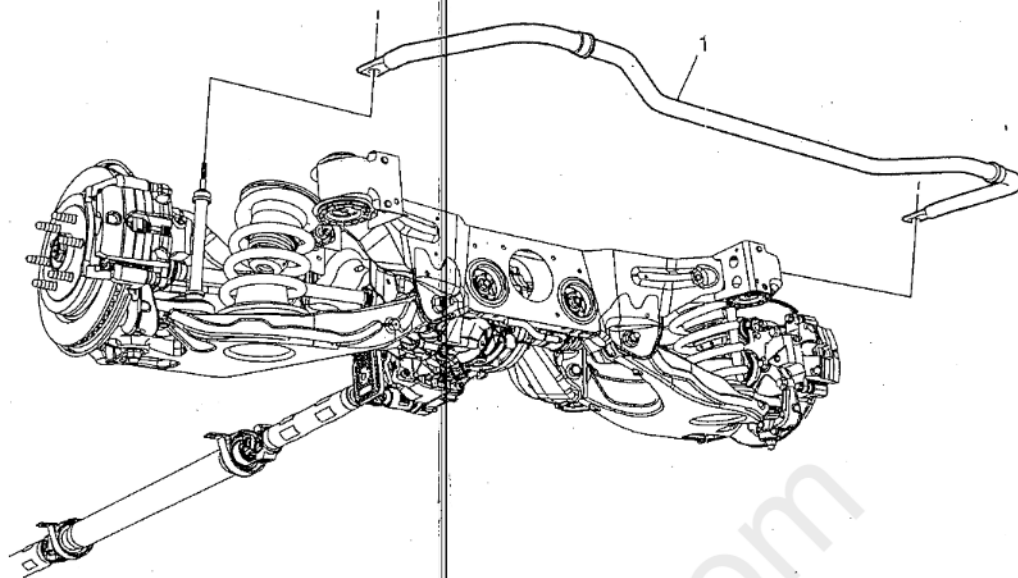


Fig. 138 Rear stabilizer shaft (1)

2235265

1. Rear upper control arm nut
2. Rear upper control arm adjuster cam
3. Rear upper control arm adjuster bolt
4. Rear upper control arm bolt
5. Rear upper control arm nut
6. Rear upper control arm

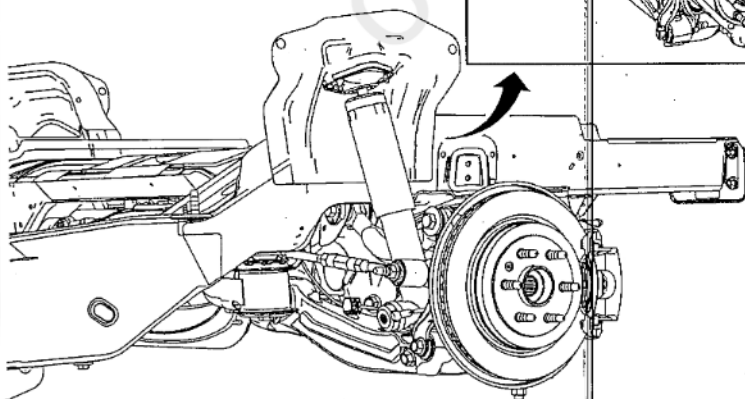
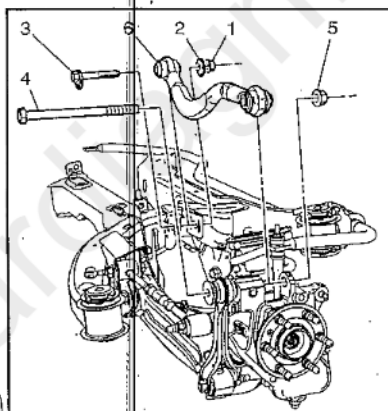
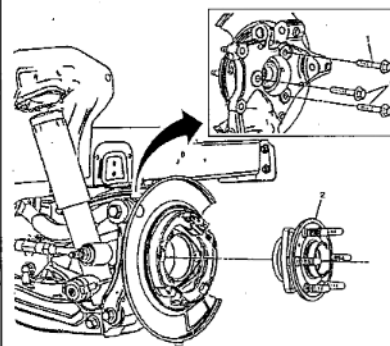


Fig. 139 Rear upper control arm

2235670

1. Before servicing the vehicle, refer to the Precautions Section.
2. Raise and safely support the vehicle.

3. Remove the rear wheel.
4. Separate the wheel drive shaft from the knuckle, if necessary.
5. Remove the rear brake rotor.



2235679

Fig. 140 Rear wheel bearing/hub assembly (2) and bolts (1)

6. Remove the rear wheel speed sensor.
7. Remove the wheel bearing/hub bolts.
8. Remove the wheel bearing/hub assembly.

To install:

9. Installation is the reverse of removal, noting the following:
 - a. Tighten the wheel bearing/hub mounting bolts to 92 ft. lbs. (125 Nm).

ADJUSTMENT

The wheel bearings are not adjustable.

