

SECTION 1B

SOHC ENGINE MECHANICAL

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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SPECIFICATIONS

ENGINE SPECIFICATIONS

Application	2.0L SOHC
General Data:	
Engine Type	4-Cylinder (In-Line)
Displacement	1 998 cm ³ (121.92 in ³)
Bore Stroke	86 x 86 mm (3.38 x 3.38 in.)
Compression Ratio	9.2:1
Firing Order	1-3-4-2

ENGINE SPECIFICATIONS (Cont'd)

Application	2.0L SOHC
Cylinder Block:	
Cylinder Bore Diameter	85.975~86.025 mm (3.384~3.386 in.)
Cylinder Bore Out-of-Round (MAX)	0.013 mm (0.0005 in.)
Cylinder Bore Taper (MAX) Measured at Four Places, Transversely and Longitudinally	0.013 mm (0.0005 in.)
Oversize (Measure Replacement Piston Before ReBoring)	Available in 0.50 mm to suit bore (0.019 in.)
Service Replacement Standard Bore	4 Piston, Pin, and Ring Assemblies Available
Block Face Distortion	0.05 mm MAX (0.00197 in. MAX)
Piston:	
Diameter	85.955~86.485 mm (3.384~3.404 in.)
Clearance to Bore	0.030~0.050 mm (0.00117~0.00195 in.)
Piston Protrusion	0.4 mm MAX (0.015 in.)
Piston Taper	0.013 mm (0.0005 in.)
Piston Rings:	
Gap	
Top Compression	0.3~0.5 mm (0.011~0.019 in.)
2 nd Compression	0.3~0.5 mm (0.011~0.019 in.)
Oil	0.4~1.4 mm (0.015~0.055 in.)
Piston Pin:	
Diameter	20.9970~20.9985 mm (0.8266~0.8267 in.)
Pin Off Set	0.8 mm (0.03 in.) Toward Thrust Side
Clearance:	
In Piston	0.0035~0.0140 mm (0.00013~0.00055 in.)
In Rod	Interference Fit in Rod
Length	61.5 mm (2.42 in.)
Camshaft:	
Lift-Intake	10.0 mm (0.39 in.)
Lift-Exhaust	10.0 mm (0.39 in.)
Camshaft Cap-to-Bearing Journal Clearance	0.04~0.144 mm (0.0015~0.0056 in.)
Bearing Journal OD	42.455~43.470 mm (1.67~1.71 in.)

ENGINE SPECIFICATIONS (Cont'd)

Application	2.0L SOHC
Crankshaft:	
Main Journal	
Diameter (All)	57.974~57.995 mm (2.282~2.283 in.)
Radial Runout (Shaft Support On No. 1 and No. 5 Bearings Measured at No. 3 Journal)	0.061 mm (0.0024 in.)
Main Bearing Clearance (All)	0.015~0.061 mm (0.00059~0.0024 in.)
Crankshaft End Float	0.0700.302 mm (0.0027~0.0118 in.)
Service Oversize (Available in Two Sizes)	0.25 and 0.5 mm (0.0098~0.019 in.)
Connecting Rod:	
Big End Journal Diameter (All)	48.981~48.987 mm (1.9283~1.9286 in.)
Permissible Out-of-Round (MAX)	0.004 mm (0.00001 in.)
Rod Bearing Play	0.006~0.031 mm (0.0002~0.0012 in.)
Rod Bearing Clearance	0.019~0.063 mm (0.0007~0.0024 in.) (Production 0.013~0.041mm [0.0005~0.0016 in.]
Cylinder Head:	
Valve Stem Protrusion	18.4 mm MAX (0.72 in. MAX)
Valve Guide Height	12.2~12.5 mm (0.480~0.492 in.)
Overall Height	96 ± 0.025 mm (3.778~3.780 in.)
Minimum Overall Height After Machining	95.5 mm (3.759 in.)
Valve System:	
Valve Lash Compensators	Hydraulic
Seat Runout (MAX, All)	0.03 mm (0.019 in.)
Face Runout (MAX, All)	0.03 mm (0.019 in.)
Valve Length (Production)	
Intake	104.2 mm (4.10 in.)
Exhaust	104.0 mm (4.09 in.)
Valve Length (Service)	
Intake	103.8 mm (4.08 in.)
Exhaust	103.6 mm (4.07 in.)

ENGINE SPECIFICATIONS (Cont'd)

Application	2.0L SOHC
Valve Stem Diameter	
Intake	6.998~7.012 mm (0.275~0.276 in.)
Exhaust	6.978~6.992 mm (0.274~0.275 in.)
Valve Diameter	
Intake	41.8 mm (1.645 in.)
Exhaust	36.5 mm (1.437 in.)
Valve Seat Width	
Intake	1.0~1.5 mm (0.039~0.059 in.)
Exhaust	1.7~2.2 mm (0.066~0.086 in.)
Valve Face Angle	44°
Valve Seat Angle	45°
Valve Guide Inside Diameter	7.030~7.050 mm (0.276~0.277 in.)

FASTENER TIGHTENING SPECIFICATIONS

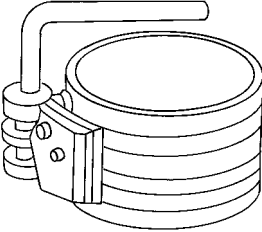
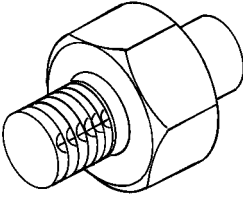
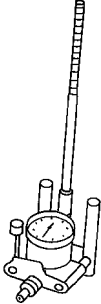
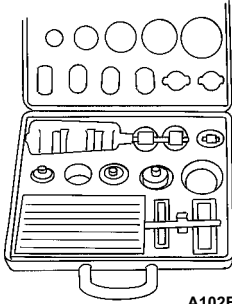
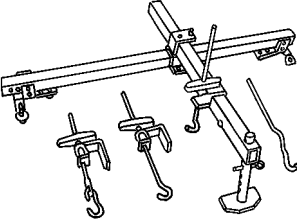
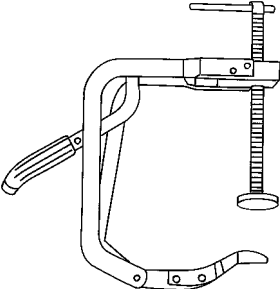
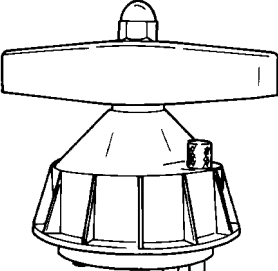
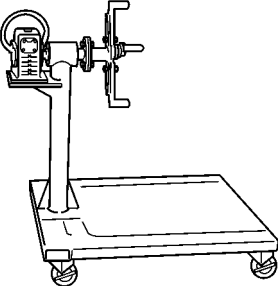
Application	N•m	Lb•Ft	Lb•In
Air Filter Housing Bolts	8	-	71
Camshaft Gear Retaining Bolt	45	33	-
Camshaft Pressure Plate Bolts	10	-	89
Connecting Rod Bearing Cap Bolts	35 + 45° + 15°	26 + 45° + 15°	-
Coolant Manifold Mounting Bolts	15	11	-
Coolant Temperature Sensor	25	18	-
Crankshaft Bearing Cap Bolts	35 + 45°	26 + 45°	-
Crankshaft Pulley Bolts	20	15	-
Crankshaft Timing Belt Drive Gear Bolt	95 + 30° + 15°	70 + 30° + 15°	-
Cylinder Head Bolts	25 + 90° + 90° + 90°	18 + 90° + 90° + 90°	-
DIS Ignition Coil Mounting Bracket Bolts	10	-	89
DIS Ignition Coil Mounting Plate Bolts	10	-	89
DIS Ignition Coil Retaining Bolts	10	-	89
Engine Block Lower Support Bracket and Splash Shield Bolts	40	30	-
Exhaust Flex Pipe to Catalytic Converter Retaining Nuts	30	22	-
Exhaust Flex Pipe to Exhaust Manifold Retaining Nuts	22	16	-
Exhaust Manifold Heat Shield Bolts	15	11	-

FASTENER TIGHTENING SPECIFICATIONS (Cont'd)

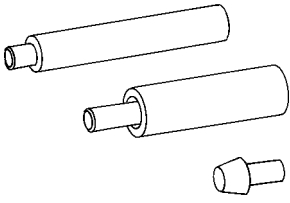
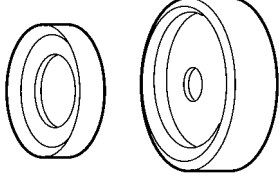
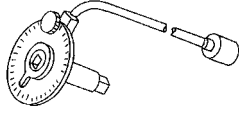
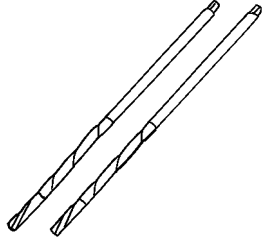

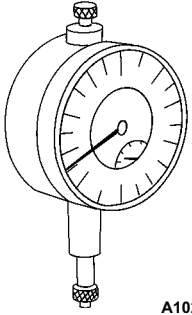
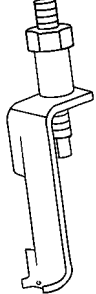
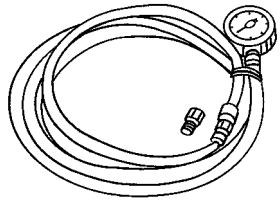
Application	N•m	Lb•Ft	Lb•
Exhaust Manifold Retaining Nuts	15	11	-
Flexible Plate Bolts	65	48	-
Flywheel Bolts	65 + 30° + 15°	48 + 30° + 15°	-
Forward Engine Mount Bolts/Nuts	65	48	-
Forward Engine Mount Bracket to Engine Block Bolts/Nuts	90	66	-
Front Timing Belt Cover Bolts	6	-	53
Injector Cover Bolts	8	-	71
Intake Manifold Retaining Nuts	18	13	-
Oil Pan Drain Plug	35	26	-
Oil Pan Flange to Transaxle Retaining Bolts	40	30	-
Oil Pan Retaining Bolts	10	-	89
Oil Pressure Switch	40	29	-
Oil Pump Rear Cover Bolts	6	-	53
Oil Pump Retaining Bolts	10	-	89
Oil Pump Safety Relief Valve Bolt	30	22	-
Oil Pump/Pickup Tube Support Bracket Bolts	10	-	89
Oil Pump/Pickup Tube Bolts	8	-	71
Power Steering Pressure Hose Clamp Bolt	10	-	89
Pulse Pickup Sensor Disc	13	-	115
Rear Timing Belt Cover Bolts	6	-	53
Resonator Retaining Bolts	8	-	71
Right Side Engine Mount Bracket Retaining Bolts/Nuts	60	44	-
Right Side Engine Mount Retaining Bolts/Nuts	60	44	-
Spark Plugs	20	15	-
Thermostat Housing Mounting Bolts	15	11	-
Throttle Cable Bracket Bolts	8	-	71
Timing Belt Automatic Tensioner Bolt	25	18	-
Transaxle Bell Housing Bolts	75	55	-
Transaxle Torque Converter Bolts	60	44	-
Valve Cover Bolts	8	-	71

SPECIAL TOOLS

SPECIAL TOOLS TABLE

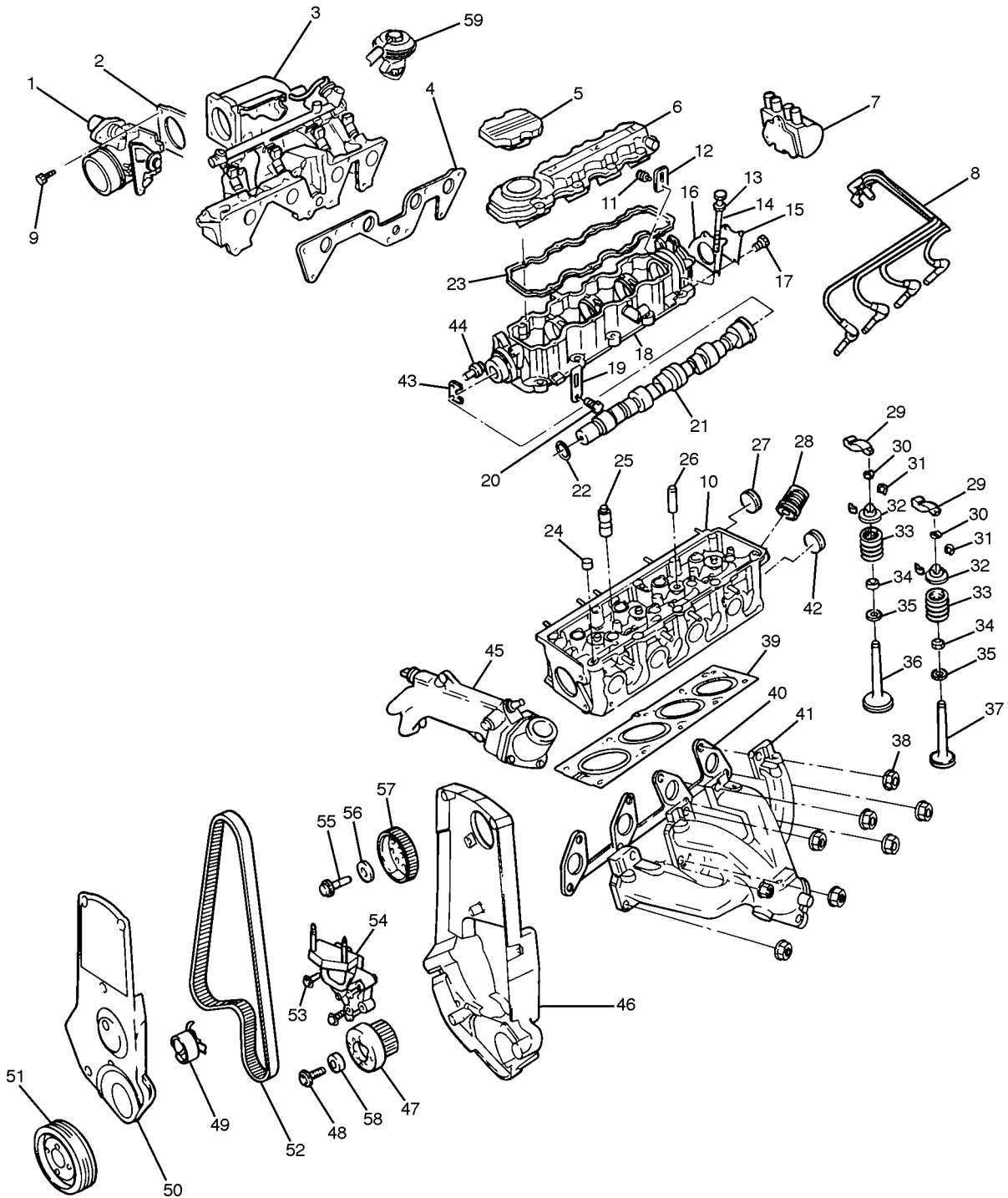
 <p>C102B004</p>	<p>J-8037 Universal Piston Ring Compressor</p>	 <p>B102C044</p>	<p>KM-135 Adapter</p>
 <p>C102B005</p>	<p>J-8087 Cylinder Bore Check Gauge</p>	 <p>A102B156</p>	<p>KM-340-0 Cutter Set Includes: KM-340-7 KM-340-13 KM-340-26</p>
 <p>A102B152</p>	<p>J-28467-B Engine Assembly Support Fixture</p>	 <p>A102B157</p>	<p>KM-348 Valve Spring Compressor</p>
 <p>A102C155</p>	<p>J-36792 Crankshaft Rear Oil Seal Installer</p>	 <p>A102B159</p>	<p>KM-412 Engine Overhaul Stand</p>

SPECIAL TOOLS TABLE (Cont'd)

 <p>A102B153</p>	<p>KM-427 Piston Pin Service Set</p>	 <p>A102B160</p>	<p>KM-635 Crankshaft Rear Oil Seal Installer</p>
 <p>A102B161</p>	<p>KM-470-B Angular Torque Gauge</p>	 <p>C102B017</p>	<p>KM-664 Valve Guide Reamer Set Includes: KM-253 KM-254 KM-255</p>
 <p>C102B016</p>	<p>KM-512 Valve Stem Projection Gauge</p>	 <p>A102B154</p>	<p>MKM-571-B Gauge</p>
 <p>A102B150</p>	<p>KM-565-A Valve Spring Compressor</p>	 <p>A202B005</p>	<p>KM-498-B Pressure Gauge</p>

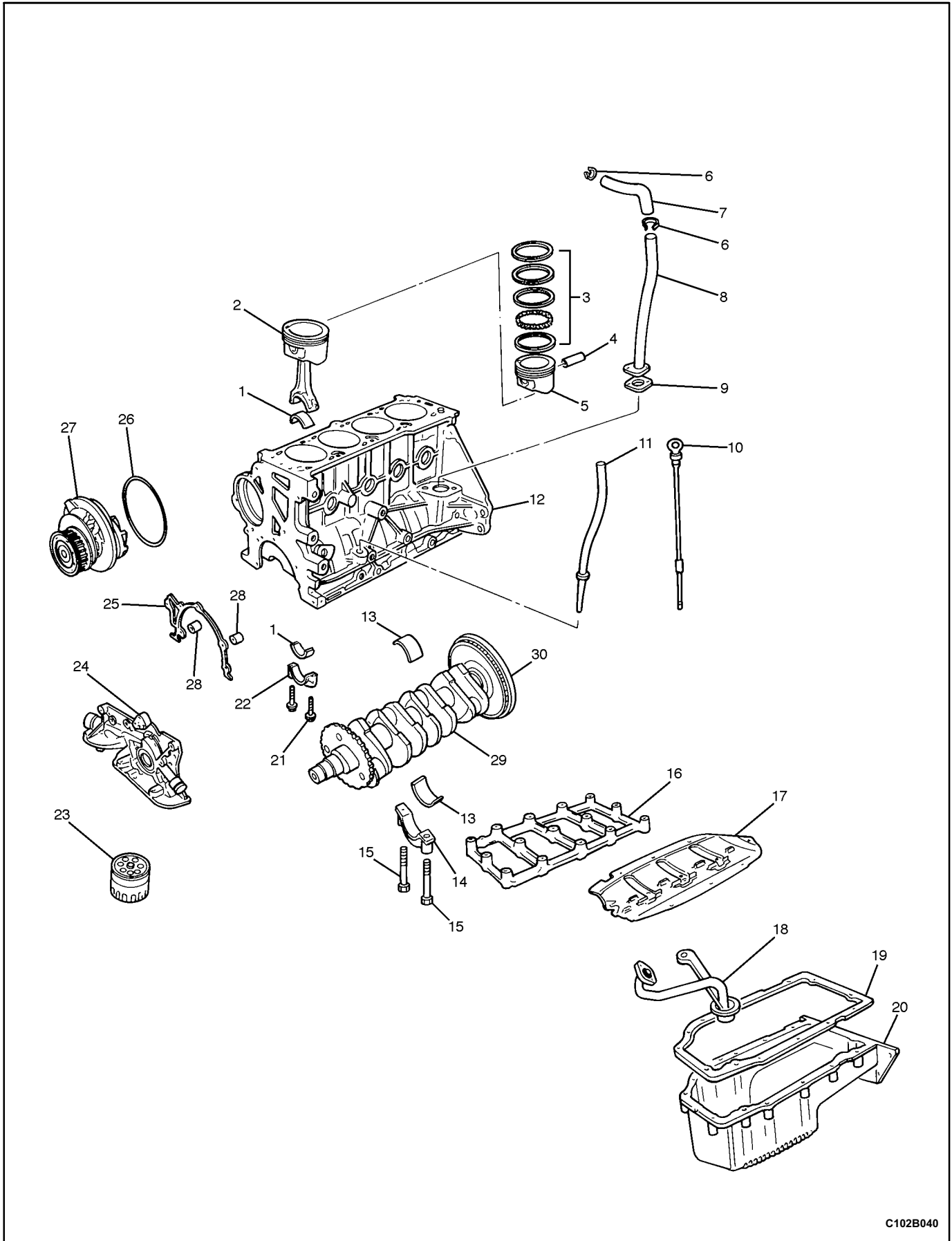
COMPONENT LOCATOR

UPPER END



- | | |
|-------------------------------|-----------------------------|
| 1 Throttle Body | 30 Thrust Piece, Valve |
| 2 Gasket | 31 Retainer |
| 3 Intake Manifold | 32 Cap, Valve |
| 4 Gasket | 33 Spring |
| 5 Filler Cap | 34 Seal |
| 6 Valve Cover, Cam Carrier | 35 Seat, Valve Spring |
| 7 Ignition Coil | 36 Valve, Intake |
| 8 Ignition Wires | 37 Valve, Exhaust |
| 9 Bolt | 38 Nut |
| 10 Stud | 39 Gasket, Head |
| 11 Bolt | 40 Gasket, Exhaust Manifold |
| 12 Shackle | 41 Exhaust Manifold |
| 13 Washer | 42 Cap, Oil Access Hole |
| 14 Bolt, Head | 43 Plate, Retainer |
| 15 Cover | 44 Bolt |
| 16 Gasket | 45 Coolant Manifold |
| 17 Bolt | 46 Rear Timing Belt Cover |
| 18 Carrier Assembly, Camshaft | 47 Crankshaft Gear |
| 19 Shackle | 48 Bolt |
| 20 Bolt | 49 Timing Belt Tensioner |
| 21 Camshaft | 50 Front Timing Belt Cover |
| 22 Seal Ring | 51 Crankshaft Pulley |
| 23 Gasket | 52 Timing Belt |
| 24 Sleeve | 53 Bolt |
| 25 Lifter | 54 Engine Mount |
| 26 Guide, Valve | 55 Bolt |
| 27 Plug, Water Jacket | 56 Washer |
| 28 Valve, Bypass | 57 Camshaft Gear |
| 29 Follower, Camshaft | 58 Washer |
| | 59 EGR Valve |
-

LOWER END



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- | | |
|--------------------------------|-------------------------------|
| 1 Connecting Rod Bearing Shell | 16 Engine Block Lower Support |
| 2 Piston Assembly | 17 Splash Pan |
| 3 Piston Rings | 18 Oil Pickup Tube |
| 4 Piston Pin | 19 Gasket |
| 5 Piston | 20 Oil Pan |
| 6 Hose Clamp | 21 Connecting Rod Bolt |
| 7 Breather Tube | 22 Connecting Rod Bearing Cap |
| 8 Ventilation Pipe | 23 Oil Filter |
| 9 Gasket | 24 Oil Pump |
| 10 Dipstick | 25 Gasket |
| 11 Dipstick Tube | 26 Oring seal |
| 12 Engine Block | 27 Coolant Pump |
| 13 Crankshaft Bearing Shell | 28 Pilot Bushing |
| 14 Crankshaft Bearing Cap | 29 Crankshaft |
| 15 Bolt | 30 Flywheel or Flex Plate |
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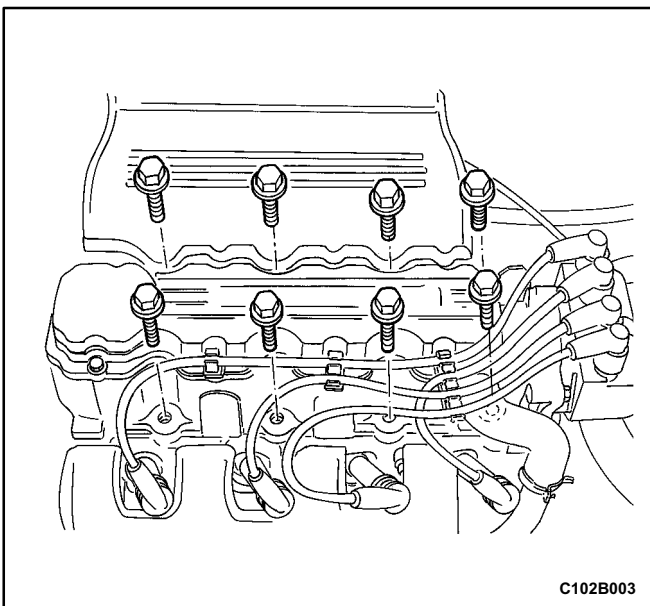
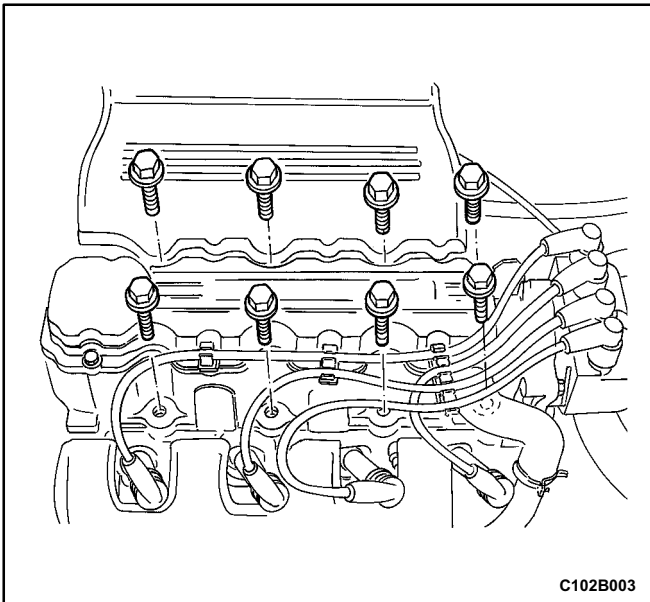
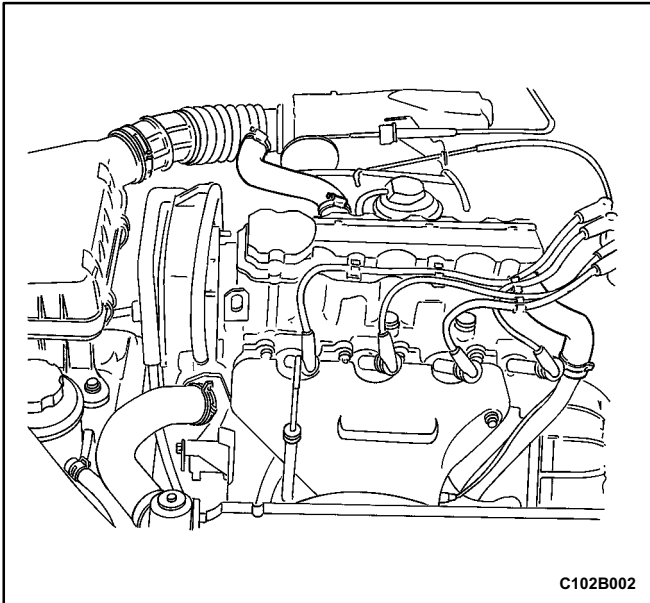
MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

VALVE COVER

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the injector cover bolts.
3. Remove the injector cover.
4. Disconnect the breather tubes from the valve cover.
5. Disconnect all of the necessary vacuum lines.
6. Remove the valve cover bolts.
7. Remove the valve cover.
8. Remove the valve cover gasket from the valve cover.

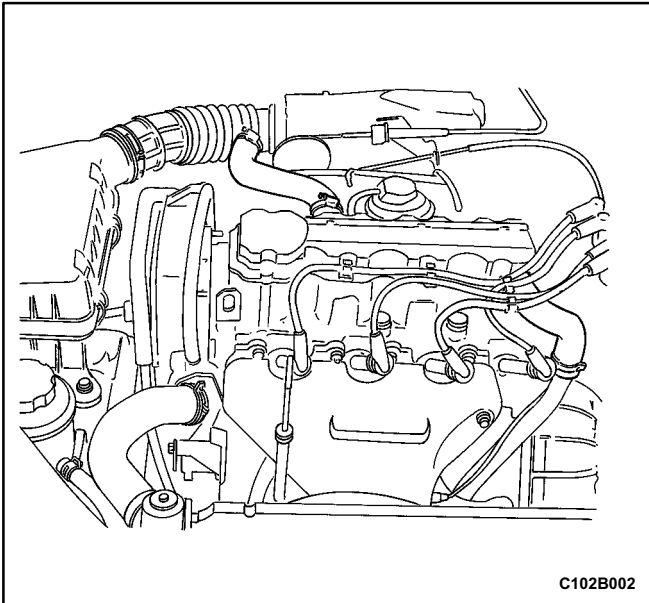


Installation Procedure

1. Install a new valve cover gasket to the valve cover.
2. Install the valve cover.
3. Install the valve cover bolts.

Tighten

Tighten the valve cover bolts to 8 N•m (71 lb•in).

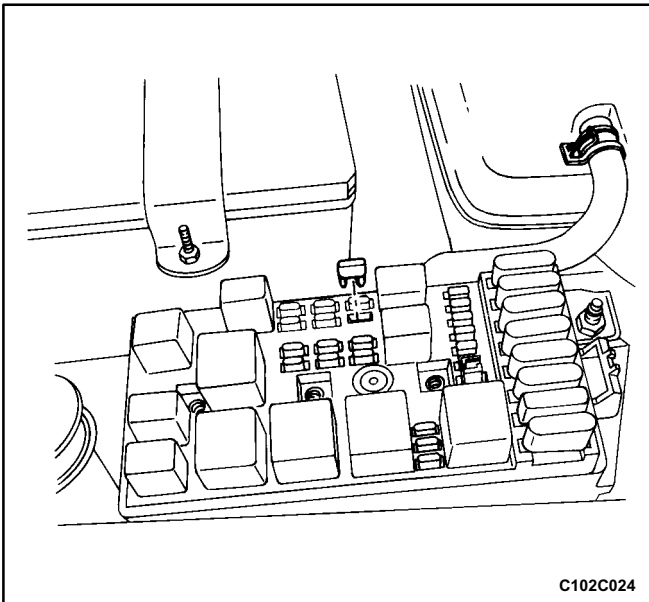


4. Connect all of the necessary vacuum lines.
5. Connect the breather tubes to the valve cover.
6. Install the injector cover.
7. Install the injector cover bolts.

Tighten

Tighten the injector cover bolts to 8 N•m (71 lb•in).

8. Connect the negative battery cable.



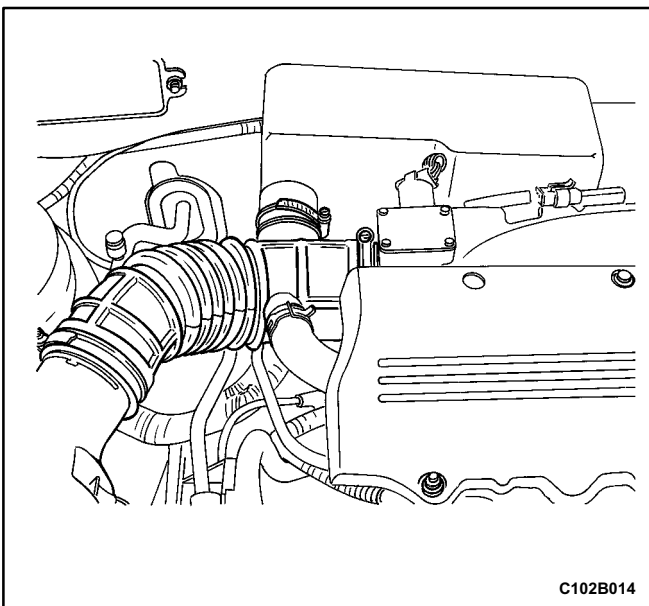
CYLINDER HEAD AND GASKET

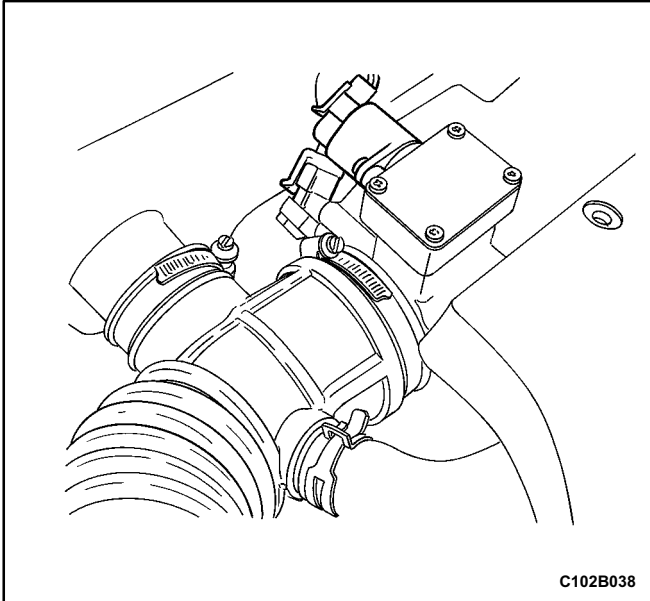
Tools Required

KM-470-B Angular Torque Gauge

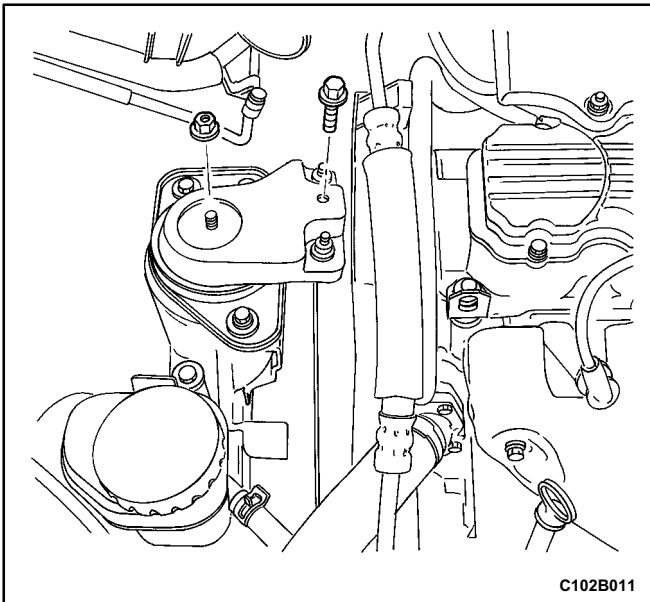
Removal Procedure

1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine for 10 seconds to rid the fuel system of fuel pressure.
3. Disconnect the negative battery cable.
4. Disconnect the ECM ground terminal.
5. Drain the engine coolant. Refer to *Section 1D, Engine Cooling*.
6. Disconnect the manifold air temperature sensor connector.
7. Disconnect the breather tubes from the air intake tube.
8. Disconnect the air intake tube from the throttle body.
9. Disconnect the DIS ignition coil connector.
10. Disconnect the oxygen sensor connector.

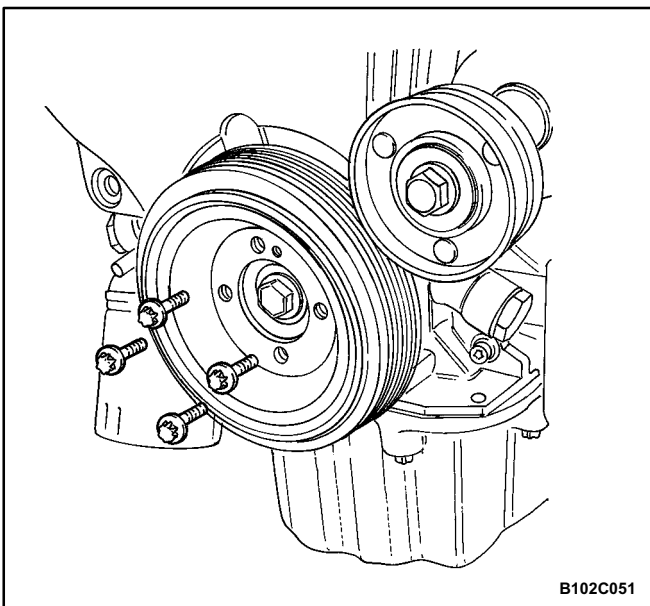




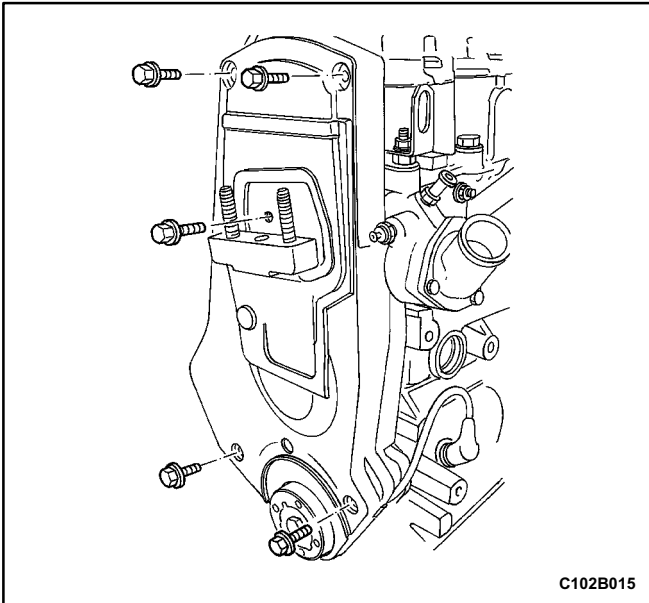
11. Disconnect the idle air control valve connector.
12. Disconnect the throttle position sensor connector.
13. Disconnect the engine coolant temperature sensor connector.
14. Disconnect the coolant temperature sensor connector.
15. Remove the air filter housing bolts.
16. Remove the air filter housing.
17. Remove the bolts and the injector cover.
18. Remove the bolts and the resonator.



19. Remove the right front wheel. Refer to *Section 2E, Tires and Wheels*.
20. Remove the right front wheel well splash shield. Refer to *Section 9R, Body Front End*.
21. Support the engine with a floor jack.
22. Remove the bolts and the right side engine mount bracket.

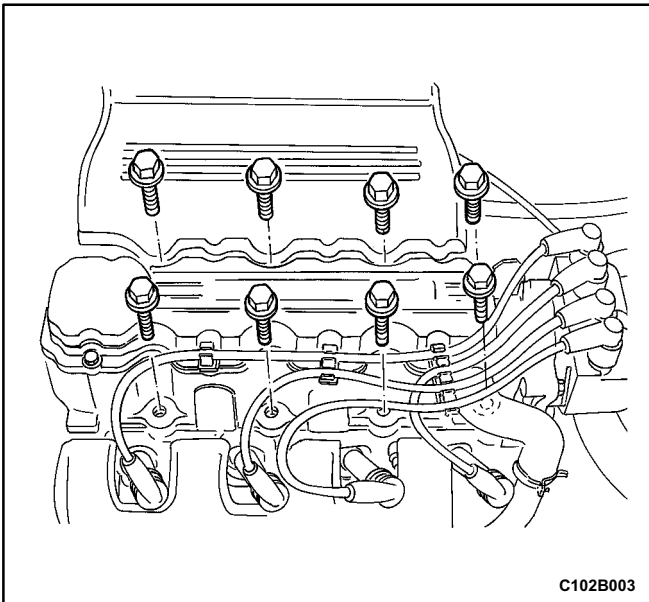


23. Disconnect the upper radiator hose at the thermostat housing.
24. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.
25. Remove the crankshaft pulley bolts.
26. Remove the crankshaft pulley.



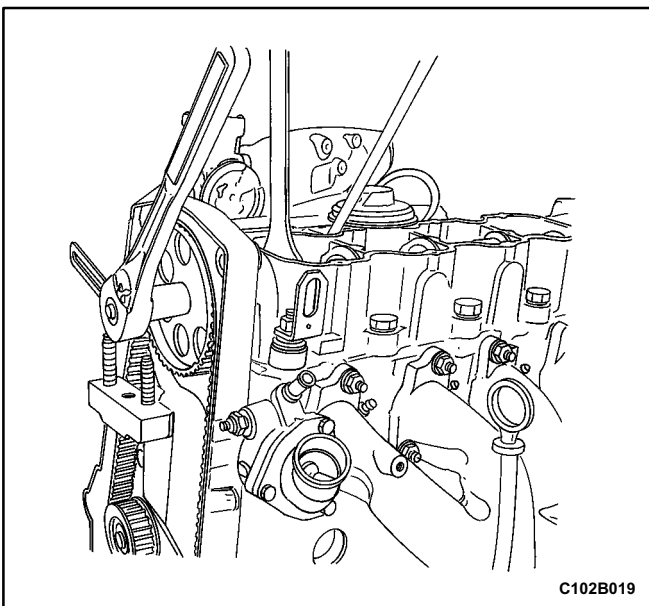
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27. Remove the front timing belt cover bolts.
28. Remove the front timing belt cover.



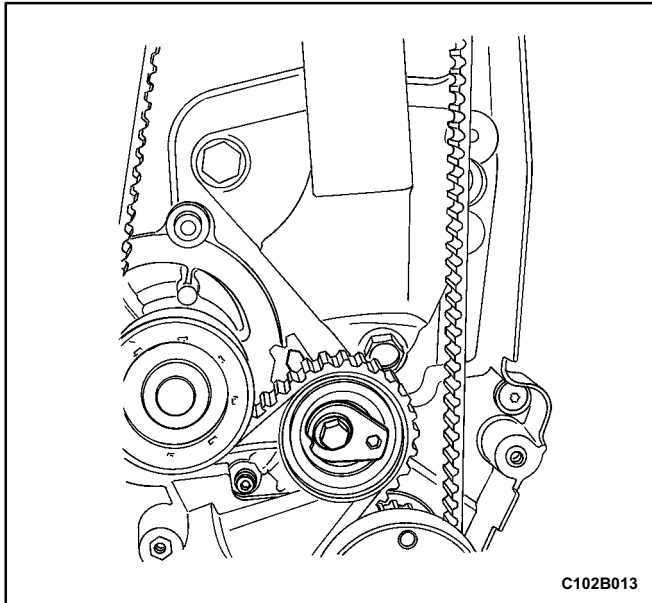
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29. Remove the timing belt. Refer to "Timing Belt" in this section.
30. Disconnect the breather tubes at the valve cover.
31. Remove the valve cover bolts.
32. Remove the valve cover and the valve cover gasket.
33. Disconnect the ignition wires from the spark plugs.

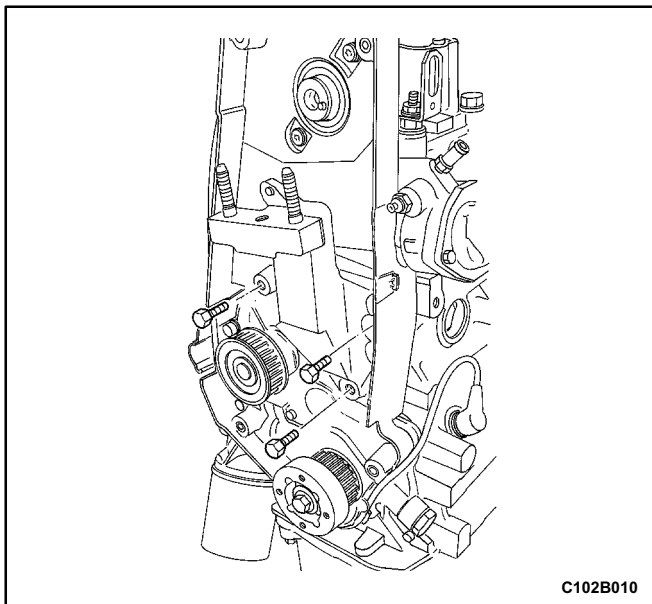


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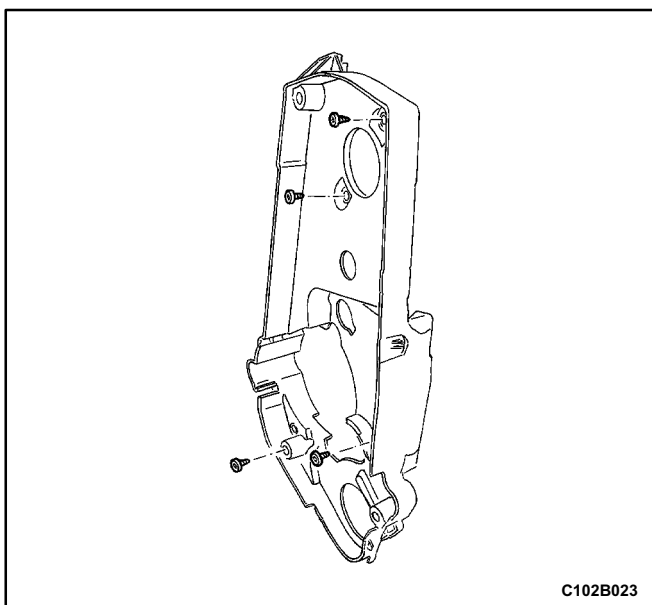
- Notice:** Take extreme care to prevent any scratches, nicks or damage to the camshaft.
34. While holding the camshaft firmly in place, remove the camshaft gear bolt.
 35. Remove the camshaft gear.



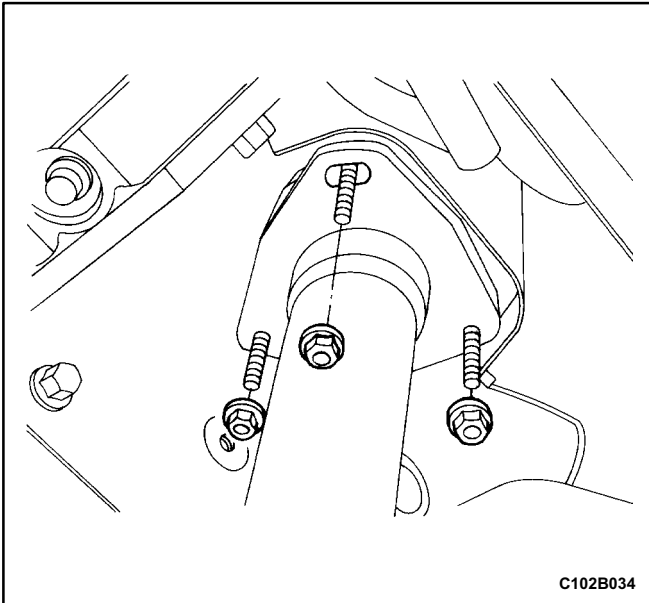
36. Remove the timing belt automatic tensioner bolt.
37. Remove the timing belt automatic tensioner.



38. Remove the right side engine mount bolts/nuts.
39. Remove the right side engine mount.
40. Remove the crankshaft gear bolt.
41. Remove the crankshaft gear.
42. Reroute the crankshaft position sensor wire away from the rear timing belt cover.

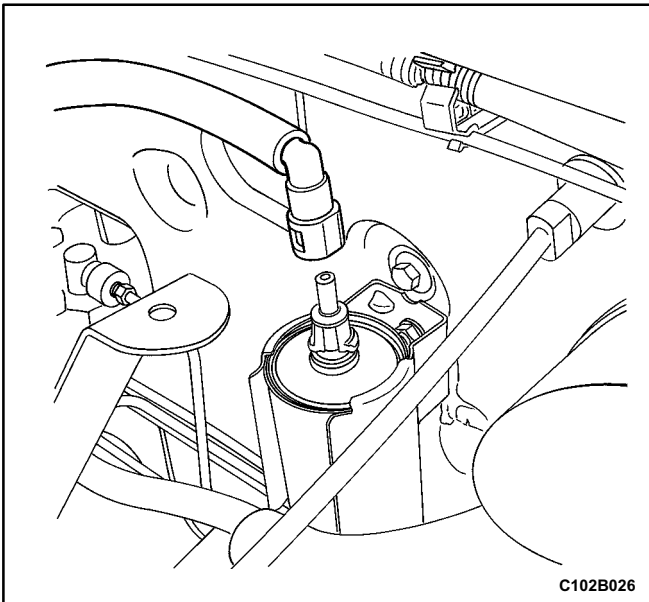


43. Remove the rear timing belt cover bolts.
44. Remove the rear timing belt cover.



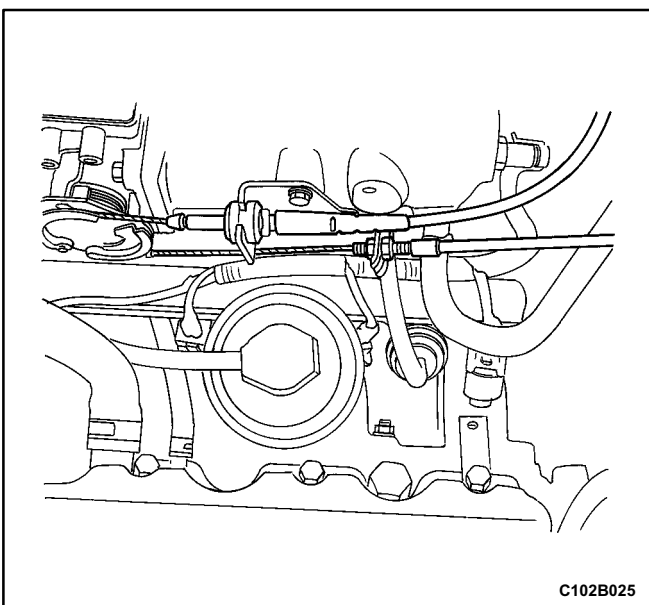
C102B034

45. Remove the exhaust flex pipe retaining nuts at the exhaust manifold studs.
46. Disconnect all of the necessary vacuum hoses.



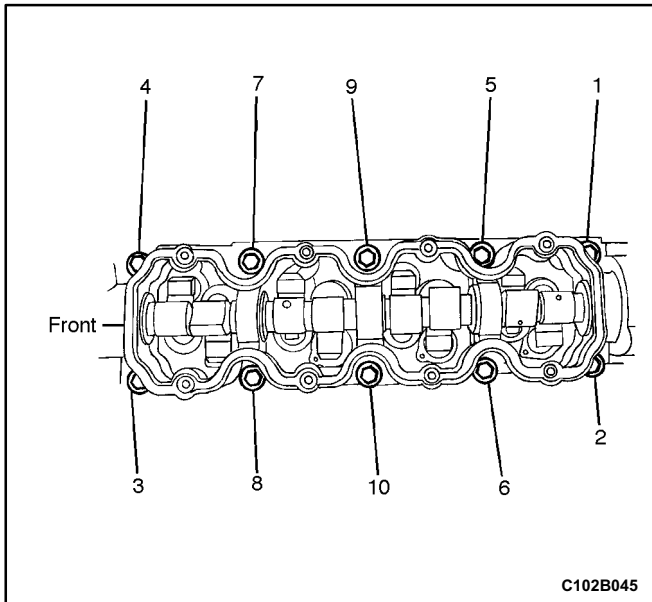
C102B026

47. Disconnect the fuel return line at the fuel pressure regulator.
48. Disconnect the fuel feed line at the fuel filter.
49. Disconnect the coolant hoses at the rear of the coolant manifold.
50. Disconnect the surge tank coolant hoses at the throttle body.
51. Disconnect the fuel injector harness connectors.

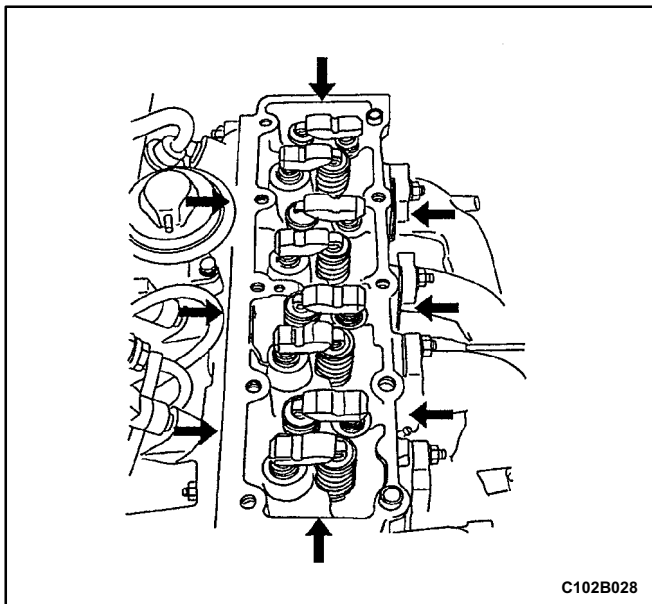


C102B025

52. Remove the alternator support bracket bolts and the bracket. Refer to *Section 1E, Engine Electrical*.
53. Remove the alternator. Refer to *Section 1E, Engine Electrical*.
54. Disconnect the throttle cable at the throttle body and the intake manifold.
55. Disconnect the canister purge solenoid connector.



56. Loosen all of the cylinder head bolts gradually and in the sequence shown.
 57. Remove the cylinder head bolts.
 58. Remove the camshaft carrier assembly.
 59. Remove the cylinder head with the intake manifold and the exhaust manifold attached.
- Notice:** Prevent any engine oil or coolant from entering the cylinders when removing the cylinder head.
60. Remove the cylinder head gasket.

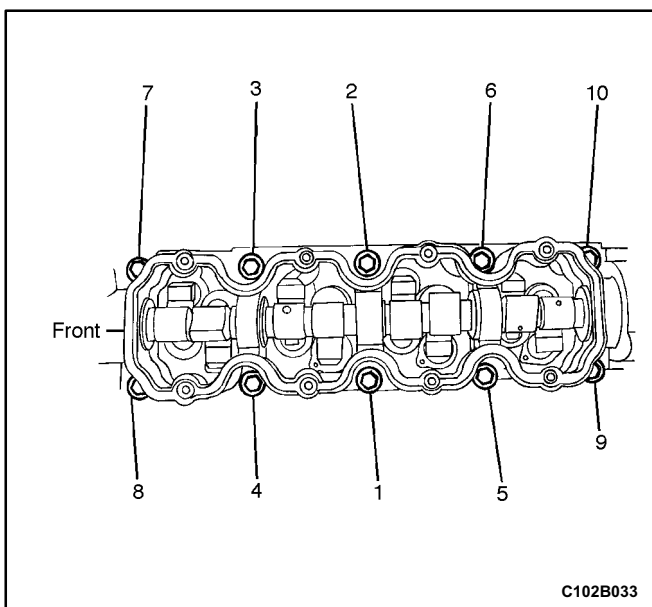


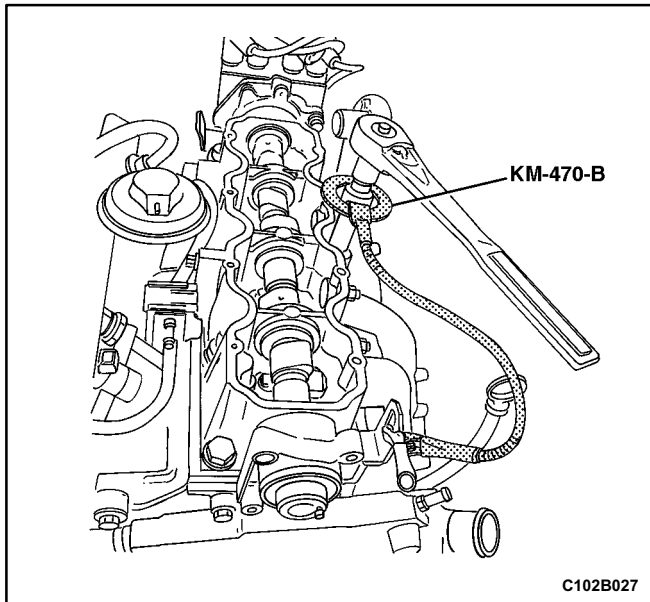
Cleaning Procedure

1. Clean the gasket surfaces of the cylinder head and the engine block.
2. Make sure the gasket surfaces of the cylinder head and the engine block are free of nicks and heavy scratches.
3. Clean the cylinder head bolts.
4. Inspect the cylinder head for warpage. Refer to "Cylinder Head and Valve Train Components" in this section.

Installation Procedure

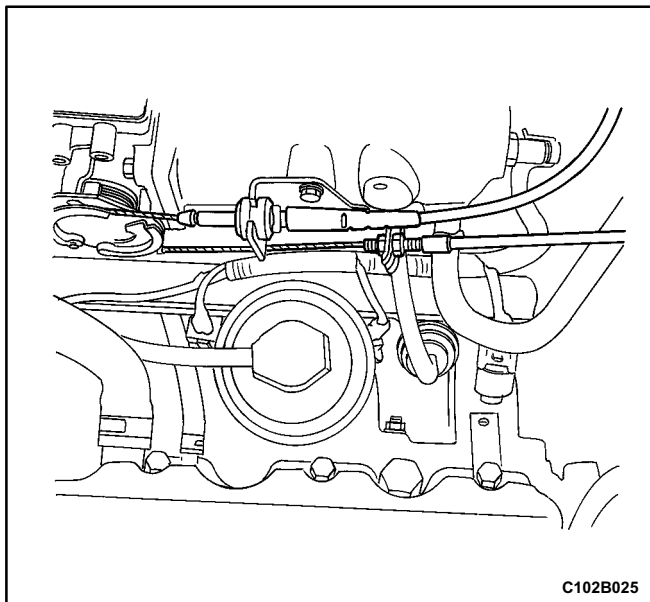
1. Apply a continuous 3 mm bead of gasket maker to the sealing surface of the camshaft carrier.
2. Install the cylinder head gasket.
3. Install the cylinder head with the intake manifold and the exhaust manifold attached.
4. Install the camshaft carrier assembly.
5. Install the cylinder head bolts.
6. Tighten the cylinder head bolts gradually and in the sequence shown.



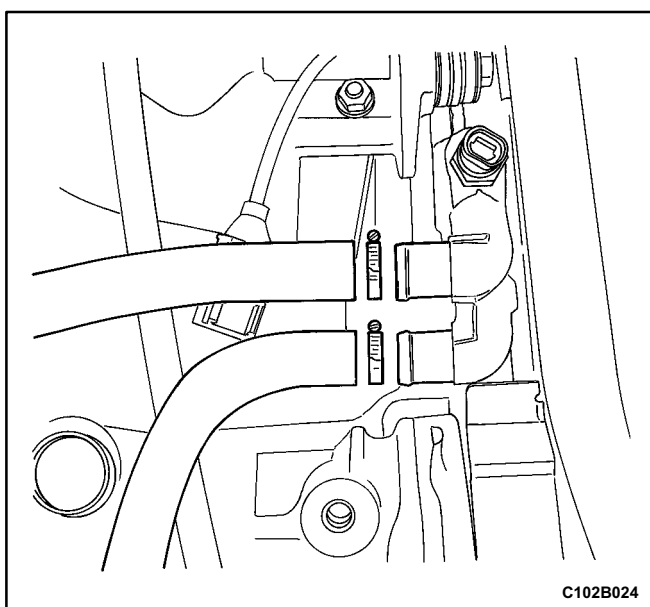


Tighten

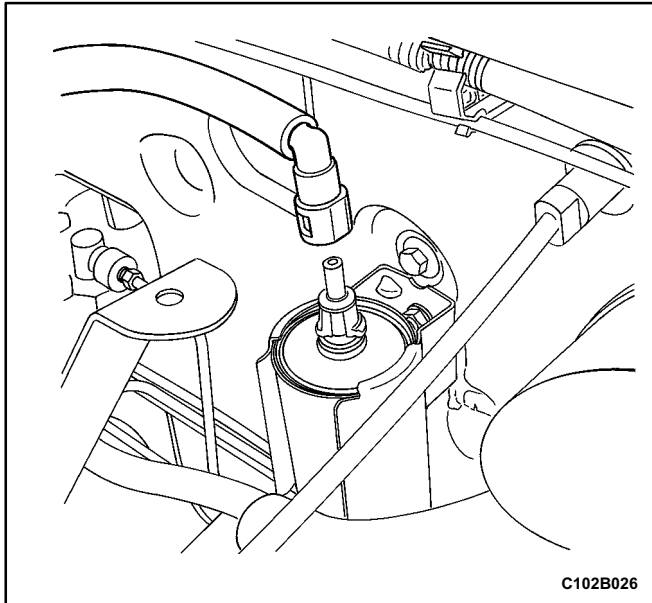
Tighten the cylinder head bolts to 25 N•m (18 lb•ft) using a torque wrench. Use the angular torque gauge KM-470-B to tighten the cylinder head bolts 90 degrees plus 90 degrees plus 90 degrees.



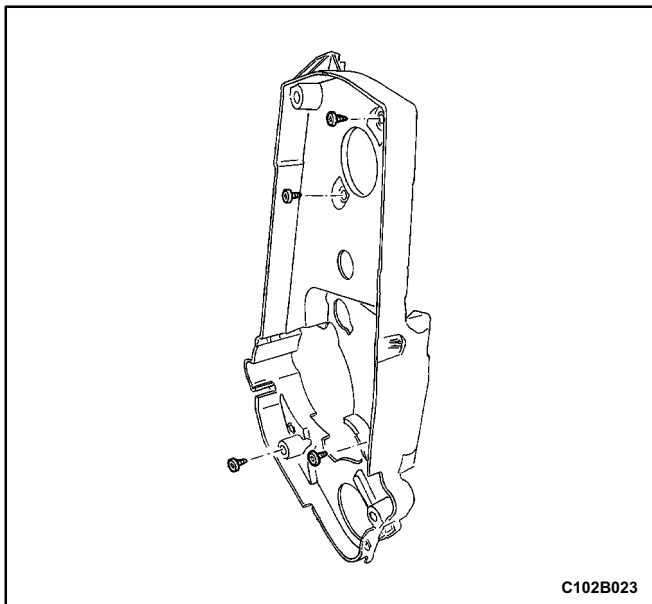
7. Connect the throttle cable at the throttle body and the intake manifold.
8. Install the alternator and the support bracket. Refer to *Section 1E, Engine Electrical*.
9. Connect the coolant surge tank hose at the throttle body.



10. Connect the coolant hoses to the rear of the coolant manifold.
11. Connect the canister purge solenoid connector.



12. Connect the fuel feed line to the fuel filter.
13. Connect the fuel return line at the fuel rail.
14. Connect all of the necessary vacuum hoses.
15. Connect the fuel injector harness connectors.



16. Install the exhaust flex pipe retaining nuts at the exhaust manifold flange.

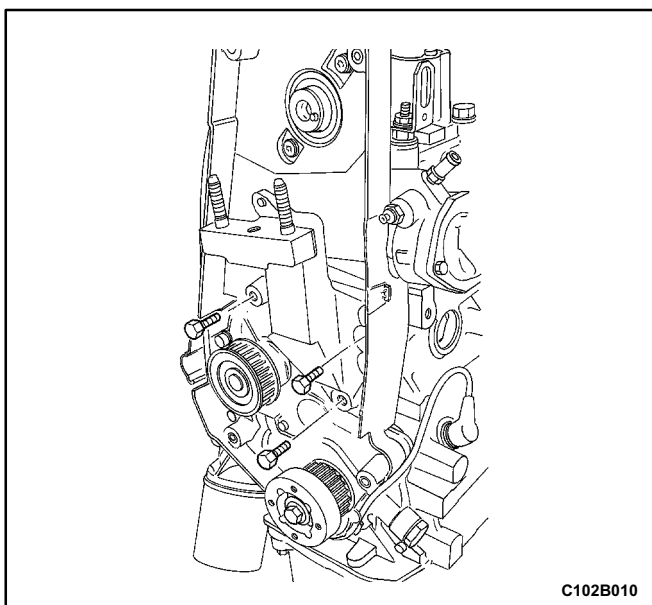
Tighten

Tighten the exhaust flex pipe to exhaust manifold retaining nuts to 22 N•m (16 lb•ft).

17. Install the rear timing belt cover.
18. Install the rear timing belt cover bolts.

Tighten

Tighten the rear timing belt cover bolts to 6 N•m (53 lb•in).



19. Install the engine mount and the retaining bolts/nuts.

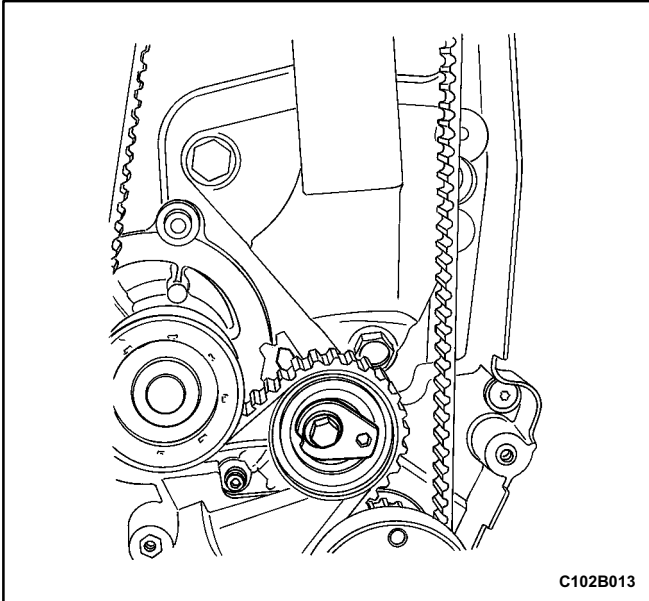
Tighten

Tighten the right side engine mount retaining bolts/nuts to 60 N•m (44 lb•ft).

20. Install the crankshaft timing belt drive gear.
21. Install the crankshaft timing belt drive gear bolt.

Tighten

Tighten the crankshaft timing belt drive gear bolt to 95 N•m (70 lb•ft). Using the angular torque gauge KM-470-B, tighten the crankshaft gear bolt 30 degrees plus 15 degrees.

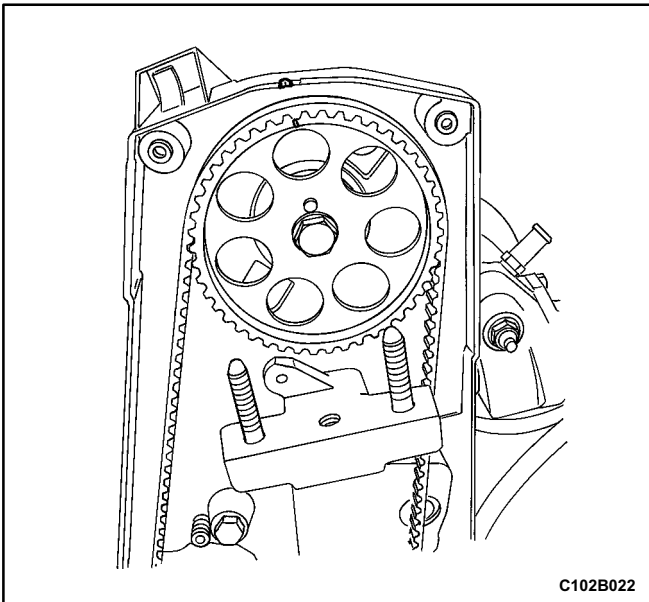


C102B013

22. Install the timing belt automatic tensioner.
23. Install the timing belt automatic tensioner bolt.

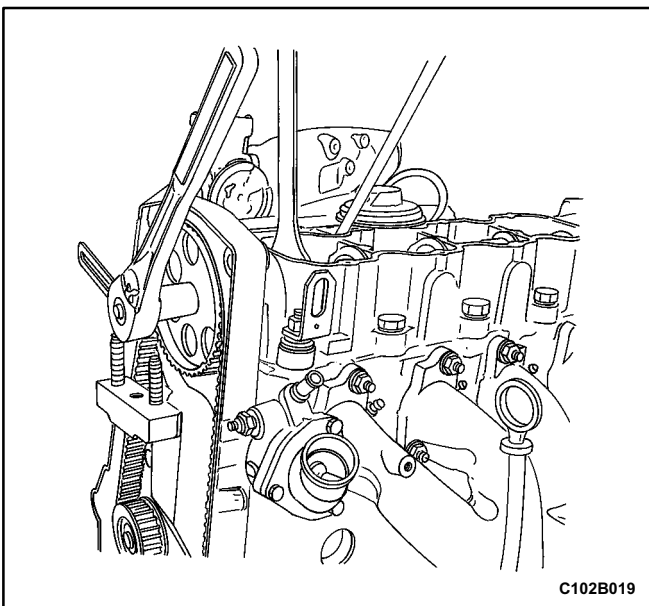
Tighten

Tighten the timing belt automatic tensioner bolt to 25 N•m (18 lb•ft).



C102B022

24. Install the camshaft gear with the timing mark aligned to the notch on the cover.

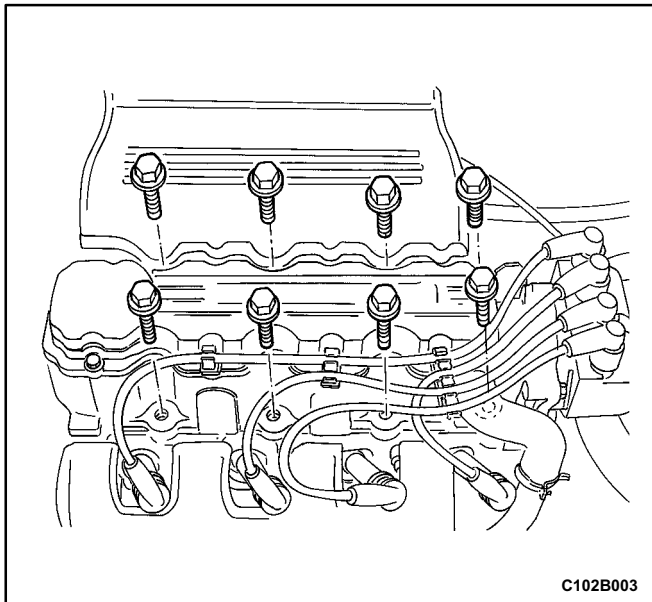


C102B019

25. Install the camshaft gear by counterholding on the hex of the camshaft with an open-ended wrench.
26. Install the camshaft gear with a new bolt to the camshaft.

Tighten

Tighten the camshaft gear retaining bolt to 45 N•m (33 lb•ft).

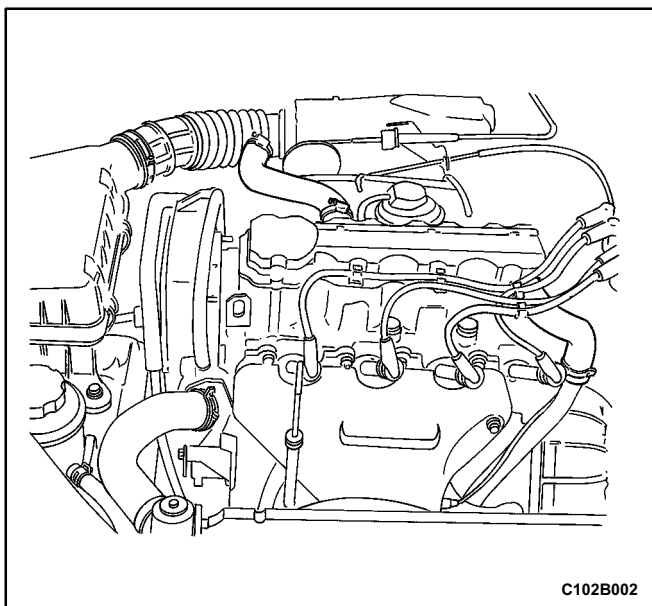


C102B003

27. Install the valve cover and the valve cover gasket.
28. Install the valve cover bolts.

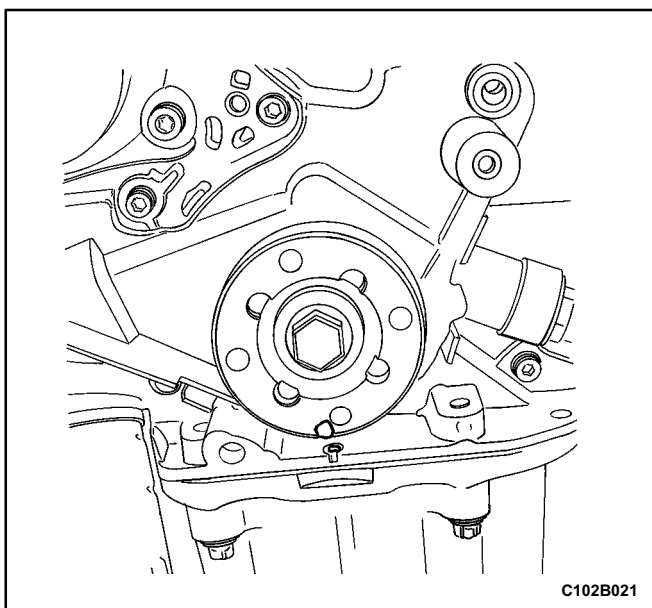
Tighten

Tighten the valve cover bolts to 8 N•m (71 lb•in).



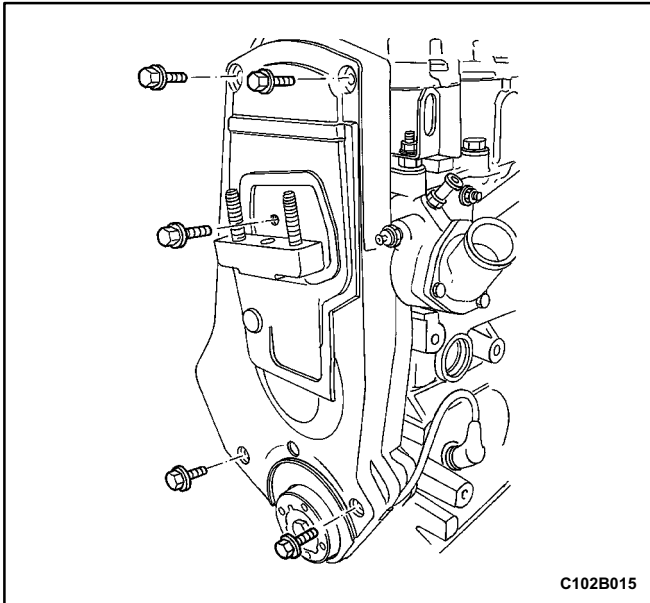
C102B002

29. Connect the ignition wires to the spark plugs.
30. Connect the breather tubes to the valve cover.



C102B021

31. Align the mark on the crankshaft gear with the notch at the bottom of the rear timing belt cover.
32. Install the timing belt. Refer to "Timing Belt" in this section.
33. Check and adjust the timing belt tension. Refer to "Timing Belt Check and Adjust" in this section.
34. Route the crankshaft position wire into its track.



C102B015

35. Install the front timing belt cover.
36. Install the front timing belt cover bolts.

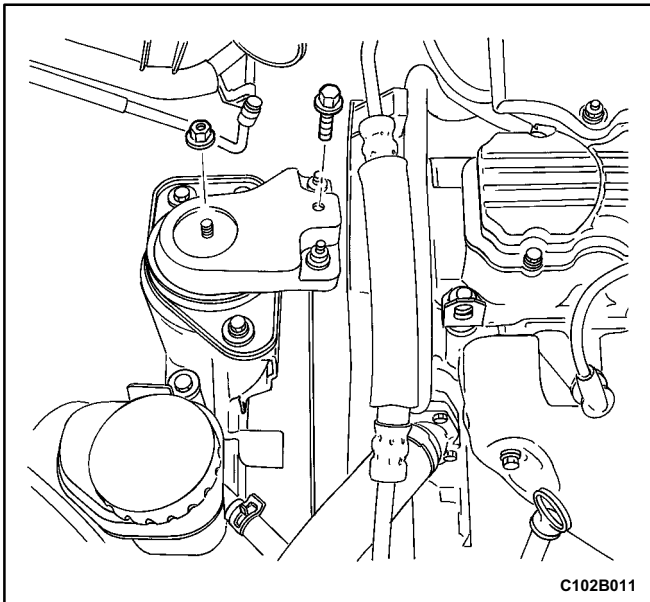
Tighten

Tighten the front timing belt cover bolts to 6 N•m (53 lb•in).

37. Install the crankshaft pulley.
38. Install the crankshaft pulley bolts.

Tighten

Tighten the crankshaft pulley bolts to 20 N•m (15 lb•ft).



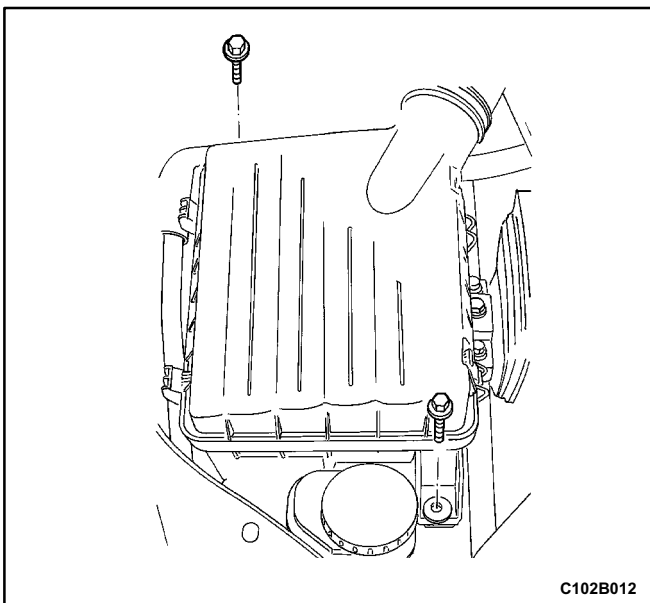
C102B011

39. Install the right side engine mount bracket and retaining bolts/nuts.

Tighten

Tighten the right side engine mount bracket retaining bolts/nuts to 60 N•m (44 lb•ft).

40. Remove the floor jack.
41. Install the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.
42. Connect the upper radiator hose to the thermostat housing.
43. Install the right front wheel well splash shield. Refer to *Section 9R, Body Front End*.
44. Install the right front wheel. Refer to *Section 2E, Tires and Wheels*.



C102B012

45. Install the air filter housing.
46. Install the air filter housing bolts.

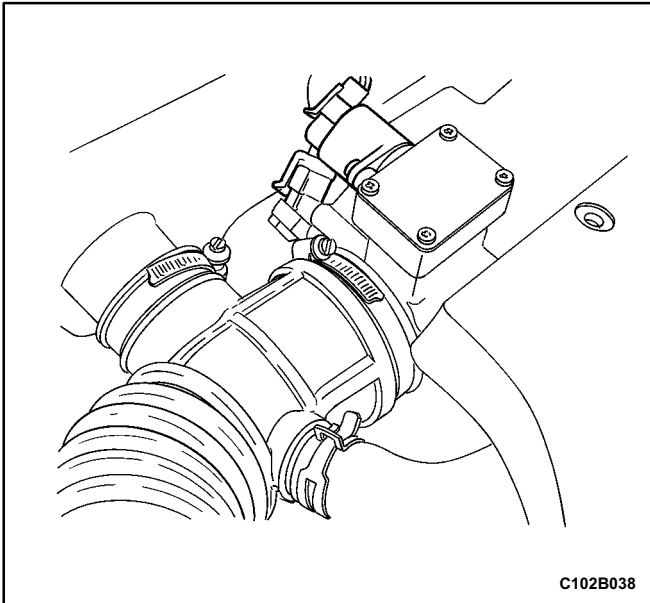
Tighten

Tighten the air filter housing bolts to 8 N•m (71 lb•in).

47. Connect the air intake tube to the throttle body.
48. Connect the breather tubes to the air intake tube.
49. Connect the manifold air temperature sensor connector.
50. Install the resonator and retaining bolts.

Tighten

Tighten the resonator retaining bolts to 8 N•m (71 lb•in).

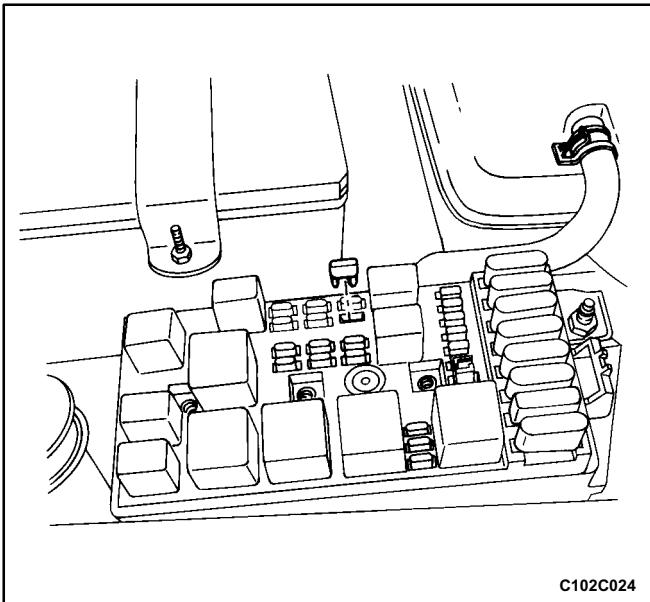


C102B038

51. Connect the coolant temperature sensor connector.
52. Connect the engine coolant temperature sensor connector.
53. Connect the idle air control valve connector.
54. Connect the throttle position sensor connector.
55. Install the injector cover and retaining bolts.

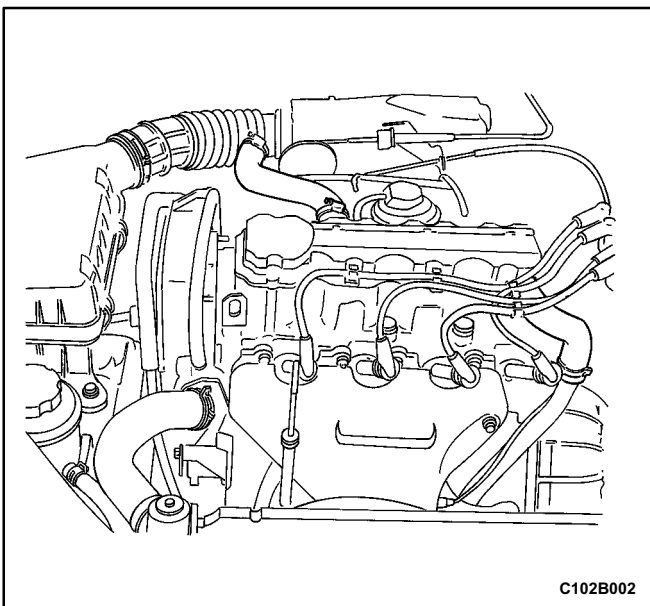
Tighten

Tighten the injector cover retaining bolts to 8 N•m (71 lb•in).



C102C024

56. Connect the DIS ignition coil connector.
57. Connect the oxygen sensor connector.
58. Connect the ECM ground terminal.
59. Install the fuel pump fuse.
60. Connect the negative battery ground cable.
61. Refill the engine cooling system. Refer to *Section 1D, Engine Cooling*.



C102B002

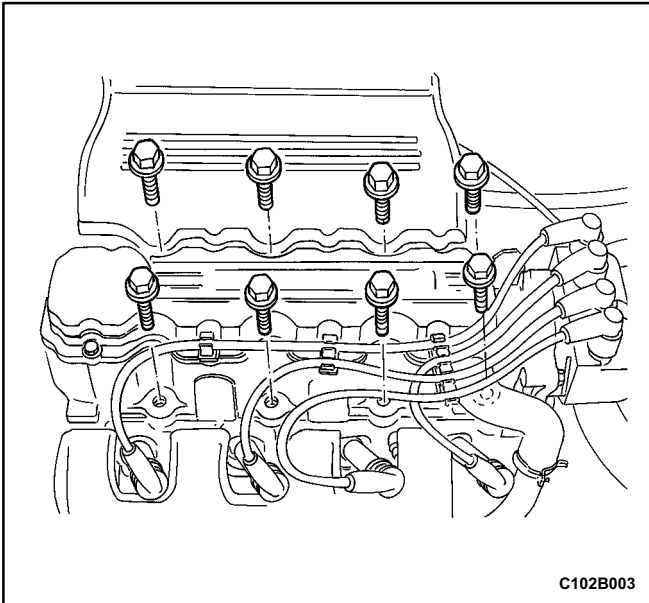
CAMSHAFT

Tools Required

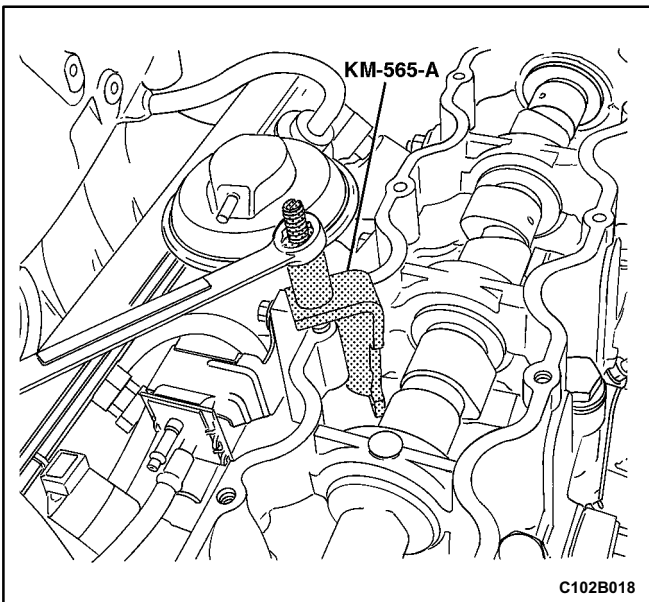
KM-565-A Valve Spring Compressor

Removal Procedure

1. Remove the timing belt. Refer to "Timing Belt" in this section.
2. Disconnect the breather tubes at the valve cover.



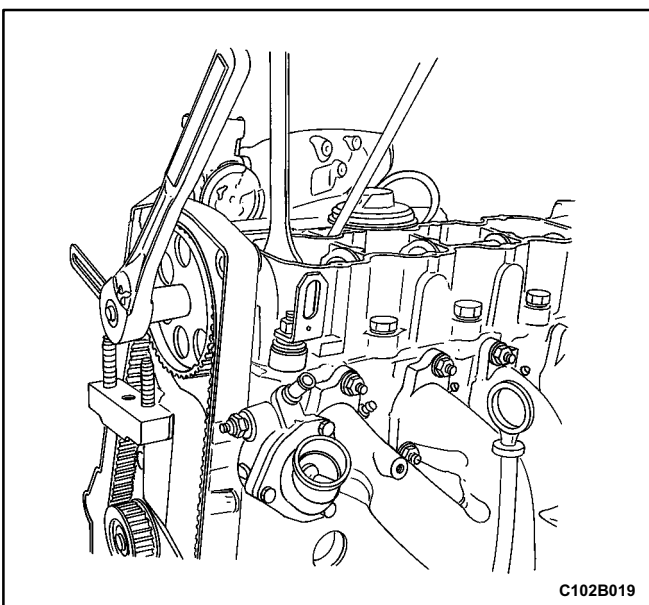
3. Remove the injector cover bolts.
4. Remove the injector cover.
5. Remove the valve cover bolts.
6. Remove the valve cover and the gasket.



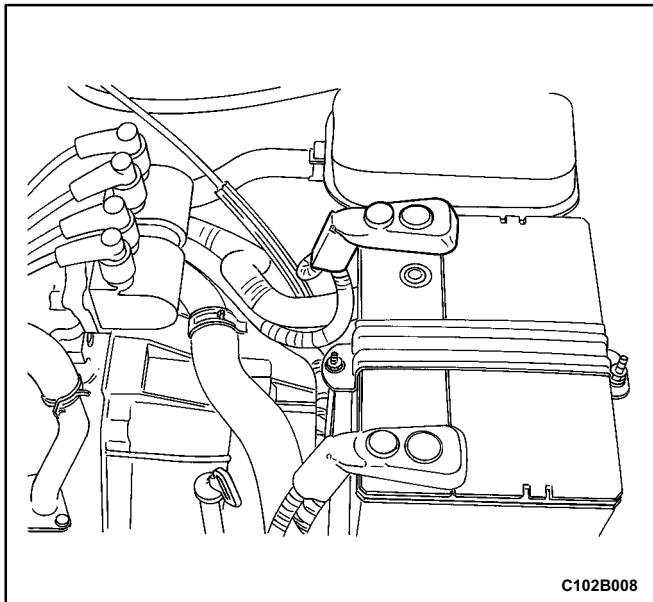
7. Install the valve spring compressor KM-565-A.

Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshaft. Such damage can cause premature engine wear.

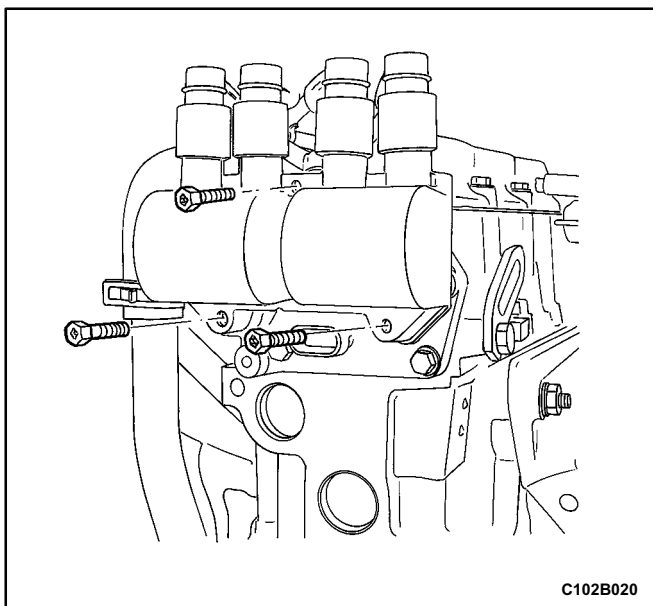
8. Remove the camshaft followers using the valve spring compressor KM-565-A.



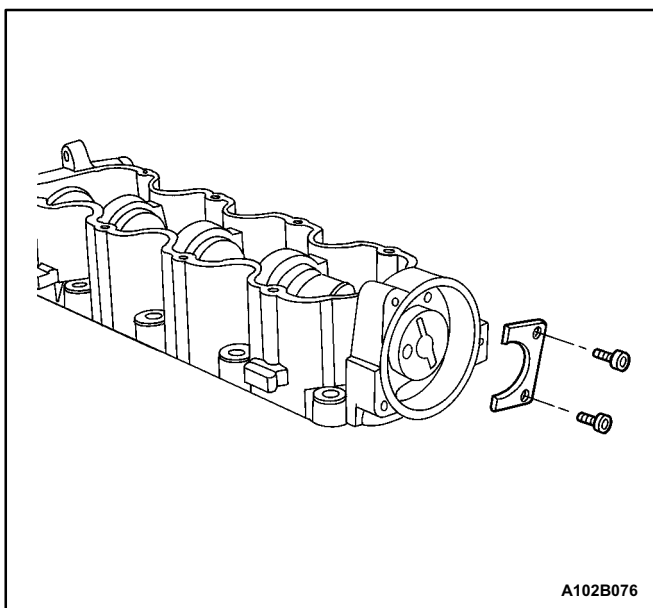
9. While holding the camshaft firmly in place, remove the camshaft gear bolt.
10. Remove the camshaft gear.



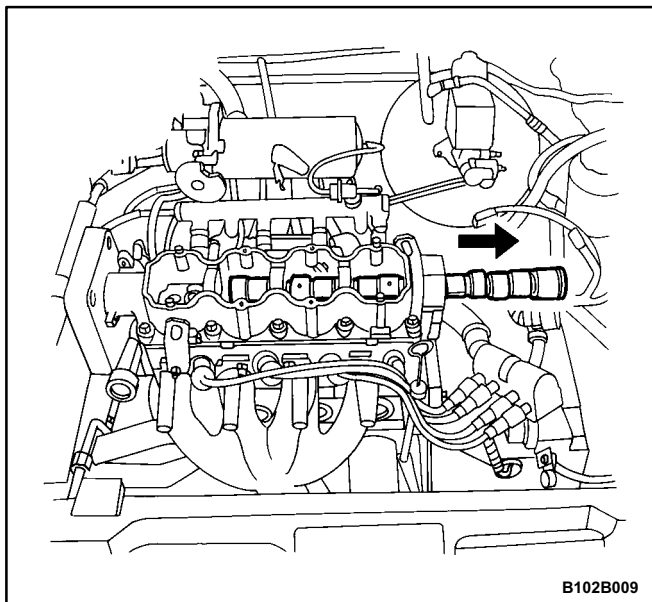
11. Remove the power steering pressure hose clamp bolt. Move the hose out of the way.
12. Disconnect the positive battery cable.
13. Remove the battery and the battery tray. Refer to *Section 1E, Engine Electrical*.



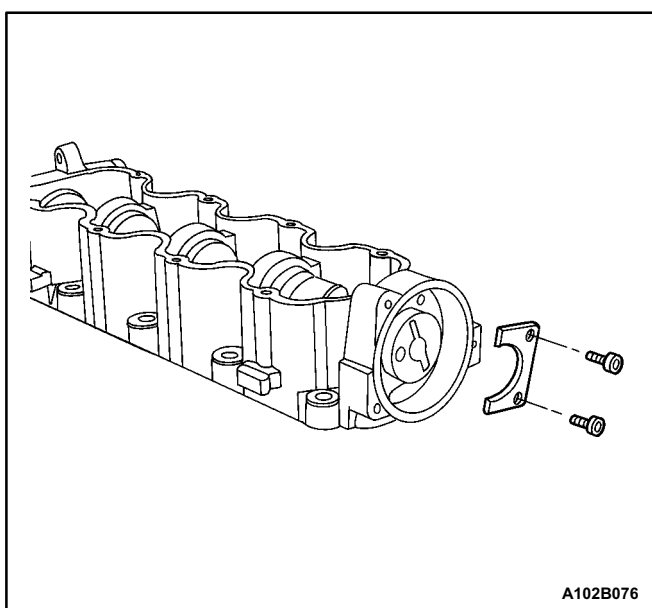
14. Disconnect the DIS ignition coil connector.
15. Disconnect the ignition wires at the DIS ignition coil.
16. Remove the DIS ignition coil mounting bolts.
17. Remove the DIS ignition coil.



18. Remove the DIS ignition coil mounting plate bolts.
19. Remove the DIS ignition coil mounting plate.
20. Remove the camshaft pressure plate bolts.
21. Remove the camshaft pressure plate.



22. Remove the camshaft.

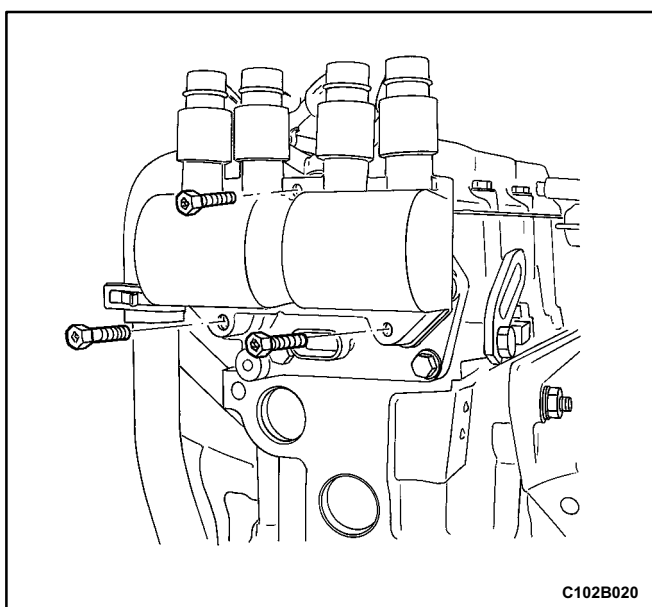


Installation Procedure

1. Install the camshaft.
2. Install the camshaft pressure plate.
3. Install the camshaft pressure plate bolts.

Tighten

Tighten the camshaft pressure plate bolts to 10 N•m (89 lb•in).



4. Measure the camshaft end play. The camshaft end play should be 0.04 to 0.16 mm (0.016 to 0.64 inch).
5. Install the DIS ignition coil mounting plate.
6. Install the DIS ignition coil mounting plate bolts.

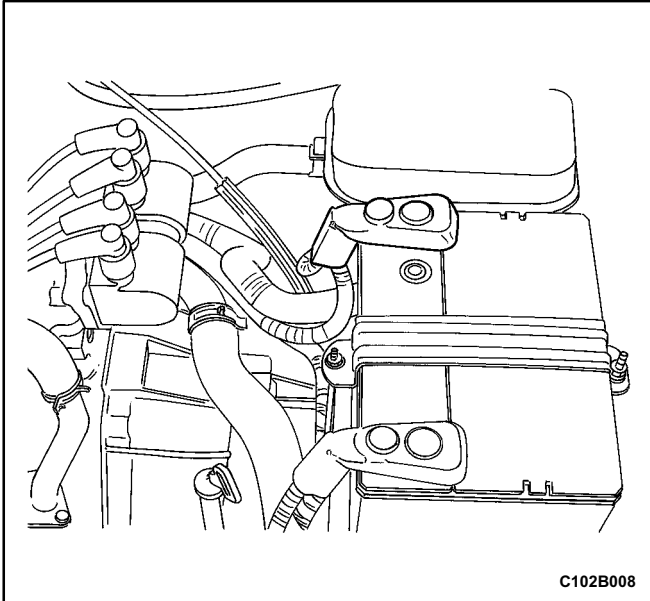
Tighten

Tighten the DIS ignition coil mounting plate bolts to 10 N•m (89 lb•in).

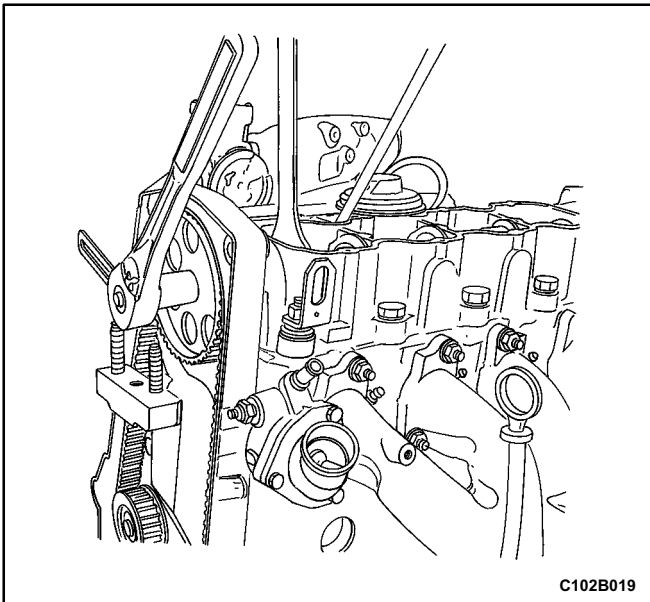
7. Install the DIS ignition coil.
8. Install the DIS ignition coil retaining bolts.

Tighten

Tighten the DIS ignition coil retaining bolts to 10 N•m (89 lb•in).



9. Connect the ignition wires at the DIS ignition coil.
10. Connect the DIS ignition coil connector.
11. Install the battery and the battery tray. Refer to *Section 1E, Engine Electrical*.
12. Connect the positive battery cable.

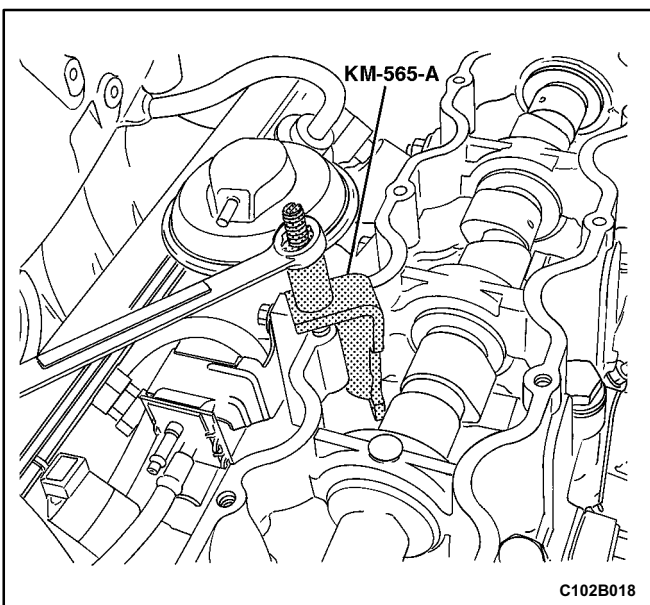


Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshaft. Such damage can cause premature engine wear.

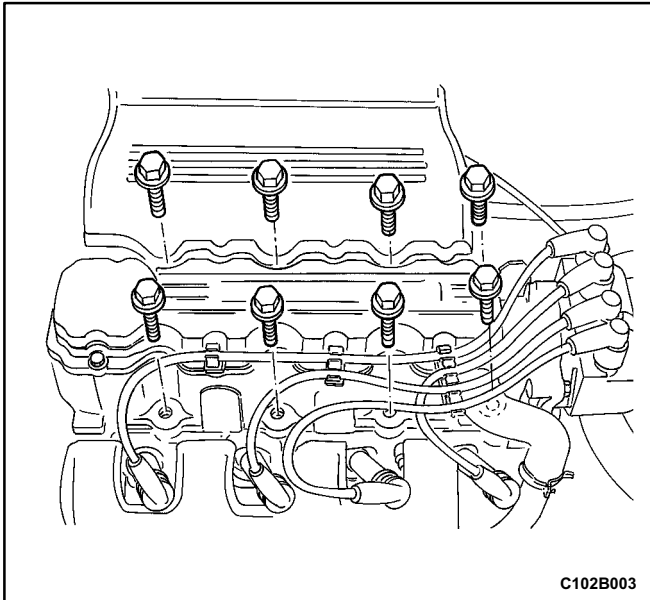
13. Install the camshaft gear.
14. While holding the camshaft firmly in place, install the camshaft gear retaining bolt.

Tighten

Tighten the camshaft gear retaining bolt to 45 N•m (33 lb•ft).



15. Install the camshaft followers using the valve spring compressor KM-565-A.
16. Remove the valve spring compressor KM-565-A.

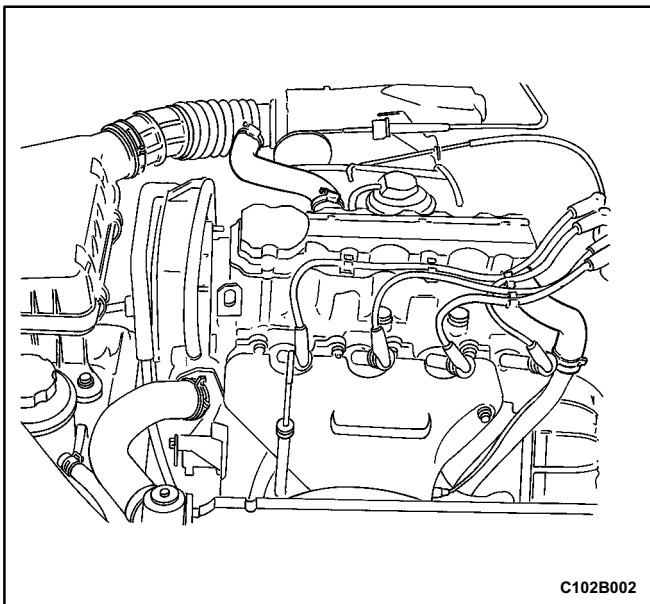


C102B003

17. Install the valve cover gasket.
18. Install the valve cover.
19. Install the valve cover bolts.

Tighten

Tighten the valve cover bolts to 8 N•m (71 lb•in).



C102B002

20. Connect the breather tubes to the valve cover.
21. Install the injector cover.
22. Install the injector cover bolts.

Tighten

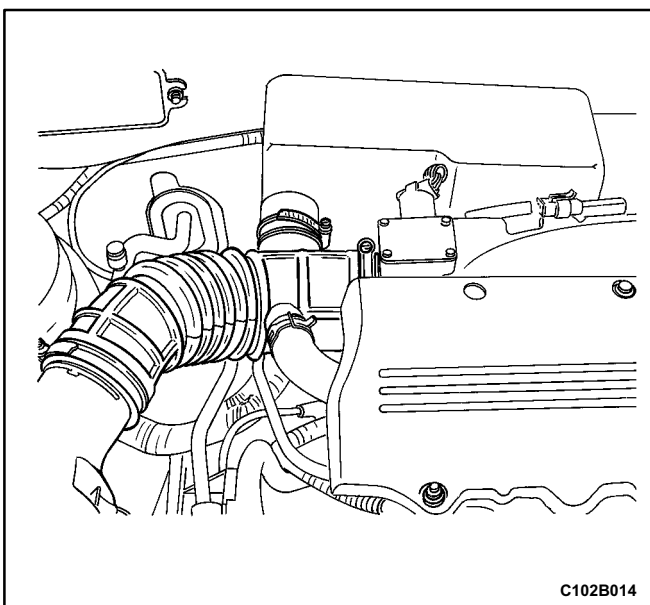
Tighten the injector cover bolts to 8 N•m (71 lb•in).

23. Install the power steering pressure hose clamp bolt.

Tighten

Tighten the power steering pressure hose clamp bolt to 10 N•m (89 lb•in).

24. Install the timing belt. Refer to "Timing Belt" in this section.

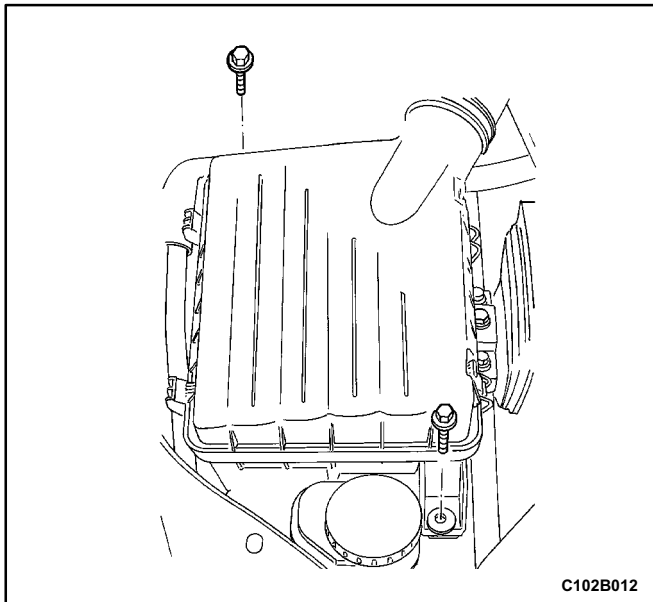


C102B014

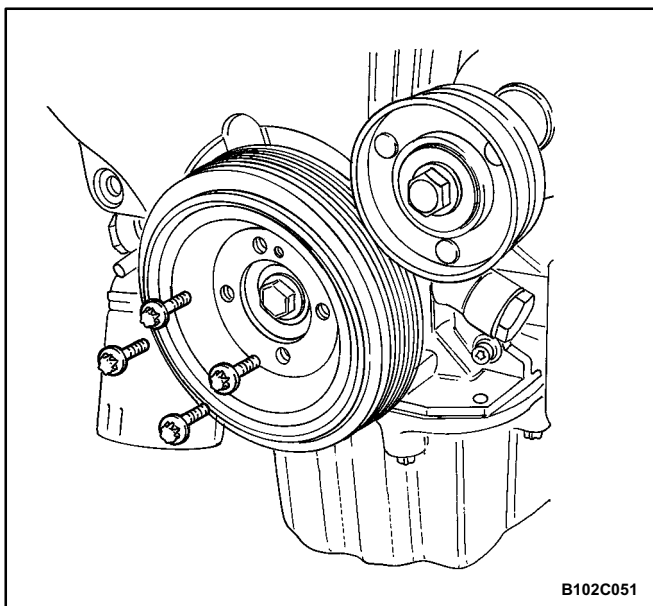
TIMING BELT CHECK AND ADJUST

Adjustment Procedure

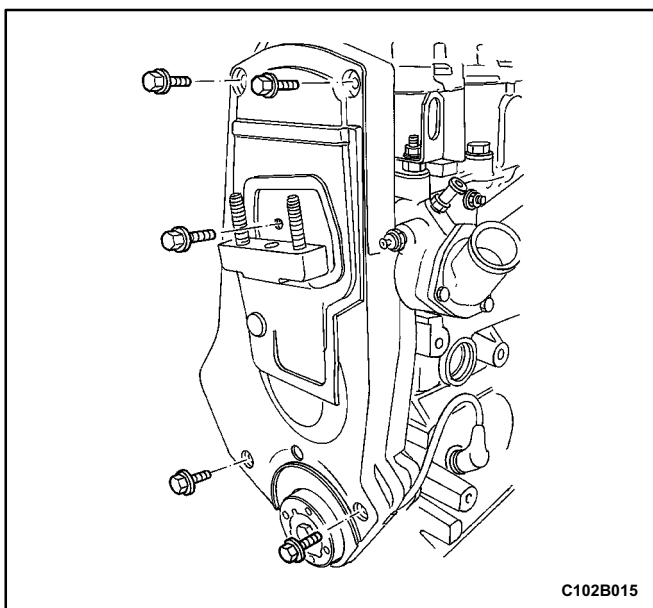
1. Disconnect the negative battery cable.
2. Remove the air intake tube.
3. Disconnect the breather tube.
4. Remove the power steering hose clamp bolt and position the hose clear.



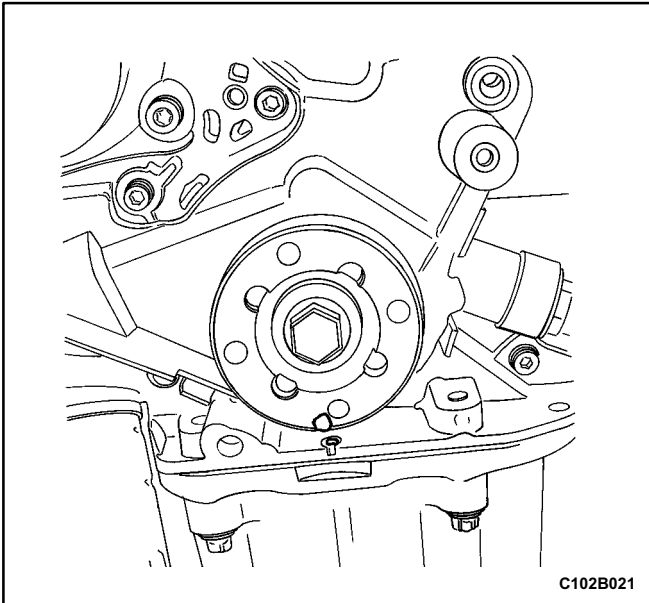
5. Remove the air filter housing bolts.
6. Remove the air filter housing.
7. Remove the right front wheel. Refer to *Section 2E, Tires and Wheels*.
8. Remove the right front wheel well splash shield. Refer to *Section 9R, Body Front End*.



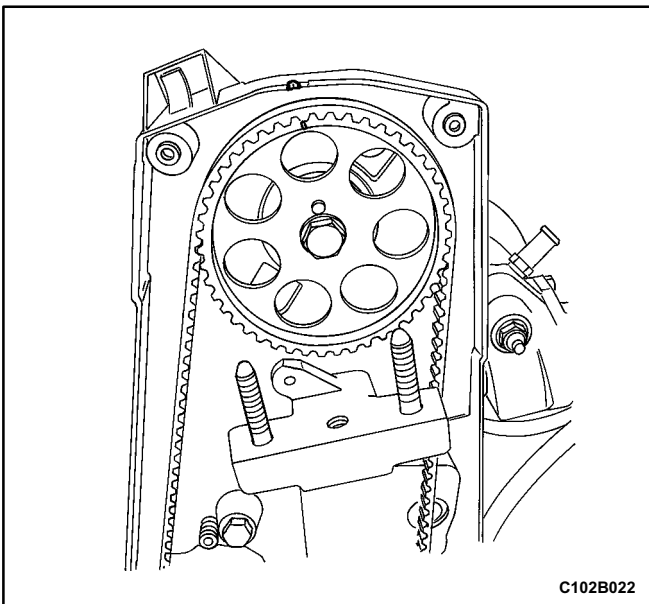
9. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.
10. Remove the crankshaft pulley bolts.
11. Remove the crankshaft pulley.
12. Remove the right side engine mount bracket. Refer to "Engine Mount, Right Side" in this section.



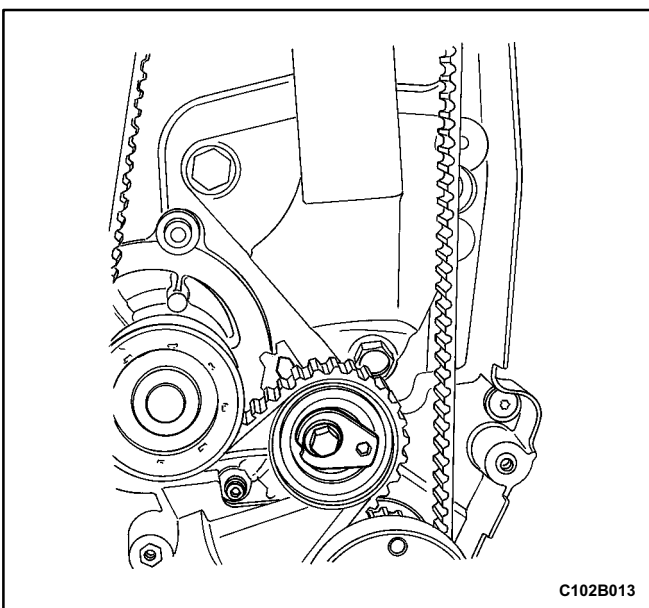
13. Remove the front timing belt cover bolts.
14. Remove the front timing belt cover.



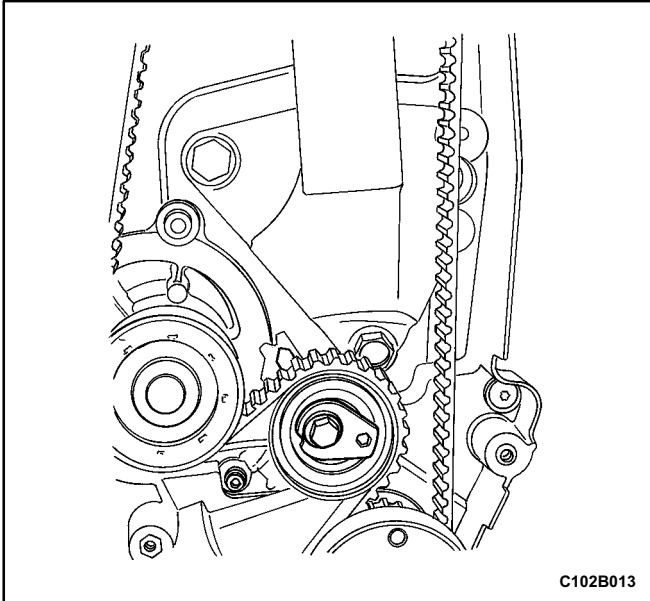
15. Rotate the crankshaft at least one full turn clockwise using the crankshaft gear bolt.
16. Align the mark on the crankshaft gear with the notch at the base of the oil pump.



17. Align the camshaft gear timing mark to the notch on the timing belt cover.



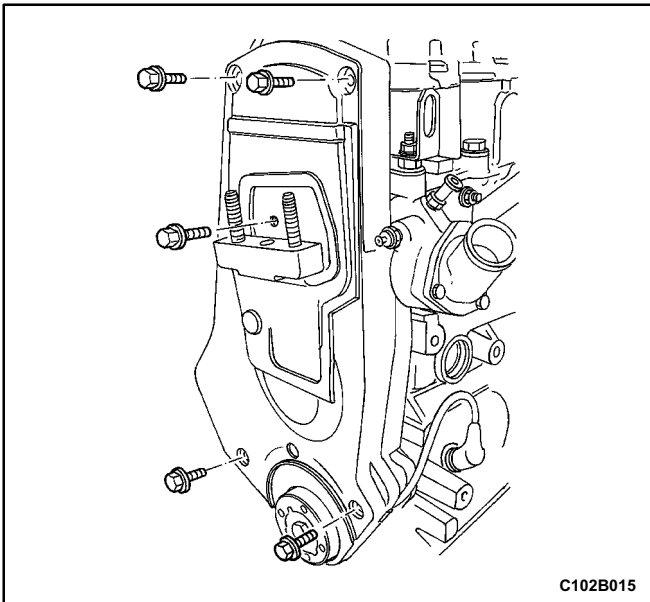
18. Loosen the automatic tensioner bolt. To relieve the belt tension, turn the hex-key tab counterclockwise.
19. Rotate the automatic tensioner hex-key tab clockwise until the adjust arm pointer of the timing belt automatic tensioner is aligned with the notch in the timing belt automatic tensioner bracket.



20. Tighten the automatic tensioner bolt.
21. Rotate the crankshaft two full turns clockwise using the crankshaft gear bolt.
22. Check the automatic tensioner pointer.
23. When the adjust arm pointer of the timing belt automatic tensioner is aligned with the notch on the timing belt automatic tensioner bracket, the belt is tensioned correctly.

Tighten

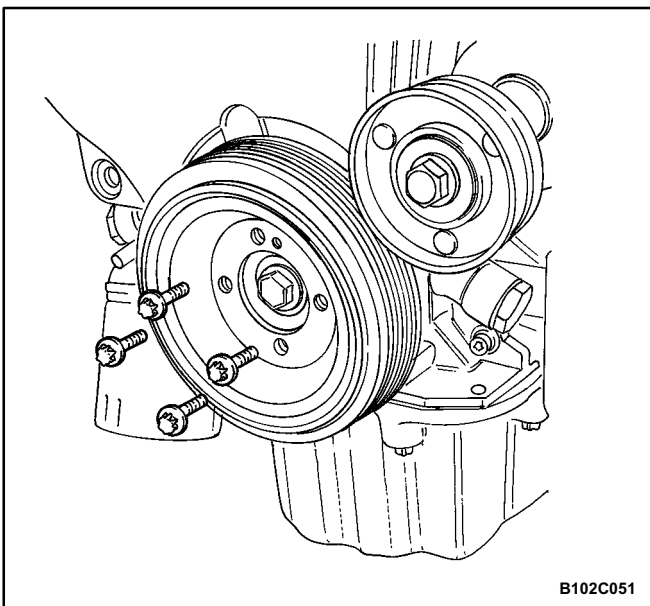
Tighten the timing belt automatic tensioner bolt to 25 N•m (18 lb•ft).



24. Install the front timing belt cover.
25. Install the front timing belt cover bolts.

Tighten

Tighten the front timing belt cover bolts to 6 N•m (53 lb•in).

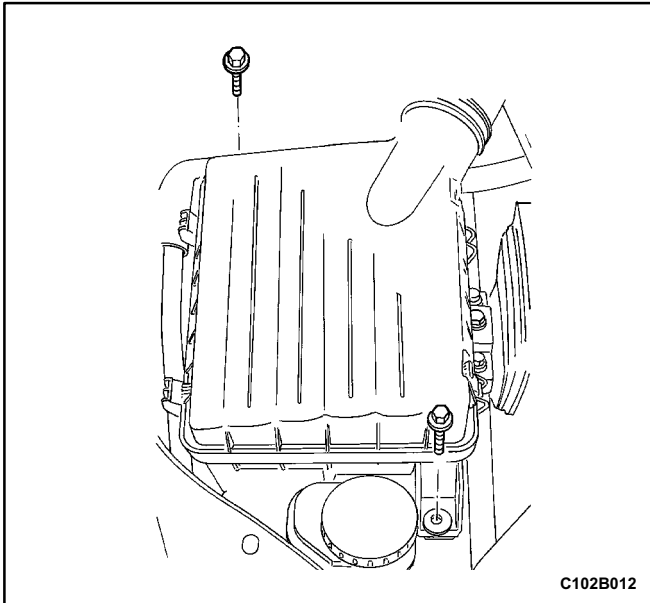


26. Install the crankshaft pulley.
27. Install the crankshaft pulley bolts.

Tighten

Tighten the crankshaft pulley bolts to 20 N•m (15 lb•ft).

28. Install the right side engine mount bracket. Refer to "Engine Mount, Right Side" in this section.
29. Install the serpentine accessory drive belt. Refer to Section 6B, Power Steering Pump.



C102B012

- 30 Install the right front wheel well splash shield. Refer to *Section 9R, Body Front End*.
31. Install the right front wheel. Refer to *Section 2E, Body Front End*.
32. Install the air filter housing.
- 33 Install the air filter housing bolts.

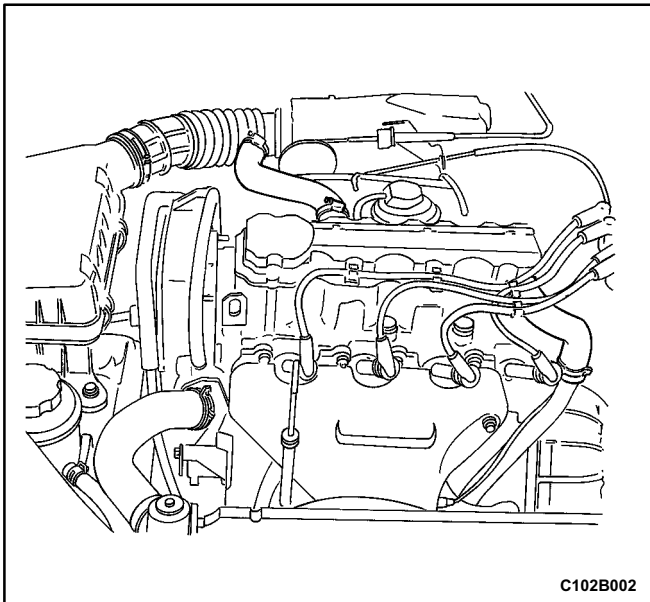
Tighten

Tighten the air filter housing bolts to 8 N•m (71 lb•in).

34. Connect the air intake tube.
35. Install the power steering hose clamp bolt.

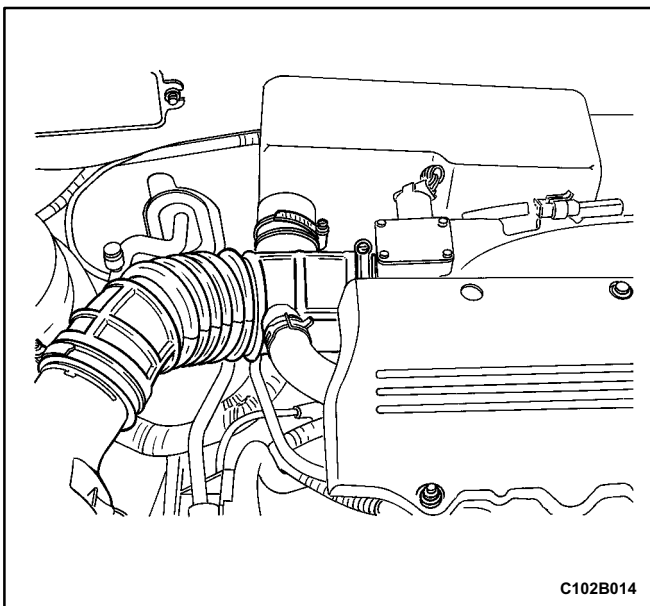
Tighten

Tighten the power steering pressure hose clamp bolt to 10 N•m (89 lb•in).



C102B002

36. Connect the breather tube.
37. Connect the negative battery cable.

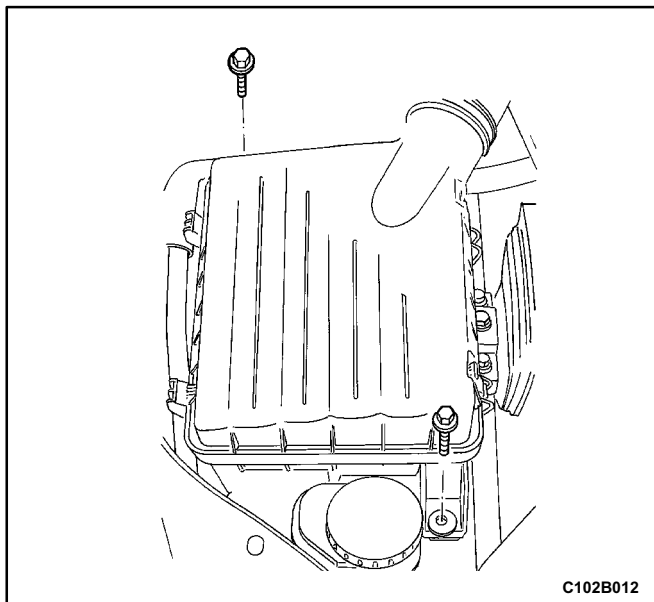


C102B014

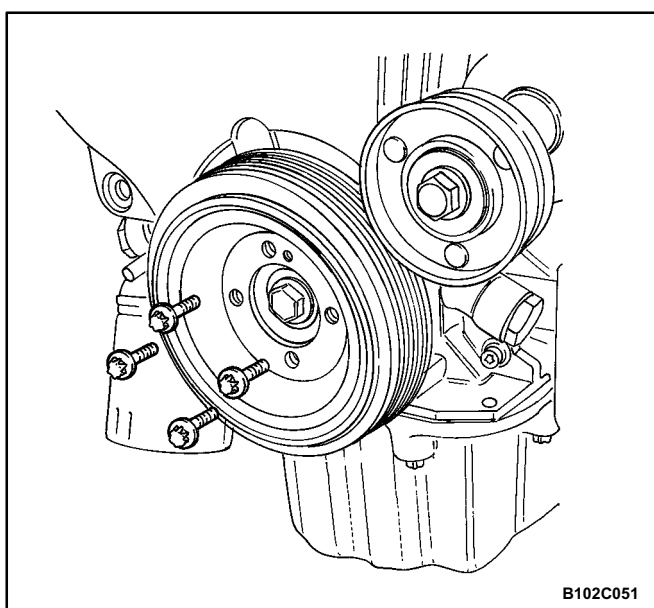
TIMING BELT

Removal Procedure

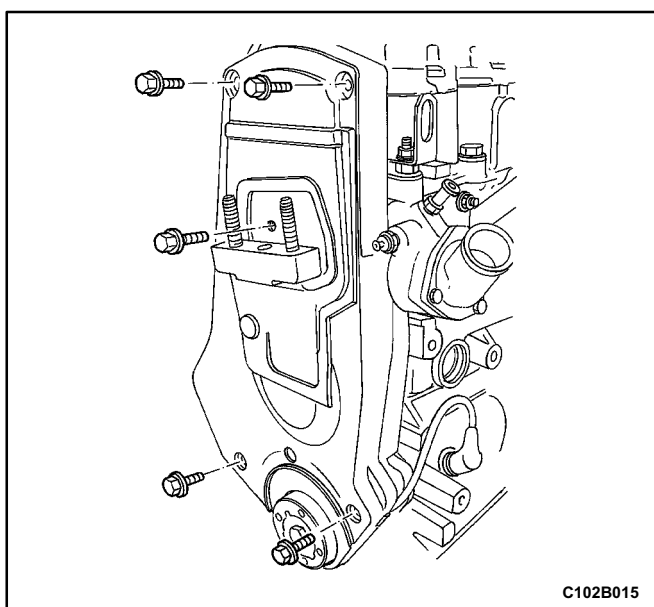
1. Disconnect the negative battery cable.
2. Disconnect the air intake tube from the throttle body.
3. Disconnect the breather tubes from the valve cover.
4. Remove the power steering hose clamp bolt.



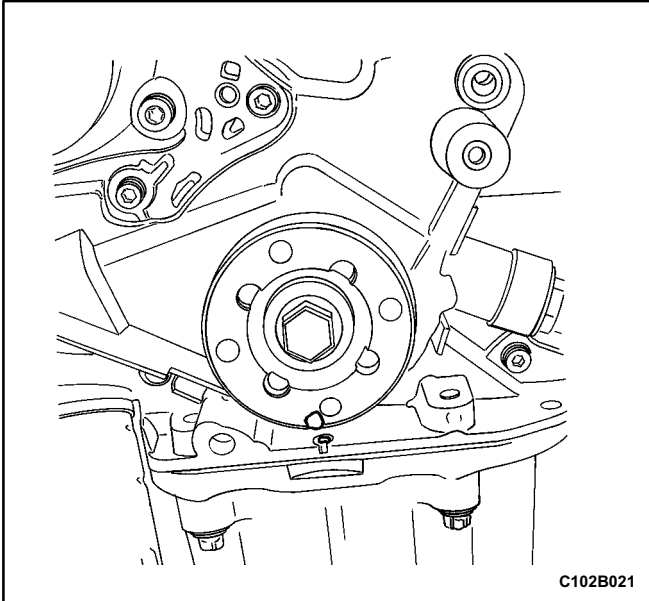
5. Remove the air filter housing bolts.
6. Remove the air filter housing.
7. Remove the right front wheel. Refer to *Section 2E, Tires and Wheels*.
8. Remove the right front wheel well splash shield. Refer to *Section 9R, Body Front End*.



9. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.
10. Remove the crankshaft pulley bolts.
11. Remove the crankshaft pulley.
12. Remove the right side engine mount bracket. Refer to "Engine Mount, Right Side" in this section.

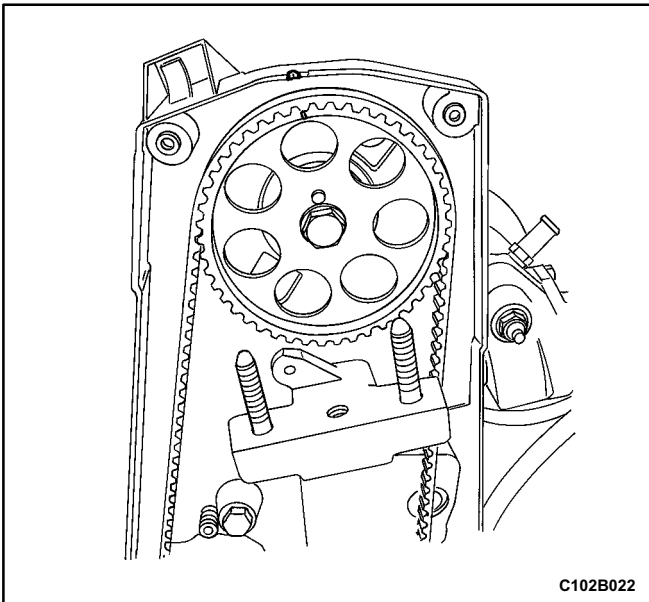


13. Remove the front timing belt cover bolts.
14. Remove the front timing belt cover.



C102B021

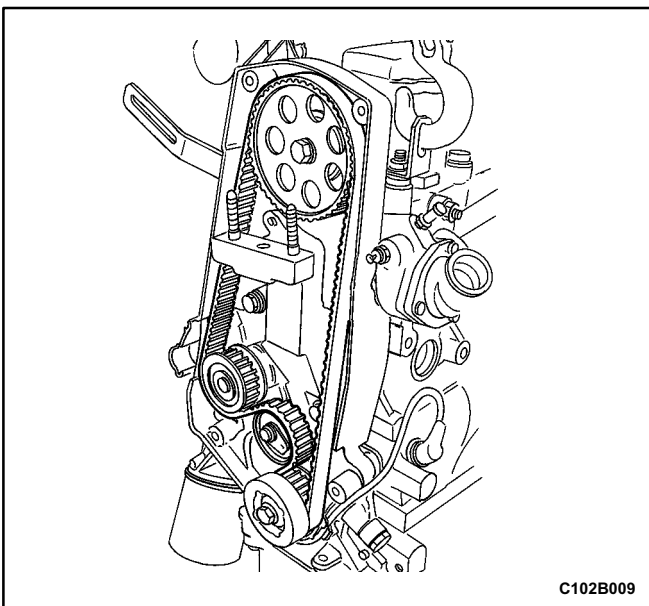
15. Using the crankshaft gear bolt, rotate the crankshaft clockwise until the timing mark on the crankshaft gear is aligned with the notch at the base of the oil pump.



C102B022

Notice: The camshaft gear must align with the notch on the timing belt cover or damage to the engine could result.

16. Align the camshaft gear with the notch on the timing belt cover.

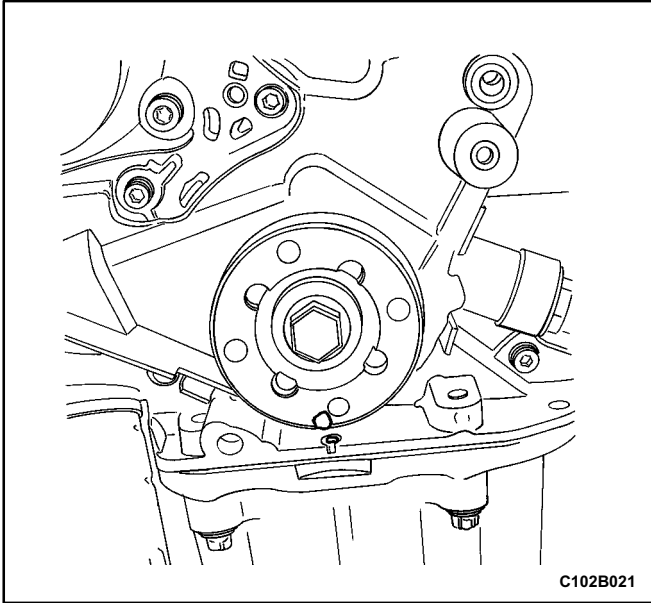


C102B009

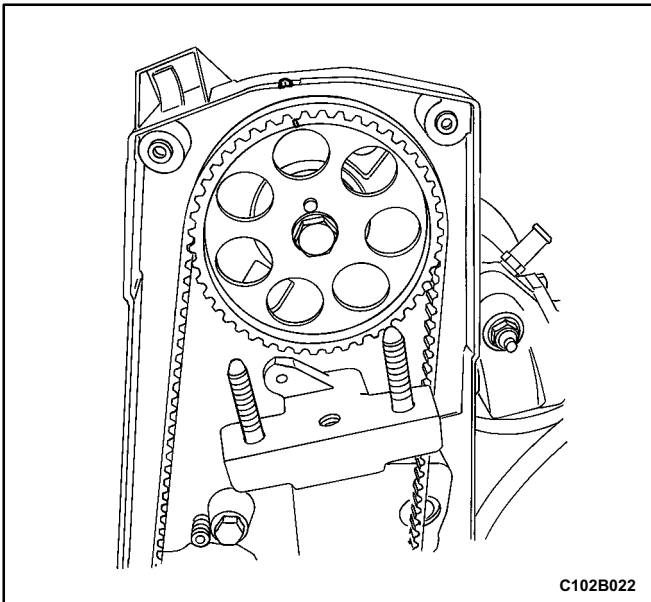
17. Loosen the timing belt automatic tensioner bolt. Turn the hex-key tab to relieve belt tension.
18. Remove the timing belt.

Installation Procedure

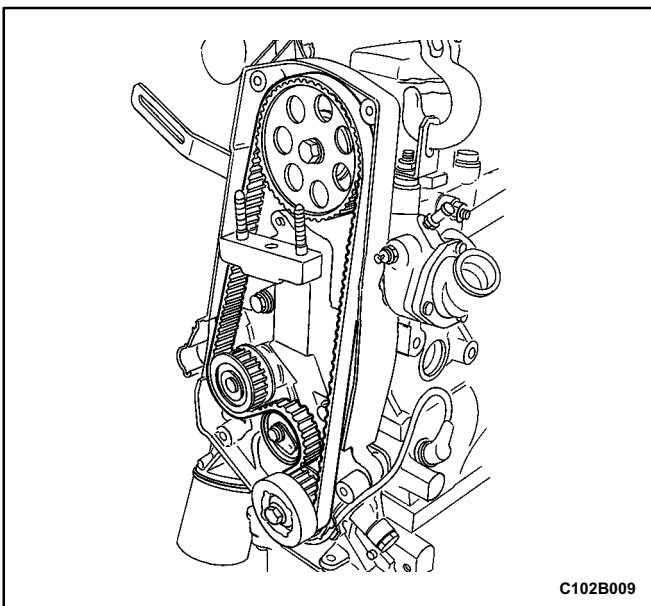
1. Align the timing mark on the crankshaft gear with the notch on the base of the oil pump.

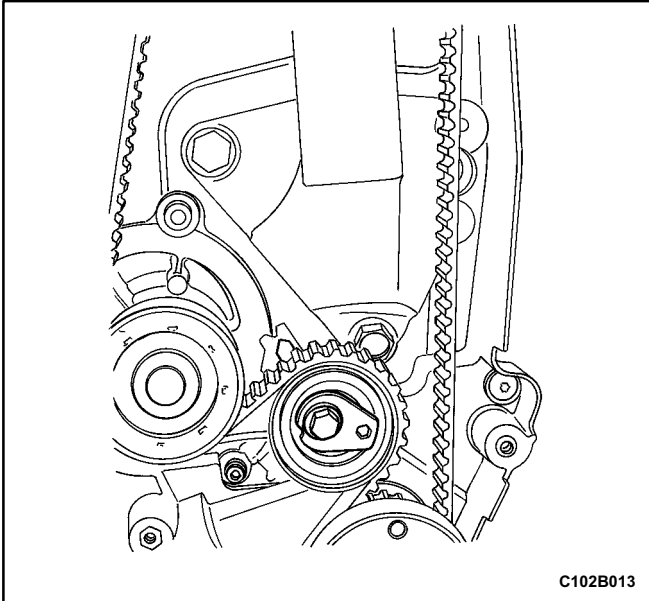


2. Align the timing mark on the camshaft gear to the notch on the timing belt cover.



3. Install the timing belt.

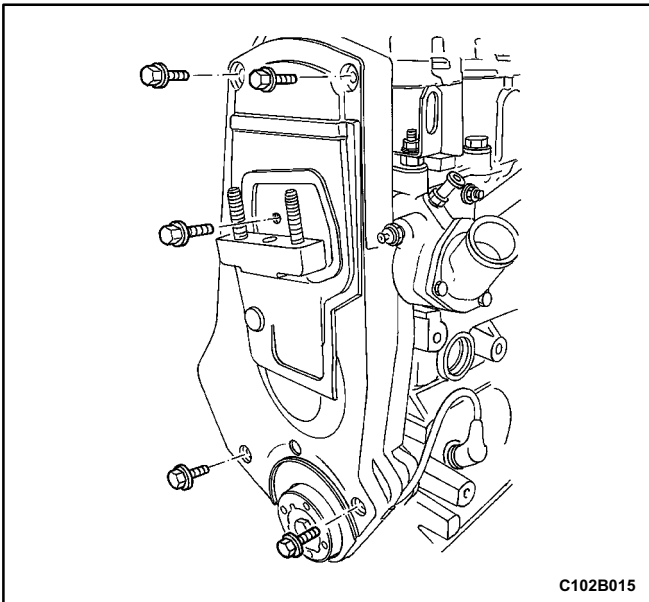




4. Turn the tensioner hex-key tab in a clockwise direction to tension the belt. Turn until the pointer aligns with the notch.
5. Tighten the timing belt automatic tensioner bolt.
6. Rotate the crankshaft two full turns clockwise using the crankshaft pulley bolt.
7. Recheck the automatic tensioner pointer. If the pointer aligns with the notch, retighten the automatic tensioner bolt.

Tighten

Tighten the timing belt automatic tensioner bolt to 25 N•m (18 lb•ft).

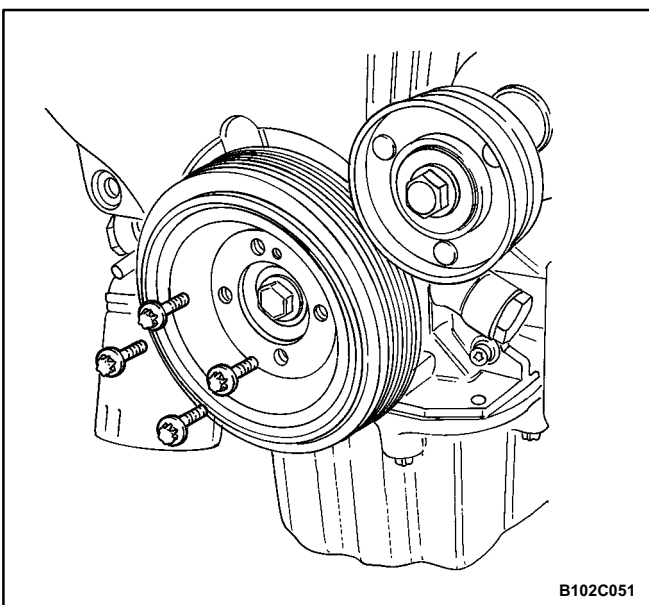


8. Install the front timing belt cover.
9. Install the front timing belt cover bolts.

Tighten

Tighten the front timing belt cover bolts to 6 N•m (53 lb•in).

10. Install the right engine mount bracket. Refer to "Engine Mount, Right Side" in this section.



11. Install the crankshaft pulley
12. Install the crankshaft pulley bolts.

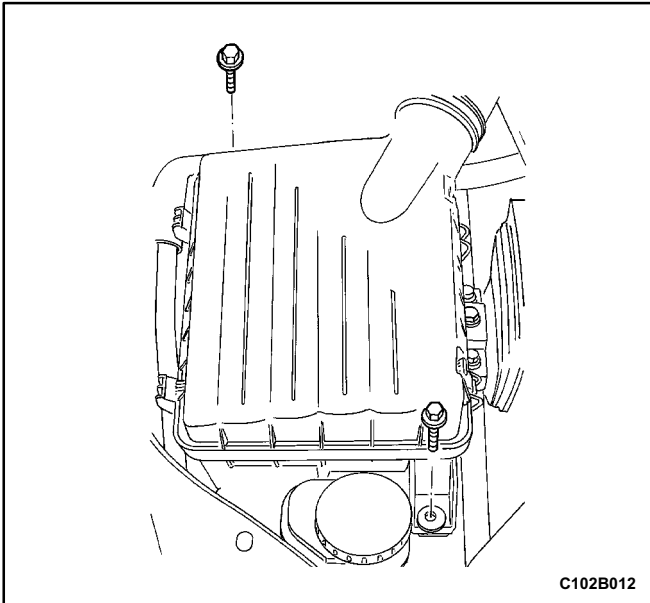
Tighten

Tighten the crankshaft pulley bolts to 20 N•m (15 lb•ft).

13. Install the power steering hose clamp bolt.

Tighten

Tighten the power steering pressure hose clamp bolt to 10 N•m (89 lb•in).



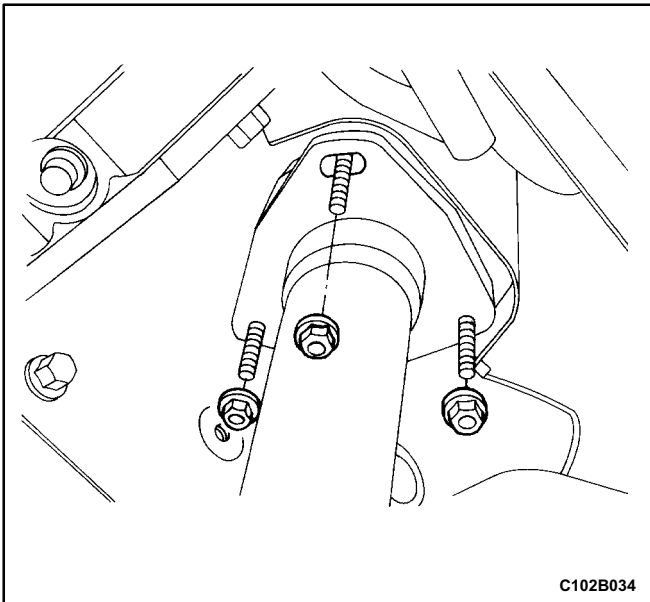
C102B012

14. Install the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.
15. Install the right front wheel well splash shield. Refer to *Section 9R, Body Front End*.
16. Install the right front wheel. Refer to *Section 2E, Tires and Wheels*.
17. Install the air filter housing.
18. Install the air filter housing bolts.

Tighten

Tighten the air filter housing bolts to 8 N•m (71 lb•in).

19. Connect the air intake tube to the throttle body.
20. Connect the breather tubes to the valve cover.
21. Connect the negative battery cable.

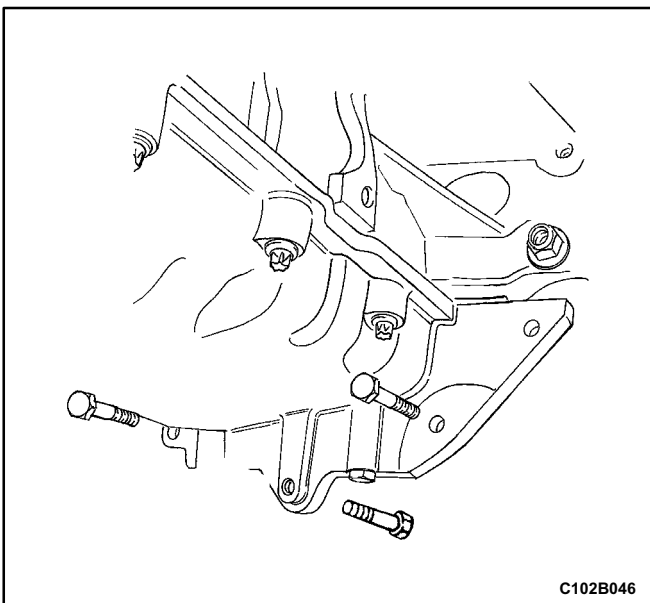


C102B034

OIL PAN

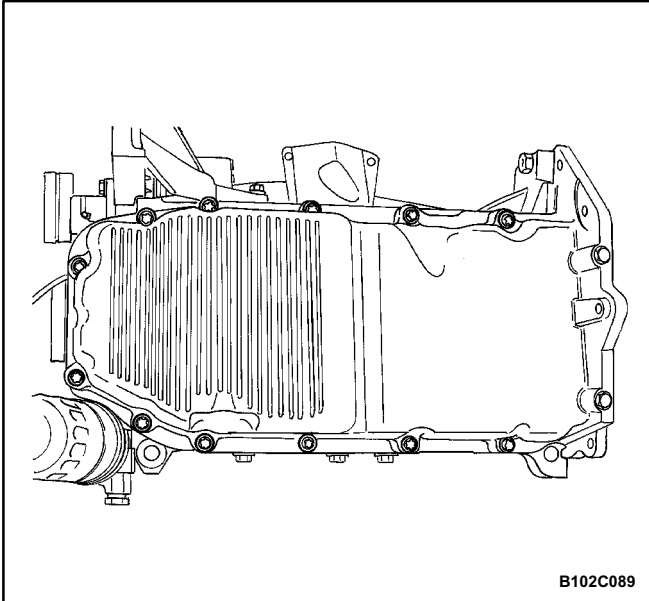
Removal Procedure

1. Disconnect the negative battery cable.
2. Drain the engine oil from the engine crankcase.
3. Remove the exhaust flex pipe retaining nuts from the exhaust manifold.
4. Remove the exhaust flex pipe retaining nuts from the catalytic converter.
5. Remove the exhaust flex pipe.
6. Remove the center member. Refer to *Section 9N, Frame and Underbody*.



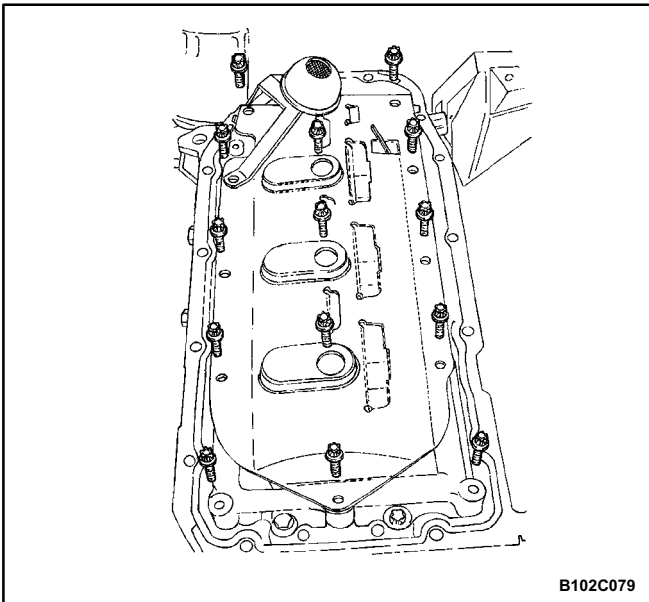
C102B046

7. Remove the oil pan flange-to-transaxle retaining bolts.



B102C089

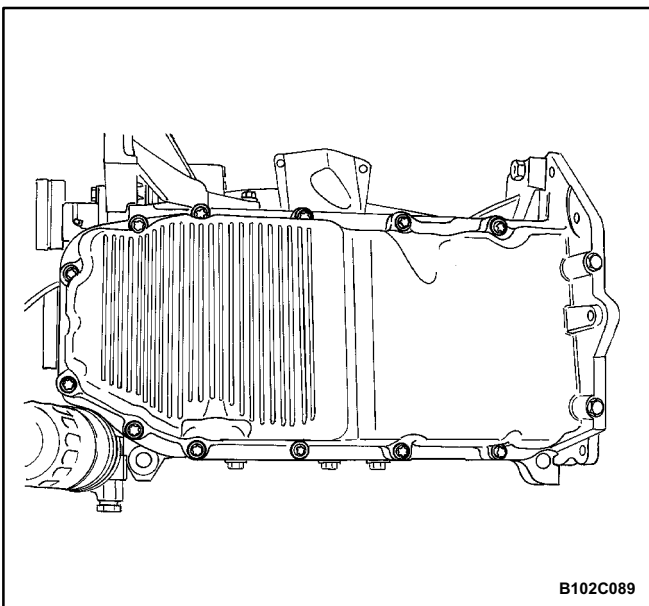
8. Remove the oil pan retaining bolts.
9. Remove the oil pan from the engine block.
10. Remove the oil pan gasket from the oil pan.



B102C079

Cleaning Procedure

1. Clean the oil pan sealing surface.
2. Clean the engine block sealing surface.
3. Clean the oil pan retaining bolts.
4. Clean the oil pan retaining bolt holes in the engine block.
5. Clean the oil pan splash shield.



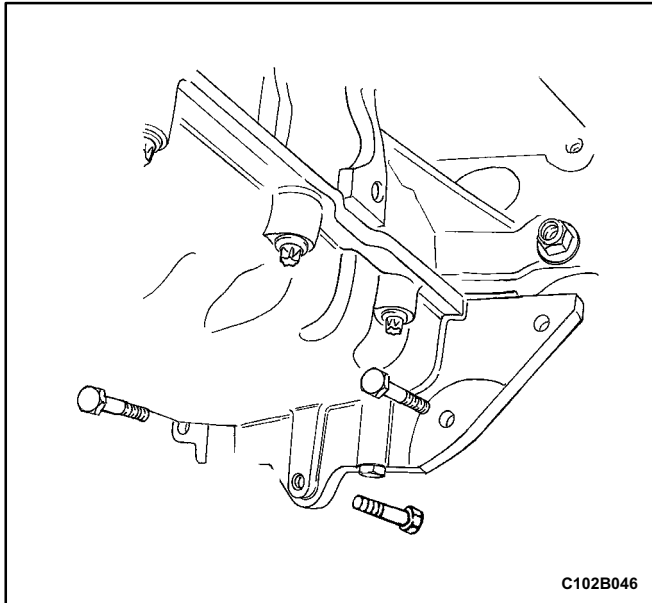
B102C089

Installation Procedure

1. Coat the new oil pan gasket with sealant.
2. Install the oil pan gasket to the oil pan.
3. Install the oil pan to the engine block.
4. Install the oil pan retaining bolts.

Tighten

Tighten the oil pan retaining bolts to 10 N•m (89 lb•in).

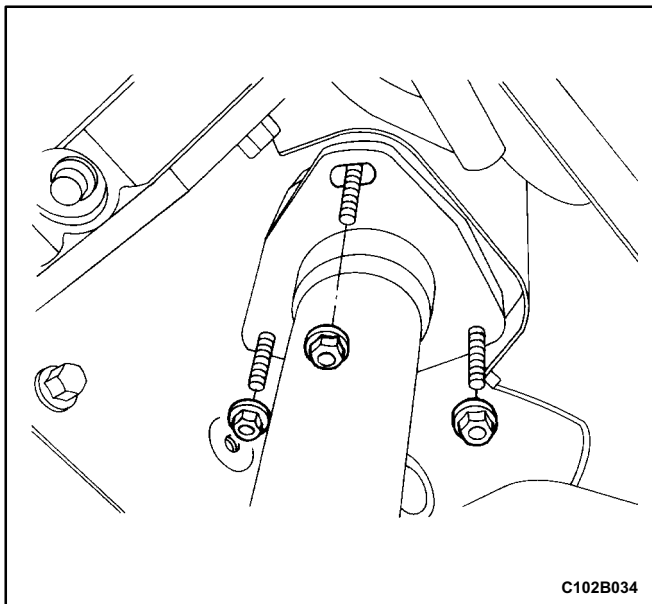


5. Install the oil pan flange-to-transaxle retaining bolts.

Tighten

Tighten the oil pan flange-to-transaxle retaining bolts to 40 N•m (30 lb•ft).

6. Install the center member. Refer to *Section 9N, Frame and Underbody*.



7. Install the exhaust flex pipe.

8. Install the exhaust flex pipe retaining nuts to the exhaust manifold.

Tighten

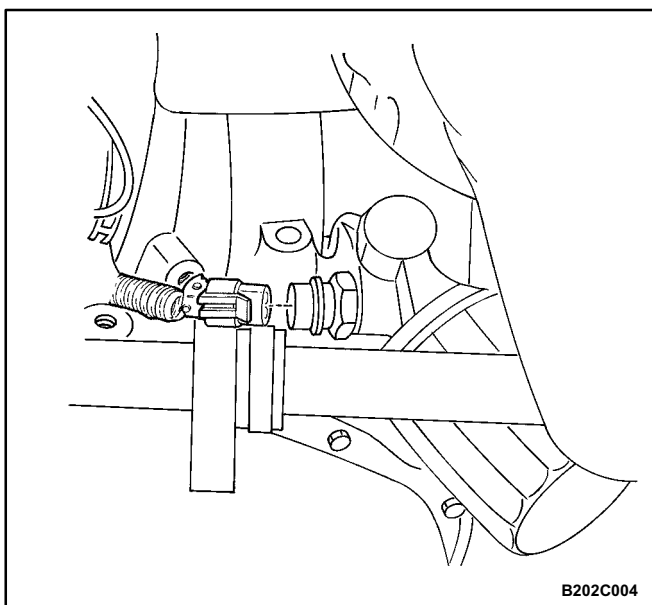
Tighten the exhaust flex pipe-to-exhaust manifold retaining nuts to 22 N•m (16 lb•ft).

9. Install the exhaust flex pipe retaining nuts to the catalytic converter.

Tighten

Tighten the exhaust flex pipe-to-catalytic converter retaining nuts to 30 N•m (22 lb•ft).

10. Connect the negative battery cable.
11. Refill the engine crankcase with engine oil.



OIL PUMP

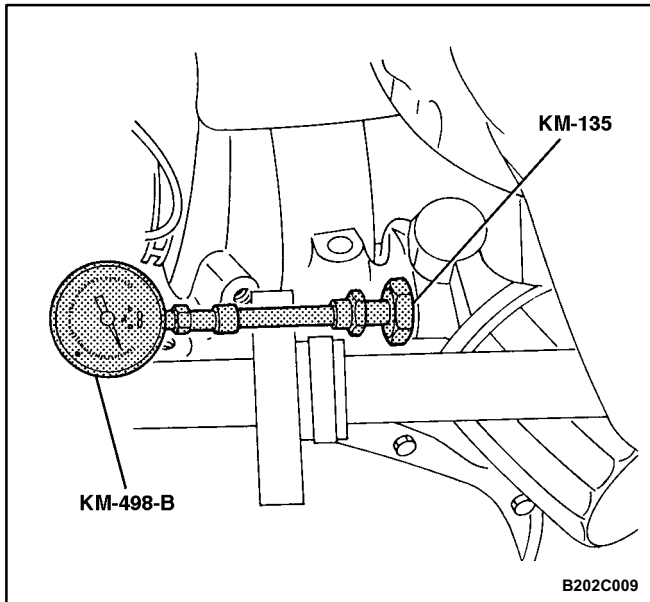
Tools Required

KM-498-B Pressure Gauge

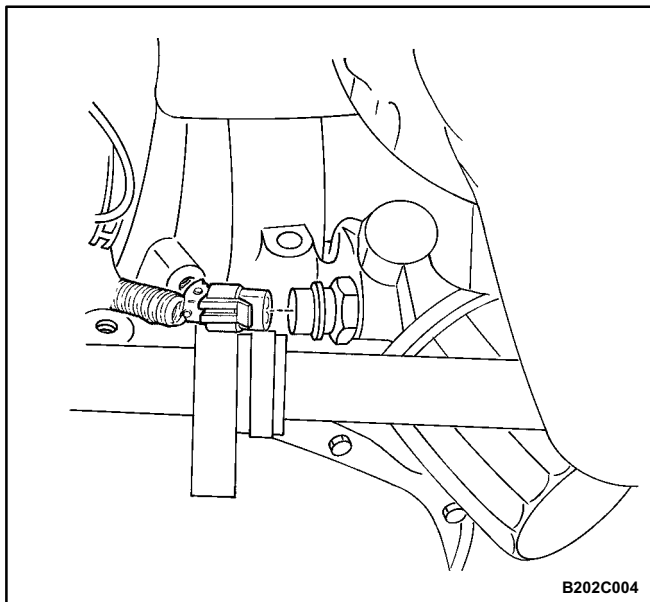
KM-135 Adapter

Engine Oil Pressure Inspection Procedure

1. Remove the front right wheel well splash shield. Refer to *Section 9R, Body Front End*.
2. Remove the oil pressure switch connector.



3. Install the adapter KM-135 in place of the oil pressure switch.
4. Connect the pressure gauge KM-498-B to the adapter.
5. Start the engine and check the oil pressure at idle speed and an engine temperature of 80°C (176°F). The minimum oil pressure should be 30 kPa (0.3 bar).
6. Stop the engine and remove the oil pressure gauge KM-498-B and the adapter KM-135.

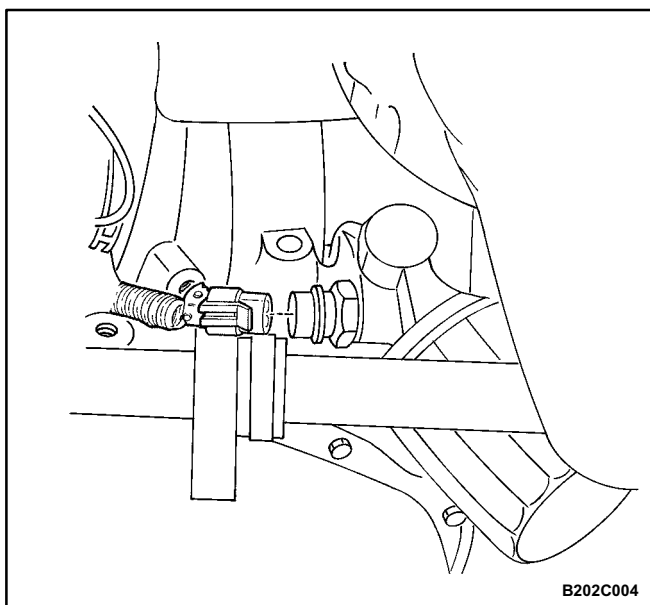


7. Install the oil pressure switch.

Tighten

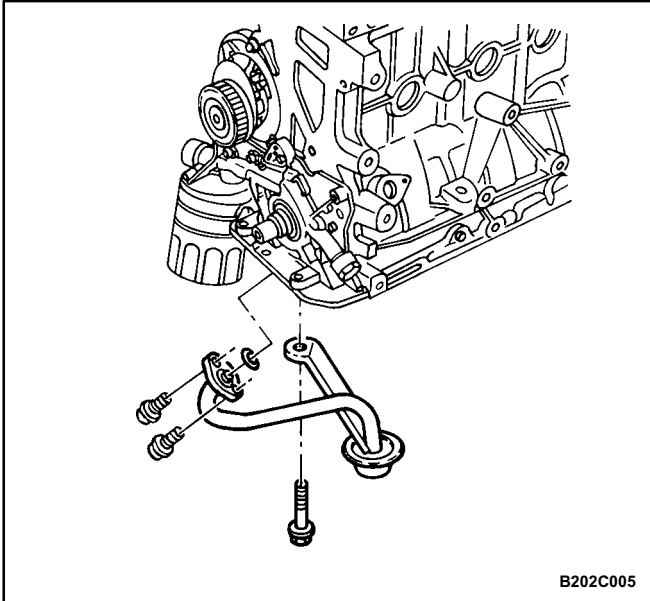
Tighten the oil pressure switch to 40 N•m (30 lb•ft).

8. Connect the electrical connector to the oil pressure switch.
9. Install the front right wheel well splash shield. Refer to *Section 9R, Body Front End*.
10. Check the oil level and add oil to the full mark.

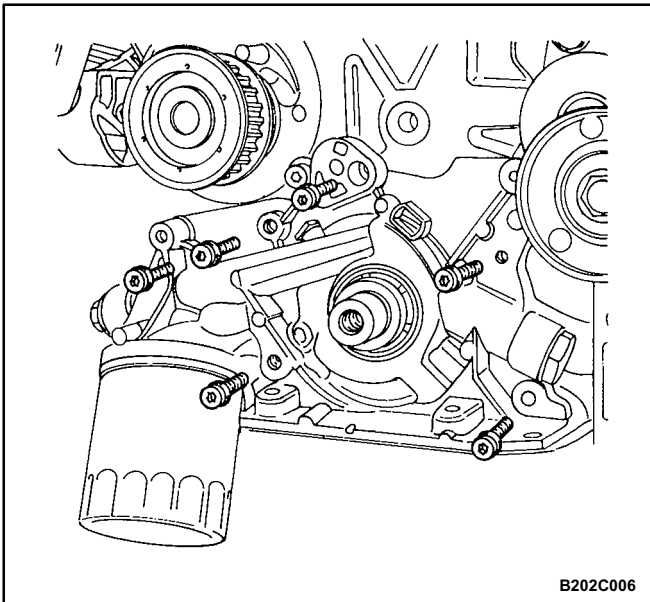


Removal Procedure

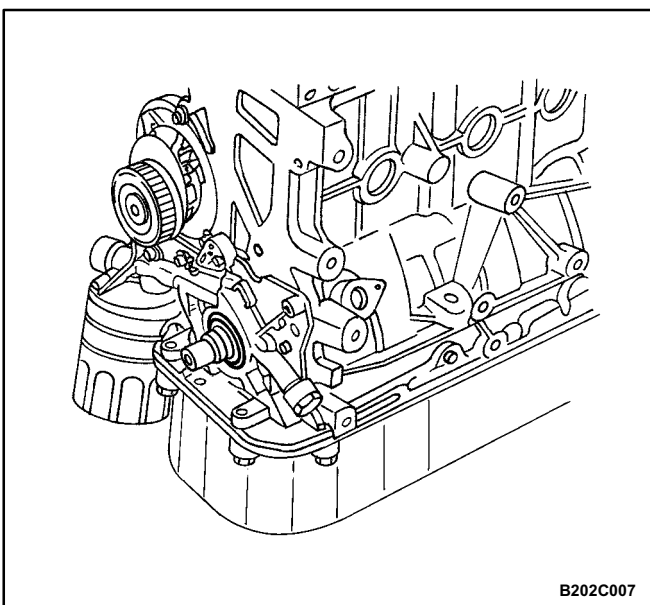
1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to "Timing Belt" in this section.
3. Remove the rear timing belt cover. Refer to "Rear Timing Belt Cover" in this section.
4. Disconnect the oil pressure switch connector.



5. Remove the oil pan. Refer to "Oil Pan" in this section.
6. Remove the oil pump pickup tube and the support bracket bolts.
7. Remove the oil pump pickup tube.

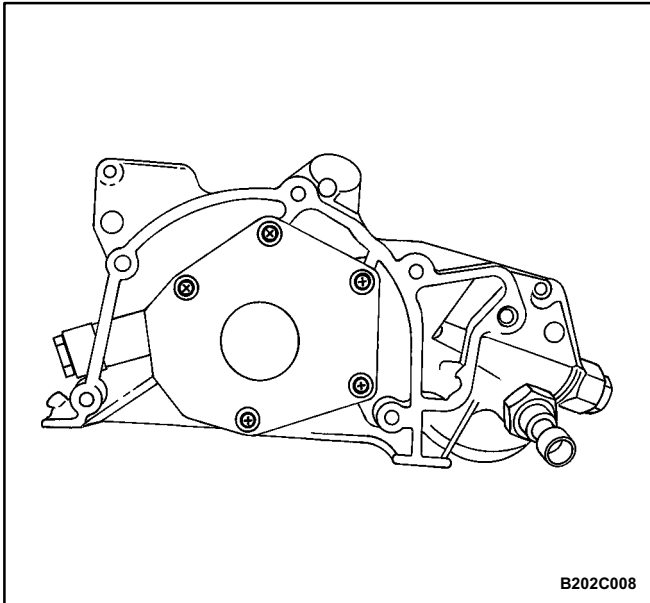


8. Remove the oil pump retaining bolts.
9. Carefully separate the oil pump and the gasket from the engine block.
10. Remove the oil pump.

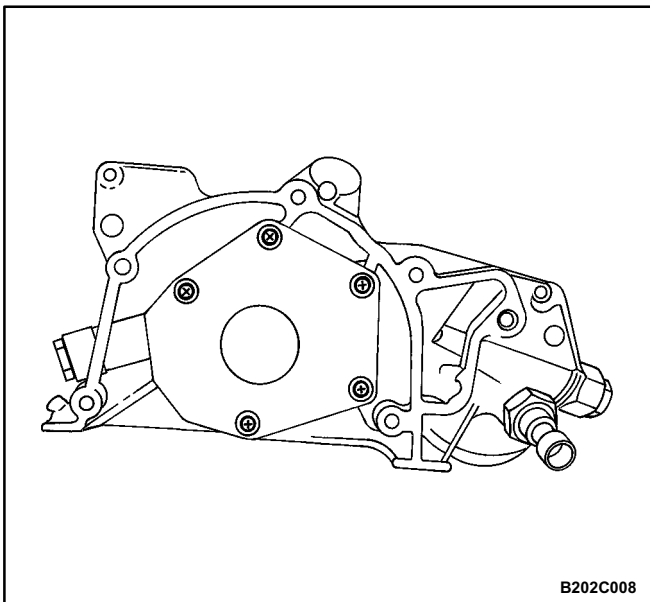


Inspection Procedure

1. Clean the oil pump and the engine block gasket mating surfaces.
2. Remove the safety relief valve bolt.
3. Remove the safety relief valve and the spring.
4. Remove the oil pump-to-crankshaft seal.



5. Remove the oil pump rear cover bolts.
6. Remove the rear cover.



7. Clean the oil pump housing and all of the parts.
8. Inspect all of the parts for signs of wear. Refer to "Engine Specifications" in this section.
9. Coat all of the oil pump parts with clean engine oil and reinstall the parts.

Notice: Pack the oil pump gear cavity with petroleum jelly to ensure an oil pump prime, or engine damage could result.

10. Apply Loctite[®] 242 to the rear cover bolts, and install the cover and the bolts.

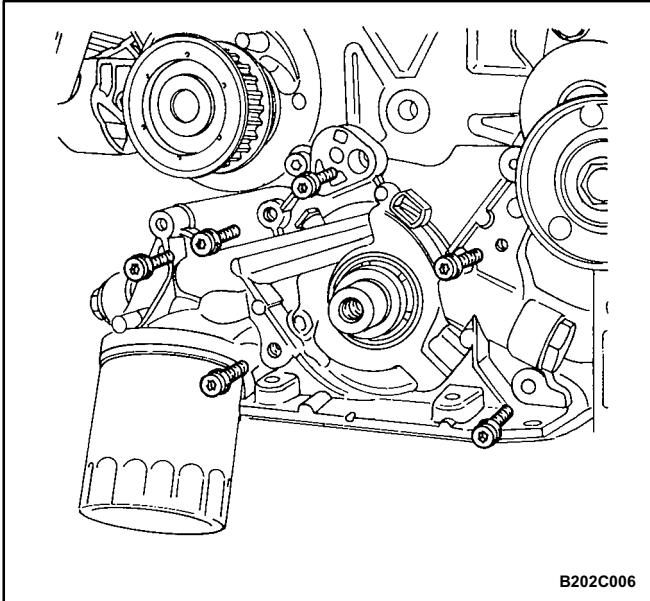
Tighten

Tighten the oil pump rear cover bolts to 6 N•m (53 lb•in).

11. Install the safety relief valve, the spring, the washer, and the bolt.

Tighten

Tighten the oil pump safety relief valve bolt to 30 N•m (22 lb•ft).

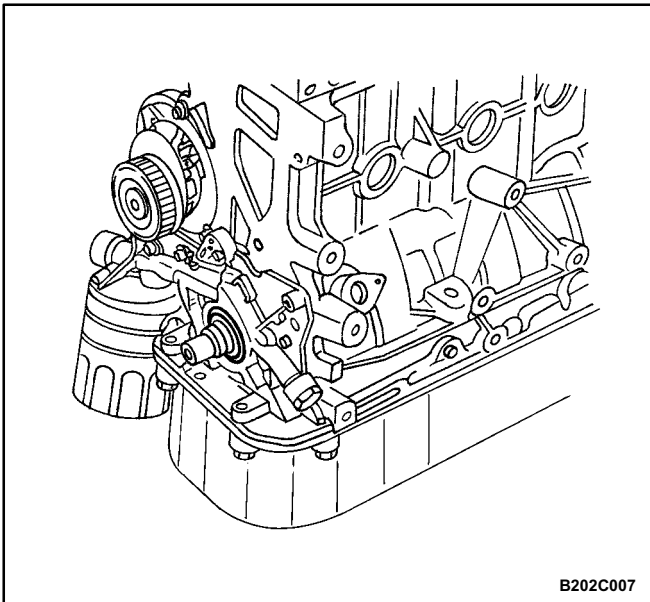


Installation Procedure

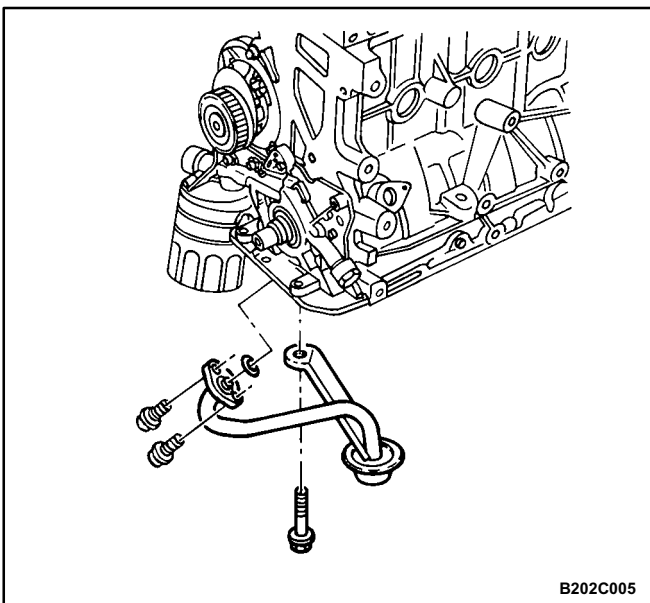
1. Apply Loctite® 242 to the oil pump bolts and room temperature vulcanizing (RTV) sealant to the new oil pump gasket.
2. Install the gasket to the oil pump, and install the oil pump to the engine block with the bolts.

Tighten

Tighten the oil pump retaining bolts to 10 N•m (89 lb•in).



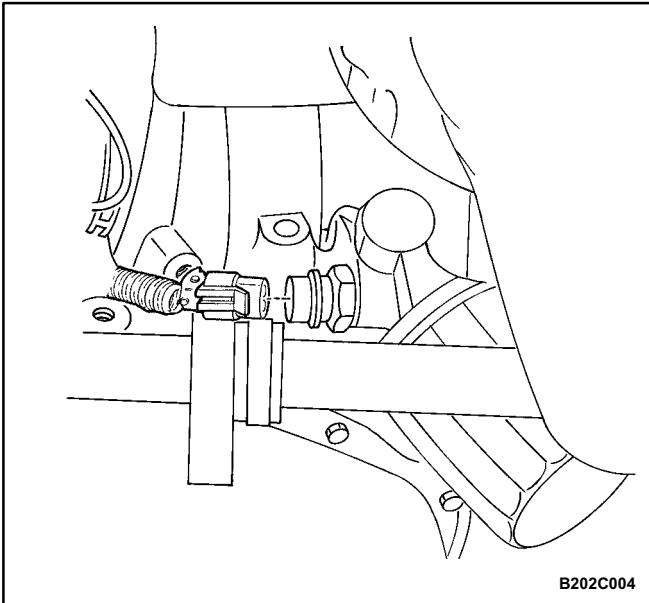
3. Install a new oil pump-to-crankshaft shaft seal. Coat the lip of the seal with a thin coat of grease.



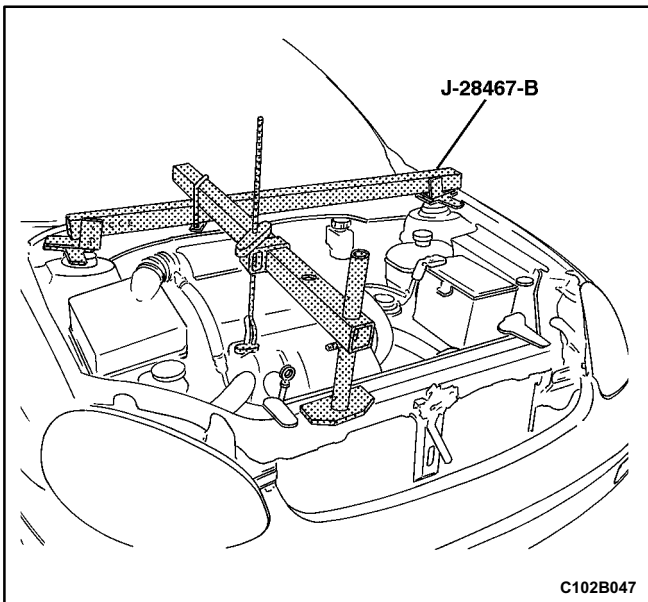
4. Coat the threads of the oil pump pickup tube and the support bracket bolts with Loctite® 242.
5. Install the oil pump pickup tube and the bolts.

Tighten

Tighten the oil pump pickup tube and the support bracket bolts to 10 N•m (89 lb•in).



6. Install the oil pan. Refer to "Oil Pan" in this section.
7. Connect the oil pressure switch connector.
8. Install the rear timing belt cover. Refer to "Rear Timing Belt Cover" in this section.
9. Install the timing belt. Refer to "Timing Belt" in this section.
10. Connect the negative battery cable.



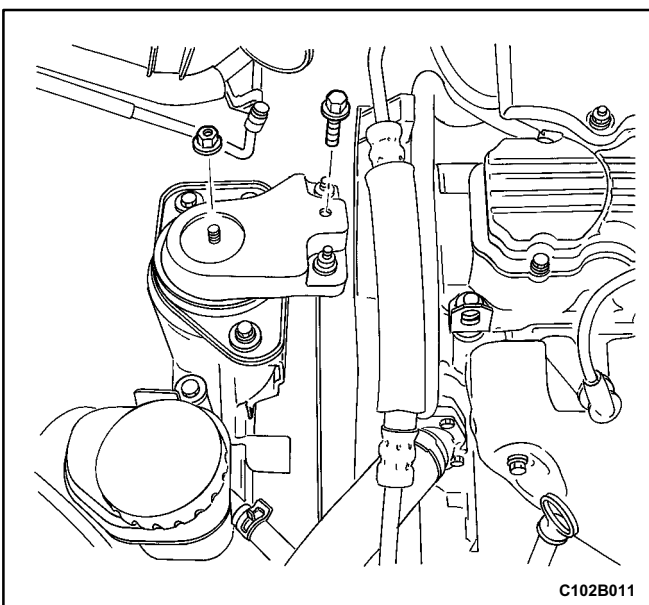
ENGINE MOUNT, RIGHT SIDE

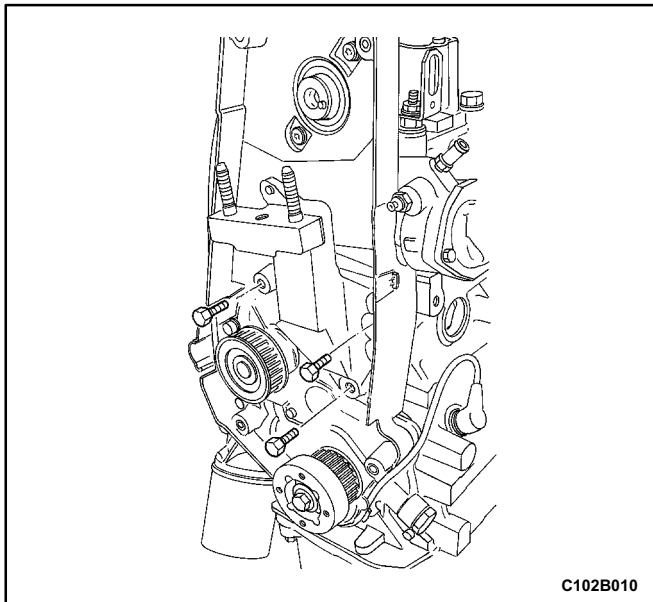
Tools Required

J28467B Engine Assembly Support Fixture

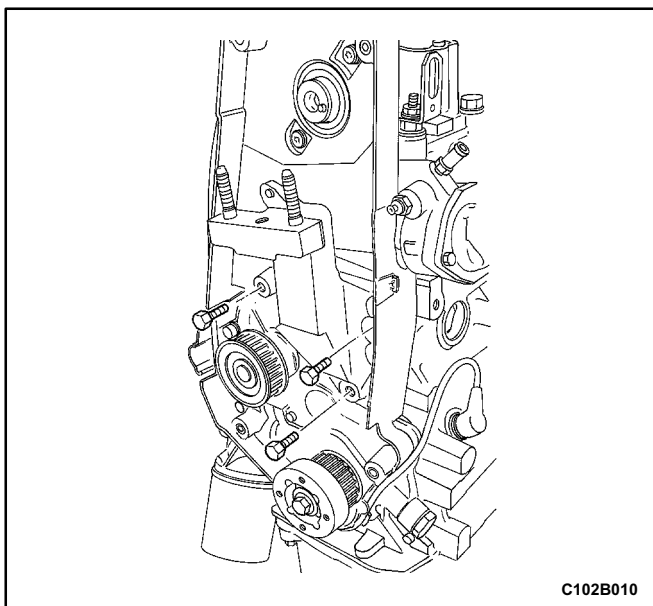
Removal Procedure

1. Disconnect the negative battery cable.
2. Support the engine assembly using the engine assembly support fixture J-28467-B.
3. Remove the right front wheel well splash shield. Refer to *Section 9R, Body Front End*.
4. Remove the air filter housing retaining bolts.
5. Remove the air filter housing.
6. Remove the right side engine mount bracket retaining bolts/nuts.
7. Remove the right side engine mount bracket.
8. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.
9. Remove the timing belt. Refer to "Timing Belt" in this section.
10. Remove the timing belt automatic tensioner bolt.
11. Remove the timing belt automatic tensioner.





12. Remove the right side engine mount retaining bolts/nuts.
13. Remove the right side engine mount.

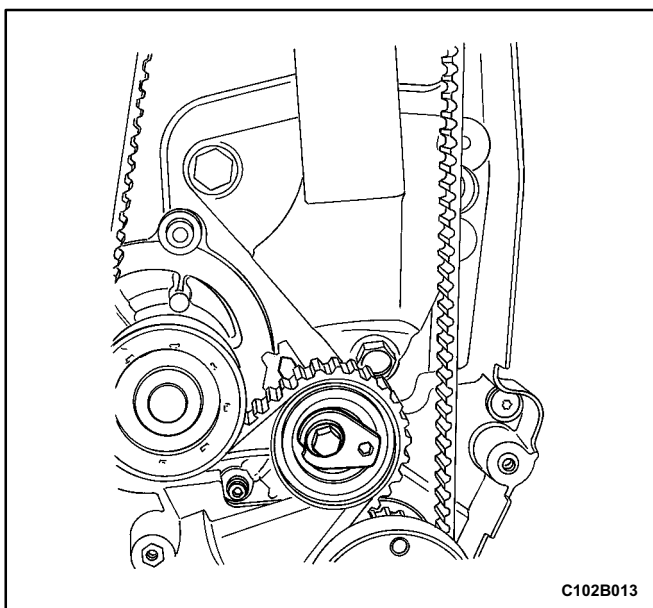


Installation Procedure

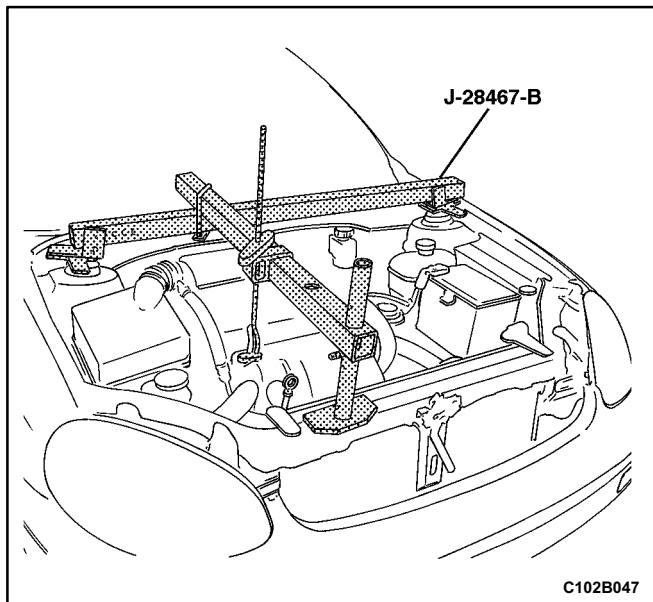
1. Install the right side engine mount.
2. Install the right side engine mount retaining bolts/nuts.

Tighten

Tighten the right side engine mount retaining bolts/nuts to 60 N•m (44 lb•ft).



3. Install the timing belt automatic tensioner and the retaining bolt.
4. Install the timing belt. Refer to "Timing Belt" in this section.



5. Install the right front wheel well splash shield. Refer to *Section 9R, Body Front End*.
6. Install the right side engine mount bracket and the retaining bolts/nuts.

Tighten

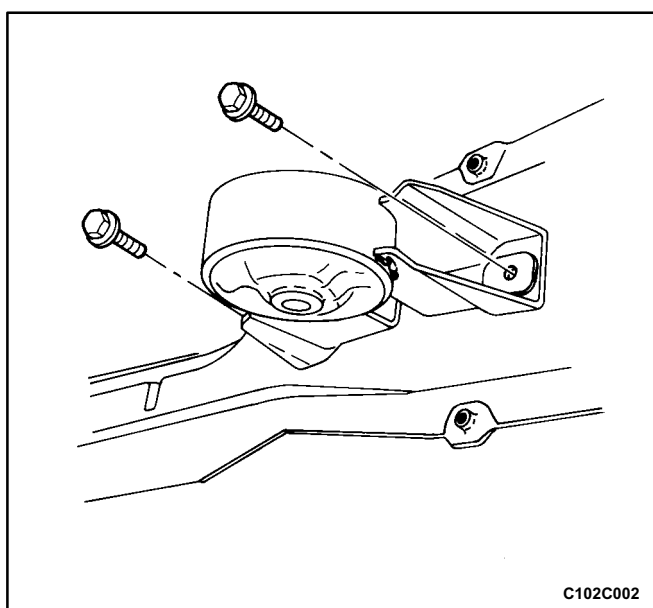
Tighten the right side engine mount bracket retaining bolts/nuts to 60 N•m (44 lb•ft).

7. Remove engine assembly support fixture J-28467-B.
8. Install the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.
9. Install the air filter housing and the bolts.

Tighten

Tighten the air filter housing bolts to 8 N•m (71 lb•in).

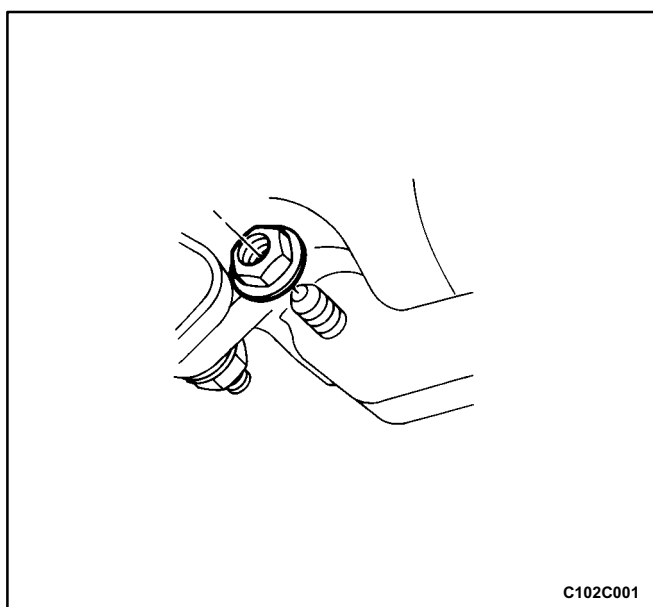
10. Connect the negative battery cable.



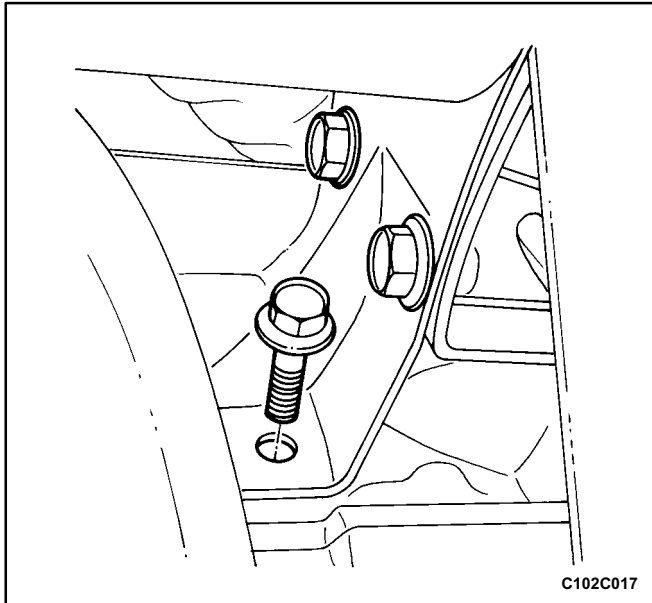
ENGINE MOUNT, FORWARD

Removal Procedure

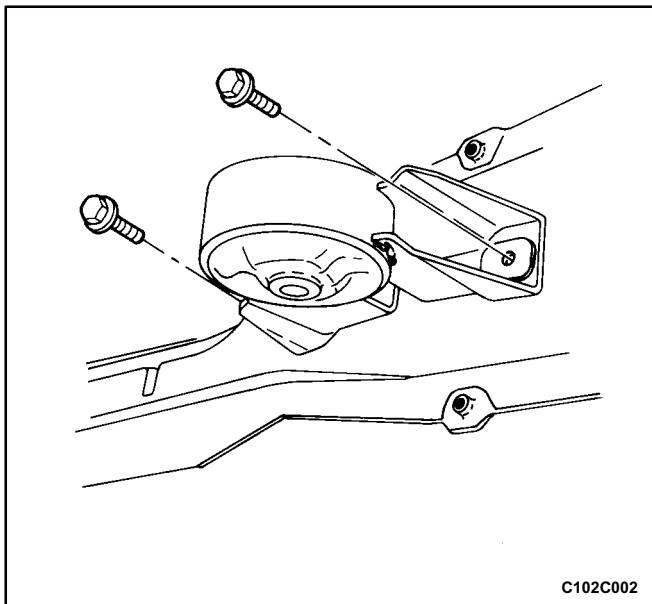
1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Remove the center member. Refer to *Section 9N, Frame and Underbody*.
4. Remove the bolts that secure the forward engine mount to the center member.
5. Remove the forward engine mount.



6. Remove the forward engine mount bracket-to-engine block nuts.



7. Remove the forward engine mount bracket-to-engine block bolts.
8. Remove the forward engine mount bracket.

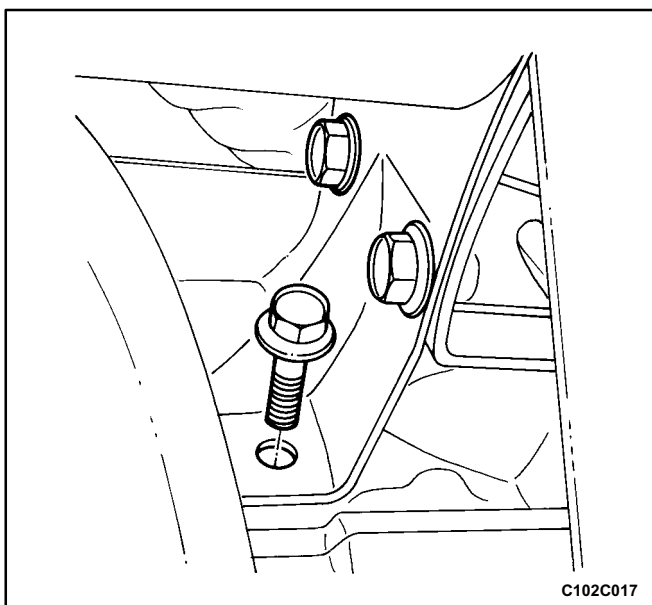


Installation Procedure

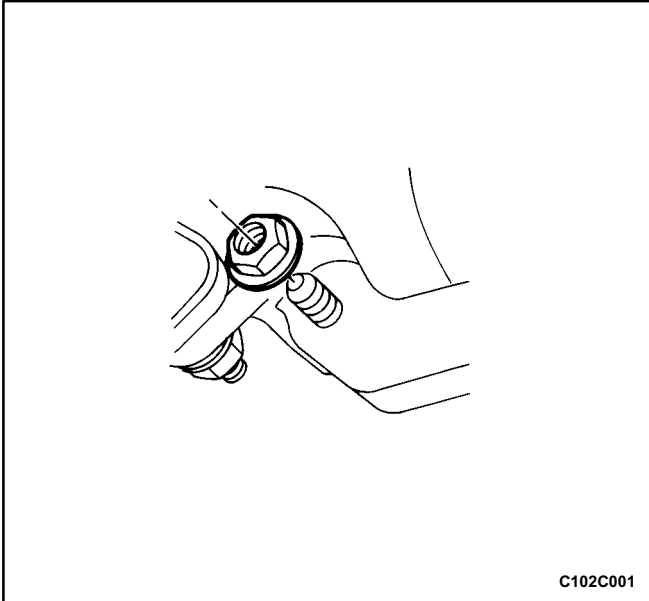
1. Install the forward engine mount to the center member with the bolts and the nuts.

Tighten

Tighten the forward engine mount bolts and the nuts to 65 N•m (48 lb•ft).



2. Install the forward engine mount bracket-to-engine block bolts.



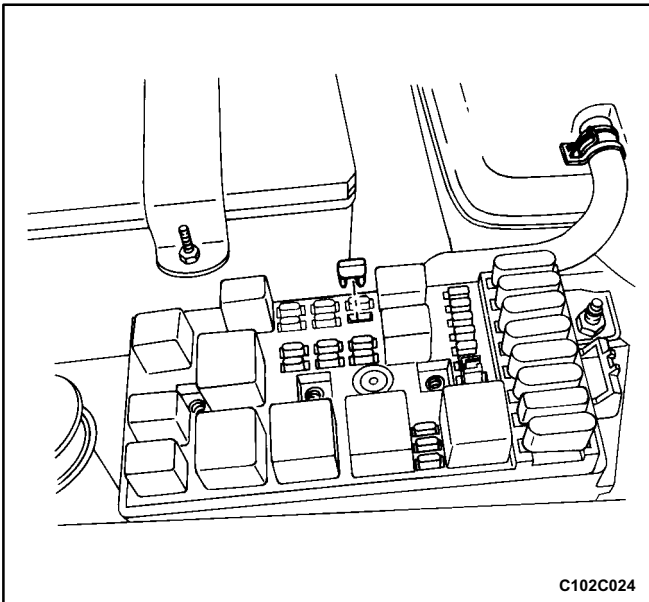
C102C001

3. Install the forward engine mount bracket-to-engine block nuts.

Tighten

Tighten the forward engine mount bracket-to-engine block bolts and the nuts to 90 N•m (66 lb•ft).

4. Install the center member. Refer to *Section 9N, Frame and Underbody*.
5. Lower the vehicle.
6. Connect the negative battery cable.

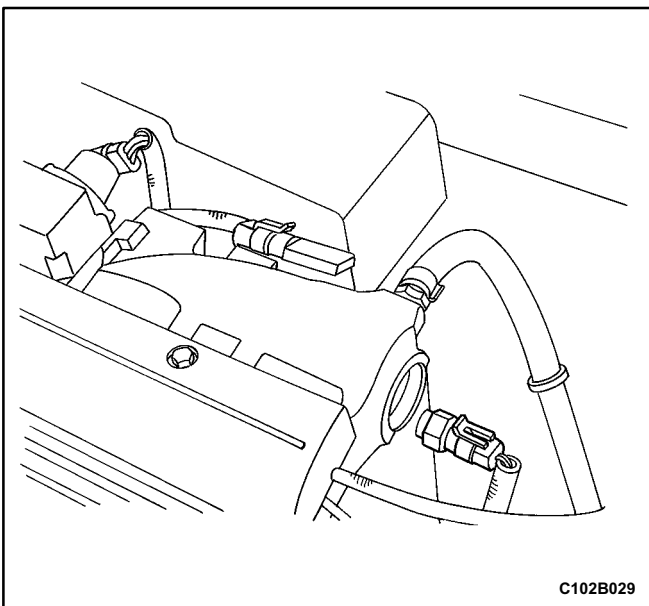


C102C024

INTAKE MANIFOLD

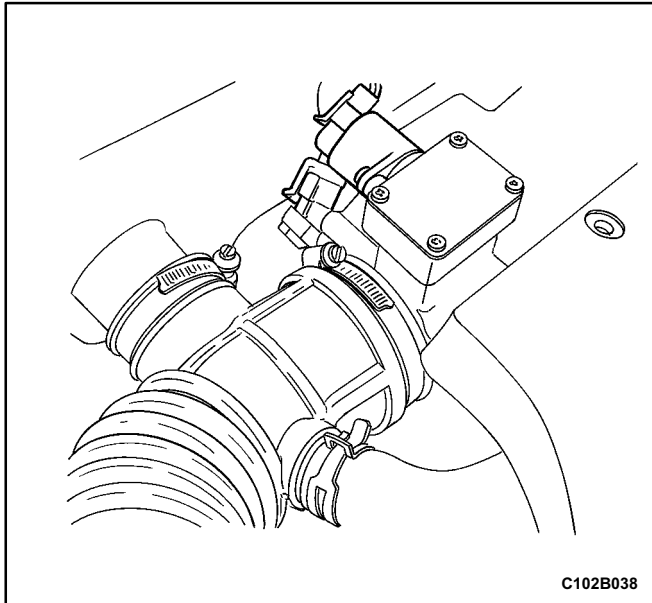
Removal Procedure

1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine for 10seconds to rid the fuel system of fuel pressure.
3. Disconnect the negative battery cable.
4. Disconnect the canister purge solenoid vacuum hose and connector.
5. Drain the engine coolant. Refer to *Section 1D, Engine Cooling*.

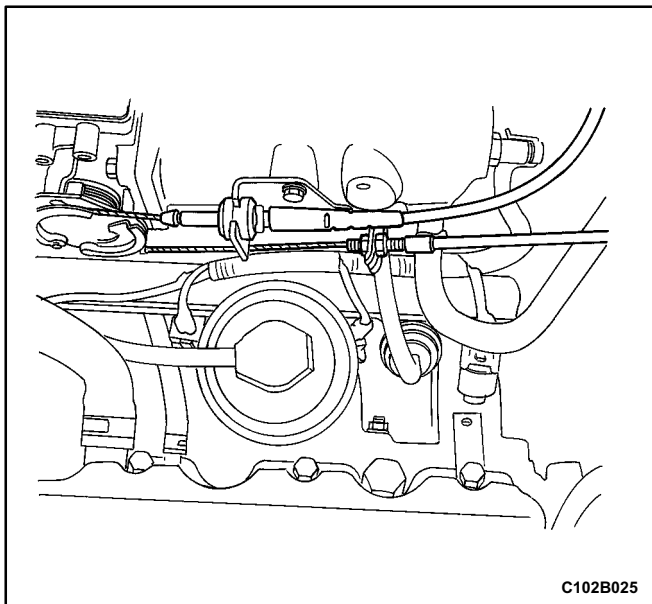


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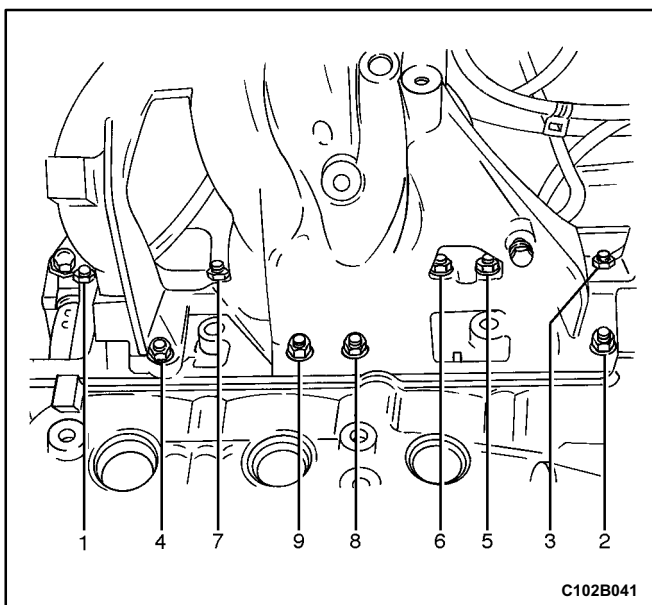
6. Disconnect the manifold air temperature sensor connector.
7. Disconnect the air intake tube from the throttle body.



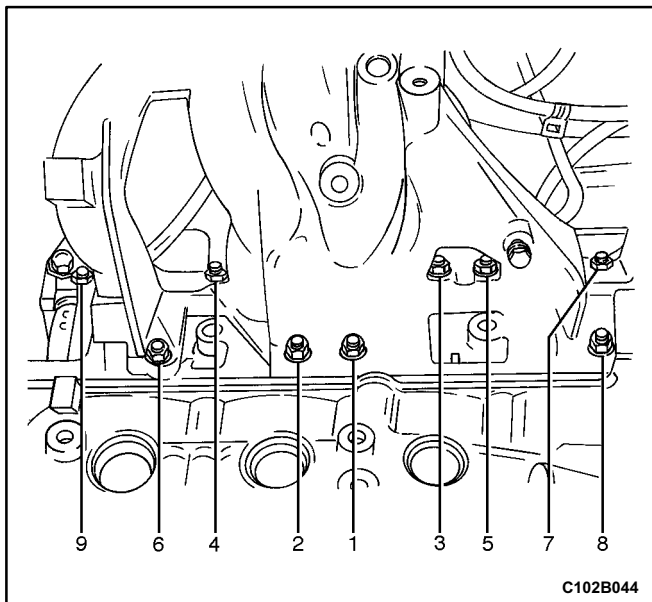
8. Disconnect the idle air control valve connector.
9. Disconnect the throttle position sensor connector.
10. Disconnect the manifold absolute pressure (MAP) sensor connector.
11. Disconnect the coolant hoses at the throttle body.



12. Disconnect all of the necessary vacuum hoses, including the vacuum hose at the fuel pressure regulator and the brake booster vacuum hose at the intake manifold.
13. Disconnect the throttle cable from the throttle body and the intake manifold.
14. Remove the throttle cable bracket bolts from the intake manifold.
15. Remove the throttle cable bracket.
16. Remove the fuel rail and injector cover as an assembly. Refer to *Section 1F, Engine Controls*.
17. Remove the alternator and the support bracket. Refer to *Section 1E, Engine Electrical*.



18. Remove the intake manifold retaining nuts in the sequence shown.
19. Remove the intake manifold.
20. Remove the intake manifold gasket.
21. Clean the sealing surfaces of the intake manifold and the cylinder head.



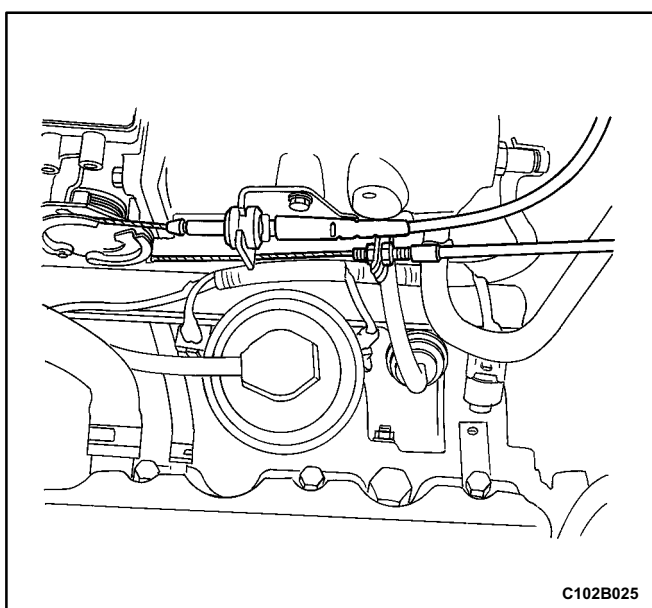
Installation Procedure

1. Install the intake manifold gasket.
2. Install the intake manifold.
3. Install the intake manifold retaining nuts in the sequence shown.

Tighten

Tighten the intake manifold retaining nuts to 18 N•m (13 lb•ft).

4. Install the alternator and the support bracket. Refer to *Section 1E, Engine Electrical*.

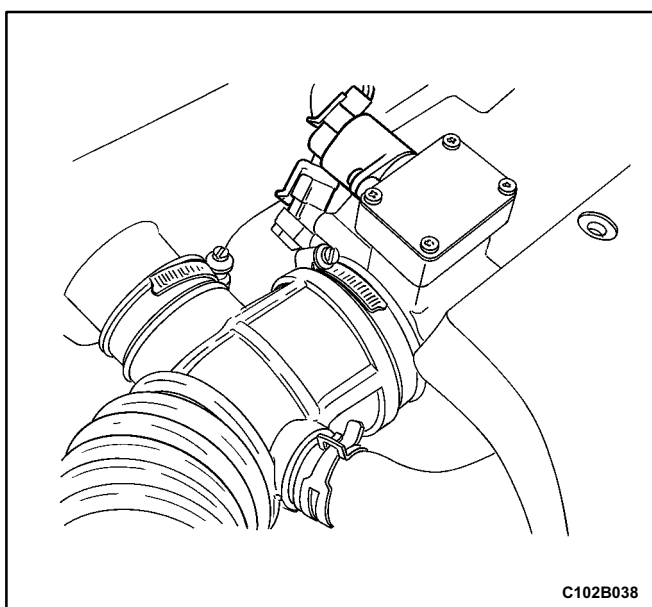


5. Install the fuel rail and injector cover as an assembly. Refer to *Section 1F, Engine Controls*.
6. Install the throttle cable bracket.
7. Install the throttle cable bracket bolts.

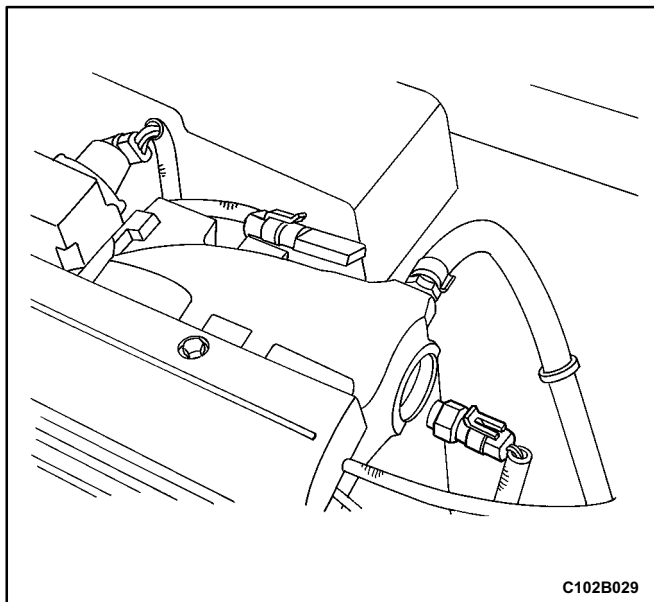
Tighten

Tighten the throttle cable bracket bolts to 8 N•m (71 lb•in).

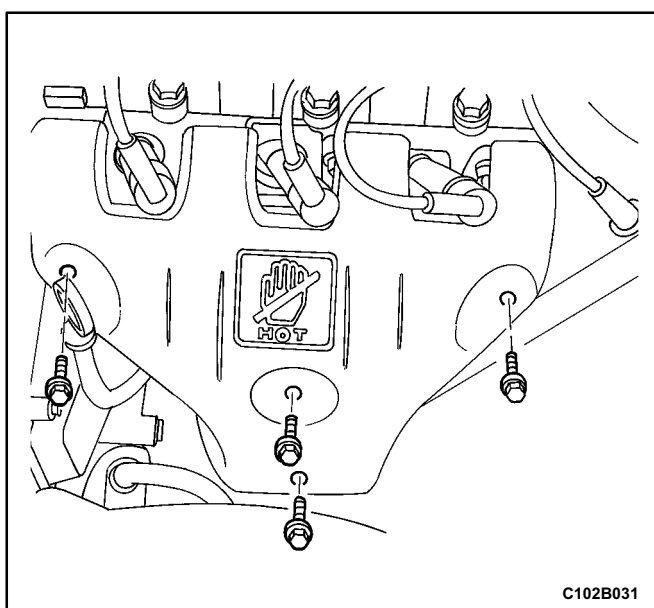
8. Connect the throttle cable to the intake manifold and the throttle body.
9. Connect all of the necessary vacuum lines that were previously disconnected.



10. Connect the MAP sensor connector.
11. Connect the coolant hoses to the throttle body.
12. Connect the idle air control valve connector.
13. Connect the throttle position sensor connector.



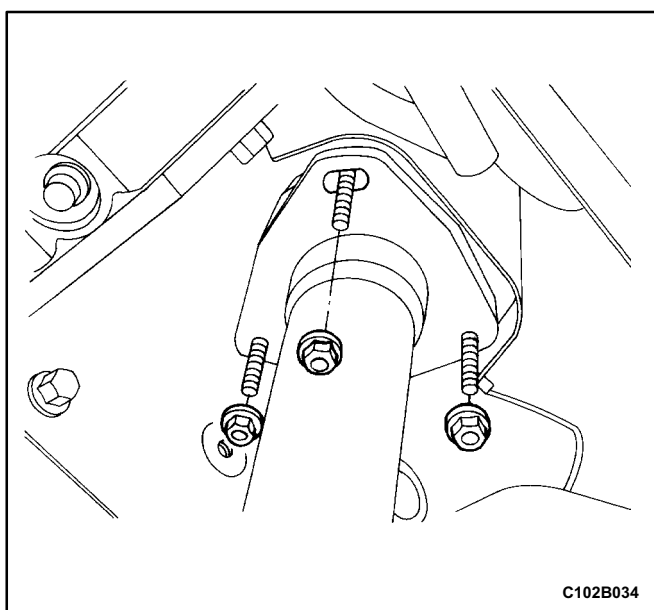
14. Connect the air intake tube to the throttle body.
15. Connect the manifold air temperature sensor connector.
16. Connect the canister purge solenoid vacuum hose and connector.
17. Install the fuel pump fuse.
18. Connect the negative battery cable.
19. Refill the engine cooling system. Refer to *Section 1D, Engine Cooling*.



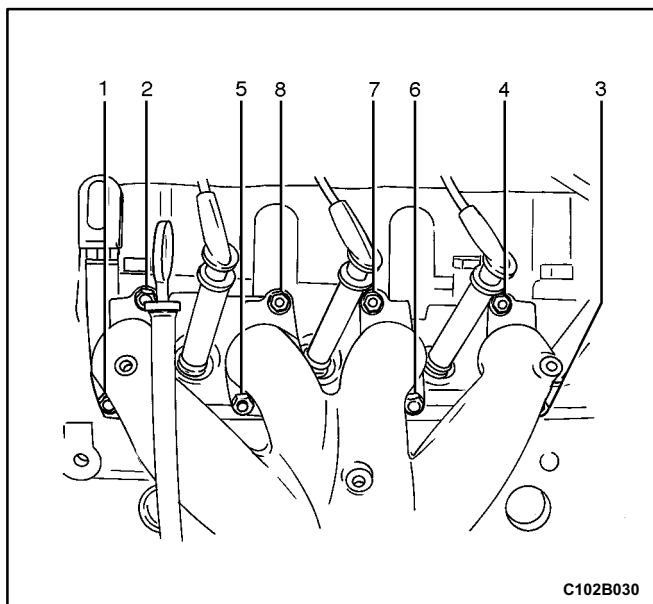
EXHAUST MANIFOLD

Removal Procedure

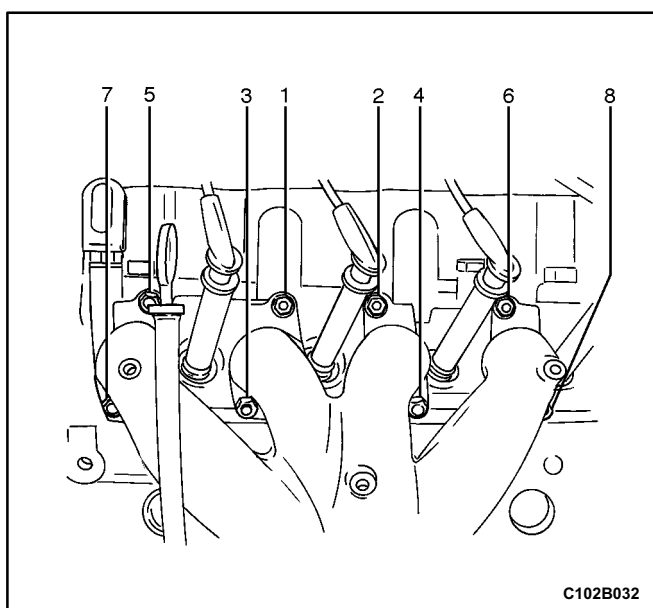
1. Disconnect the negative battery cable.
2. Disconnect the oxygen sensor connector.
3. Remove the exhaust manifold heat shield bolts.
4. Remove the exhaust manifold heat shield.



5. Remove the exhaust flex pipe retaining nuts from the exhaust manifold studs.



6. Remove the exhaust manifold retaining nuts in the sequence shown.
7. Remove the exhaust manifold.
8. Remove the exhaust manifold gasket.
9. Clean the sealing surfaces of the exhaust manifold and the cylinder head.

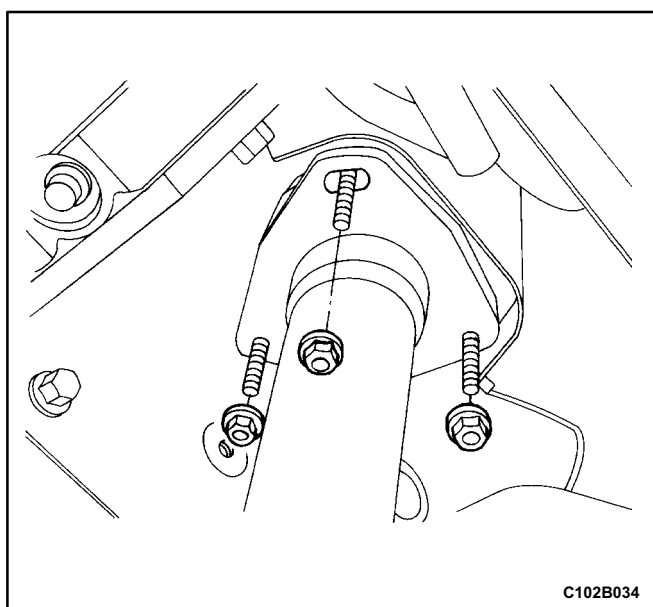


Installation Procedure

1. Install the exhaust manifold gasket.
2. Install the exhaust manifold.
3. Install the eight exhaust manifold retaining nuts and tighten in the sequence shown.

Tighten

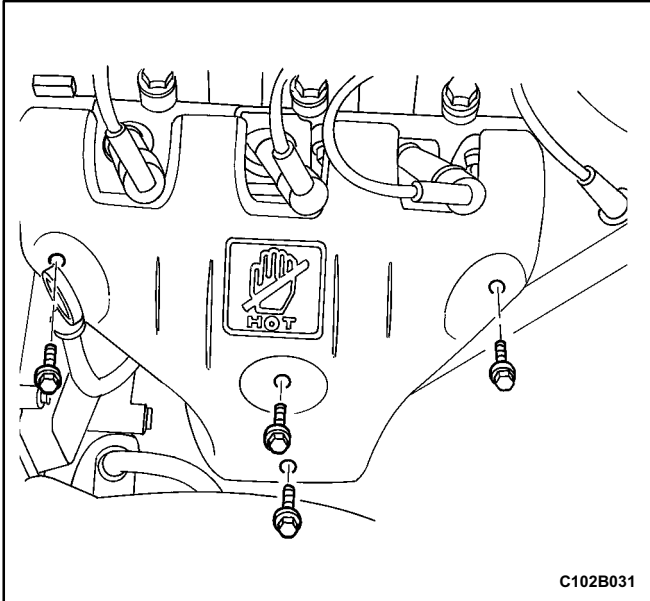
Tighten the exhaust manifold retaining nuts to 15 N•m (11 lb•ft).



4. Install the exhaust flex pipe retaining nuts to the exhaust manifold studs.

Tighten

Tighten the three exhaust flex pipe-to-exhaust manifold retaining nuts to 22 N•m (16 lb•ft).



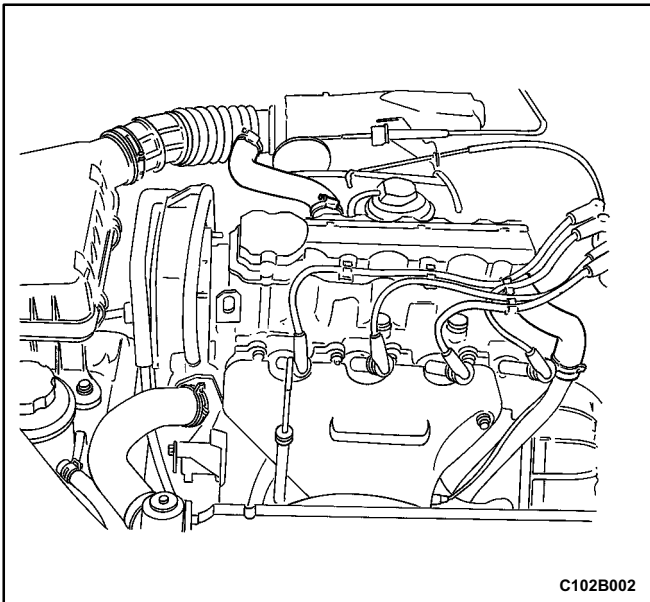
C102B031

5. Install the manifold heat shield.
6. Install the exhaust manifold heat shield bolts.

Tighten

Tighten the exhaust manifold heat shield bolts to 8N•m (71 lbf•ft).

7. Connect the oxygen sensor connector.
8. Connect the negative battery cable.

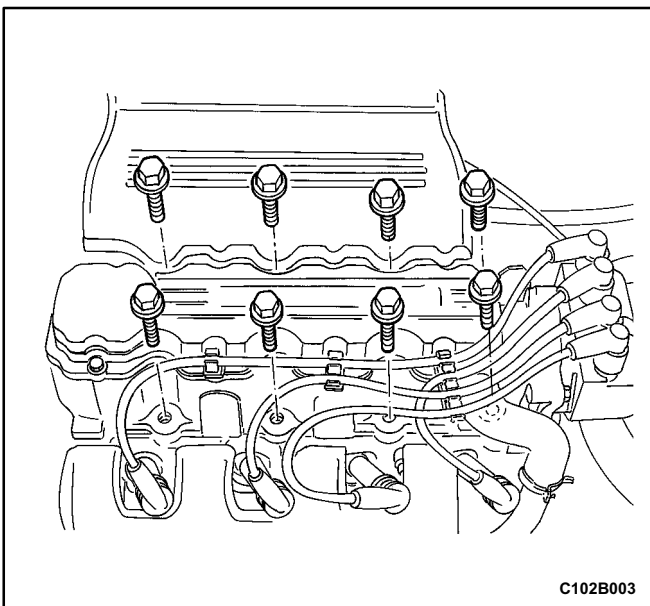


C102B002

CAMSHAFT GEAR

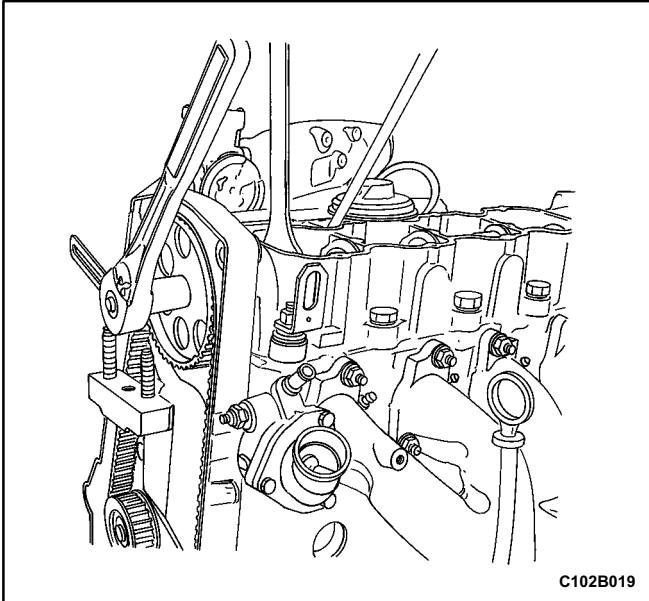
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to "Timing Belt" in this section.
3. Disconnect the ignition wires from the spark plugs.
4. Disconnect the crankcase breather tubes from the valve cover.



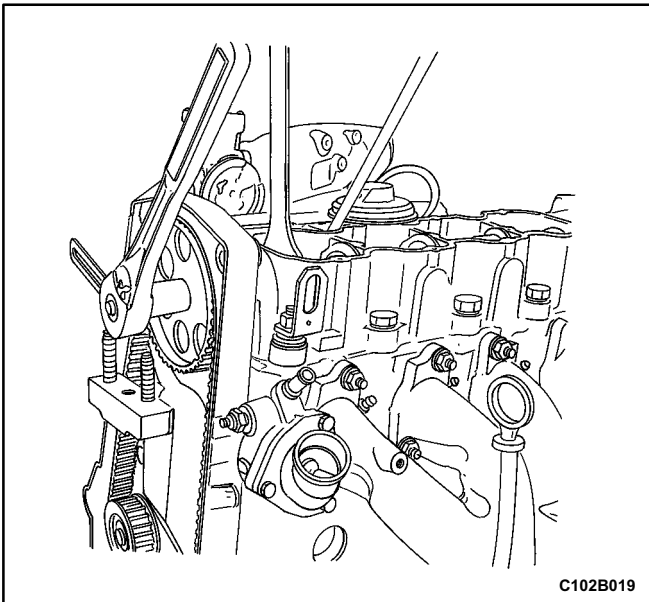
C102B003

5. Remove the valve cover bolts.
6. Remove the valve cover and the valve cover gasket.



Notice: Take extreme care to prevent any scratches, nicks or damage to the camshaft. Such damage can cause premature engine wear.

7. While holding the camshaft firmly in place, remove the camshaft gear retaining bolt.
8. Remove the camshaft gear.



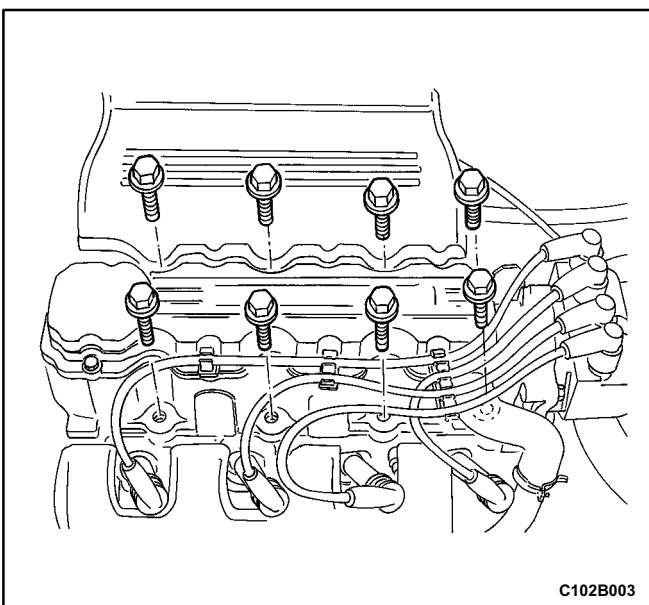
Installation Procedure

Notice: Take extreme care to prevent any scratches, nicks or damage to the camshaft. Such damage can cause premature engine wear.

1. Install the camshaft gear.
2. While holding the camshaft firmly in place, install the camshaft gear retaining bolt.

Tighten

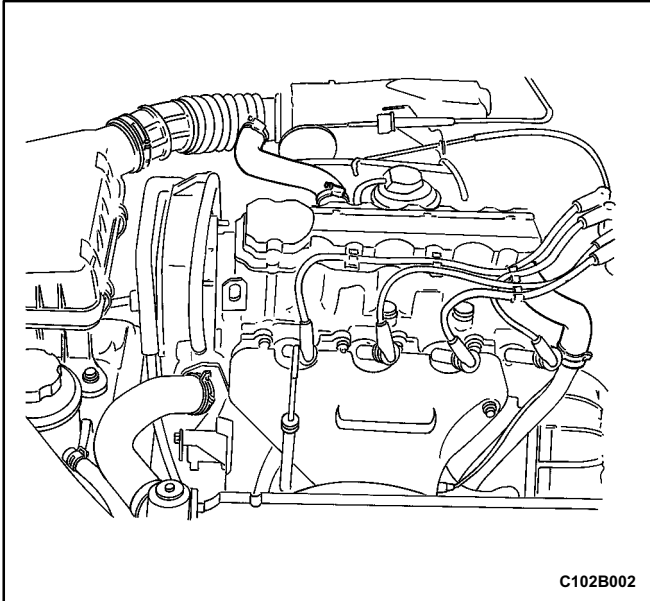
Tighten the camshaft gear retaining bolt to 45 N•m (33 lb•ft).



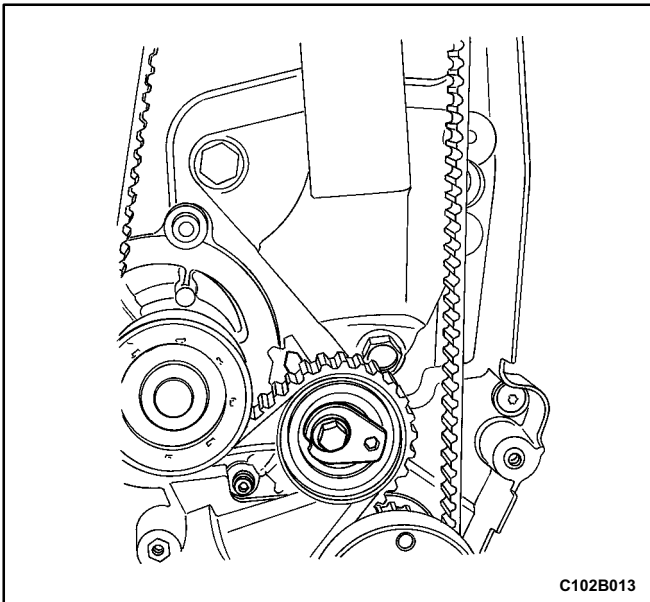
3. Install the valve cover and the valve cover gasket.
4. Install the valve cover bolts.

Tighten

Tighten the valve cover bolts to 8 N•m (71 lb•in).



5. Connect the crankcase breather tubes to the valve cover.
6. Connect the ignition wires to the spark plugs.
7. Install the timing belt. Refer to "Timing Belt" in this section.
8. Connect the negative battery cable.



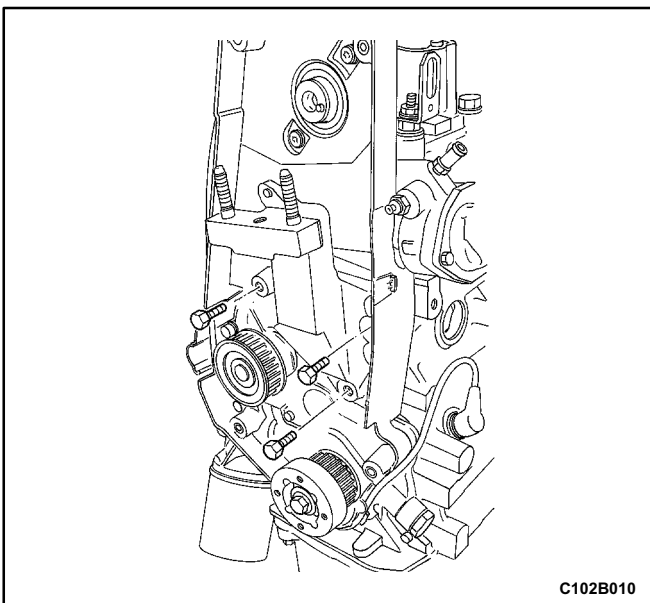
REAR TIMING BELT COVER

Tools Required

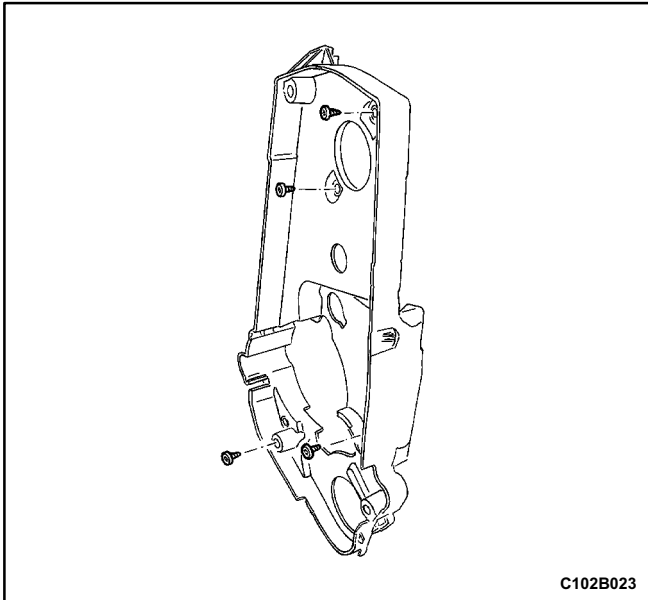
KM470B Angular Torque Gauge

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to "Timing Belt" in this section.
3. Remove the camshaft gear. Refer to "Camshaft Gear" in this section.
4. Remove the timing belt automatic tensioner bolt.
5. Remove the timing belt automatic tensioner.

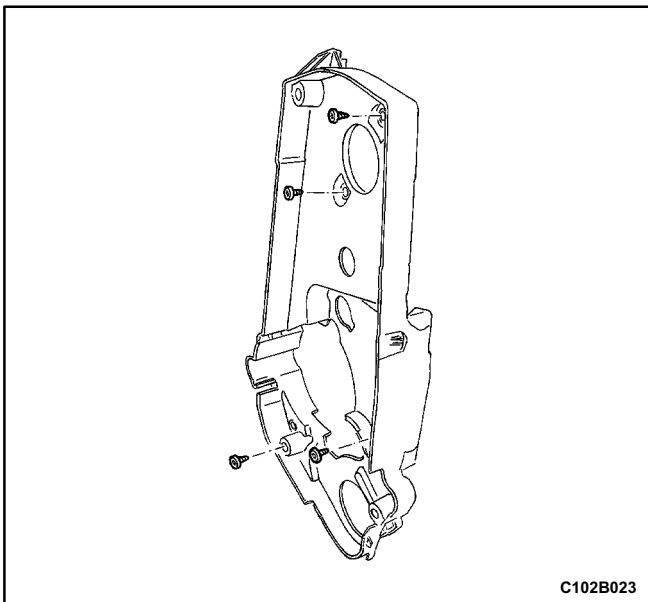


6. Remove the right side engine mount retaining bolts/nuts.
7. Remove the right side engine mount.
8. Remove the crankshaft gear bolt.
9. Remove the crankshaft gear.
10. Remove the knock sensor wire from its track.



C102B023

11. Remove the rear timing belt cover bolts.
12. Remove the rear timing belt cover.



C102B023

Installation Procedure

1. Install the rear timing belt cover.
2. Install the rear timing belt cover bolts.

Tighten

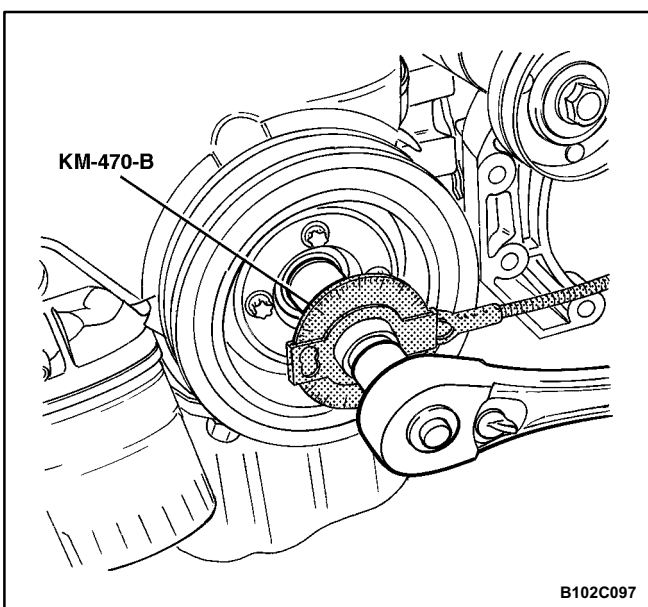
Tighten the rear timing belt cover bolts to 6 N•m (53 lb•in).

3. Install the right side engine mount and retaining bolts/nuts.

Tighten

Tighten the right side engine mount retaining bolts/nuts to 60 N•m (44 lb•ft).

4. Route the knock sensor wire into its track.

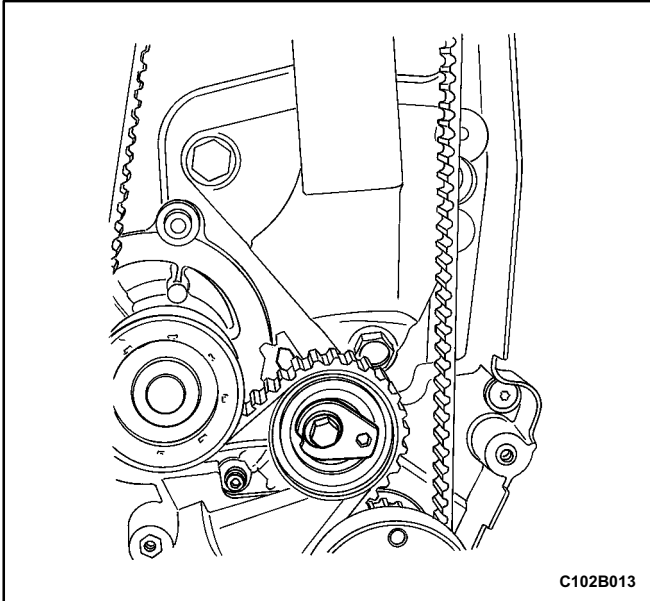


B102C097

5. Install the crankshaft timing belt drive gear and the bolt.

Tighten

Tighten the crankshaft timing belt drive gear bolt to 95 N•m (70 lb•ft). Use the angular torque gauge KM-470-B to tighten the bolt another 30 degrees plus 15 degrees.

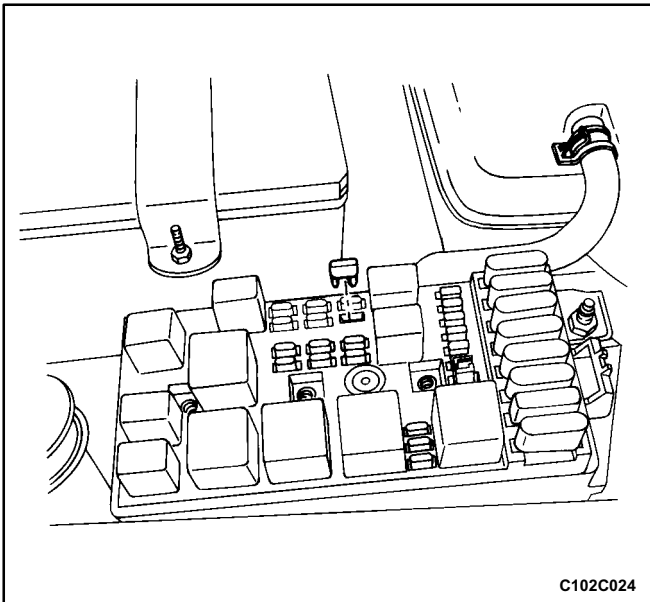


6. Install the timing belt automatic tensioner and the bolt.

Tighten

Tighten the timing belt automatic tensioner bolt to 25 N•m (18 lb•ft).

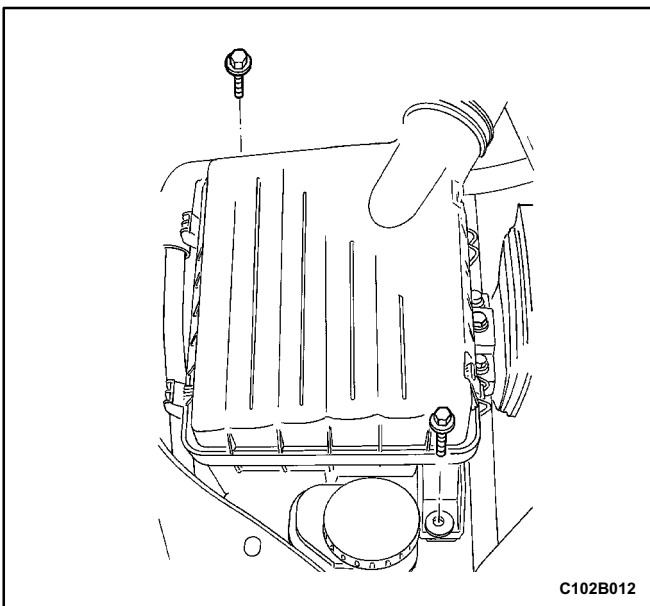
7. Install the camshaft gear. Refer to "Camshaft Gear" in this section.
8. Install the timing belt and the timing belt cover. Refer to "Timing Belt" in this section.
9. Connect the negative battery cable.



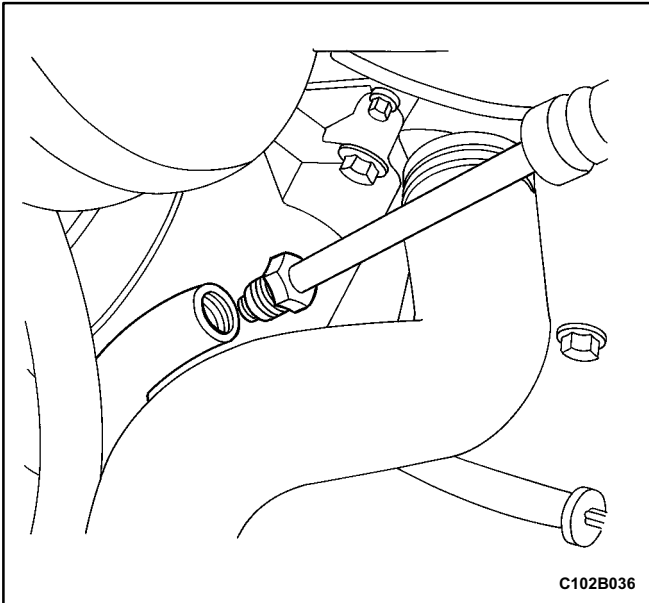
ENGINE

Removal Procedure

1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine for 10 seconds to rid the fuel system of fuel pressure.
3. Remove the hood. Refer to *Section 9R, Body Front End*.
4. Drain the engine oil.
5. Disconnect the negative battery cable.
6. Remove the bolts and the resonator.

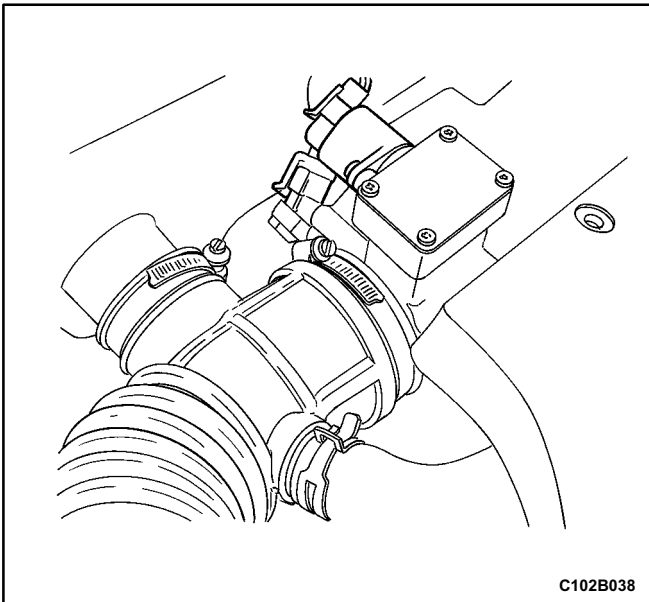


7. Discharge the air conditioning system. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System*.
8. Disconnect the manifold air temperature sensor connector.
9. Remove the air intake tube and air filter housing assembly and bolts.
10. Remove the right front wheel. Refer to *Section 2E, Tires and Wheels*.
11. Remove the right front wheel well splash shield. Refer to *Section 9R, Body Front End*.
12. Remove the accessory drive belt. Refer to *Section 6B, Power Steering Pump*.



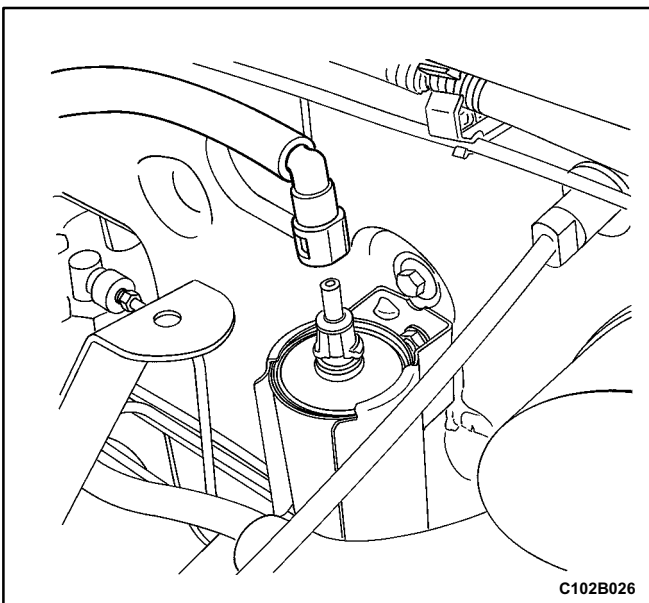
C102B036

13. Drain the engine coolant. Refer to *Section 1D, Engine Cooling*.
14. Remove the cooling system radiator and the engine cooling fans. Refer to *Section 1D, Engine Cooling*.
15. Disconnect the upper radiator hose from the thermostat housing.
16. Disconnect the power steering return hose from the power steering pump.
17. Disconnect the power steering pressure hose from the power steering pump and move clear.
18. Disconnect the electrical connector at the DIS ignition coil and the ECM ground terminal.



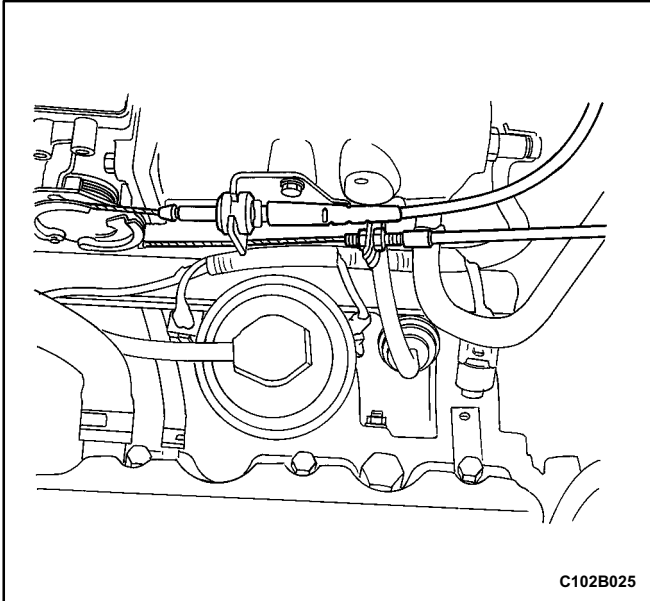
C102B038

19. Disconnect the oxygen sensor connector.
20. Disconnect the idle air control valve connector.
21. Disconnect the throttle position sensor connector.
22. Disconnect the engine coolant temperature sensor connector.
23. Disconnect the coolant temperature sensor connector.
24. Disconnect the alternator voltage regulator connector and power lead.

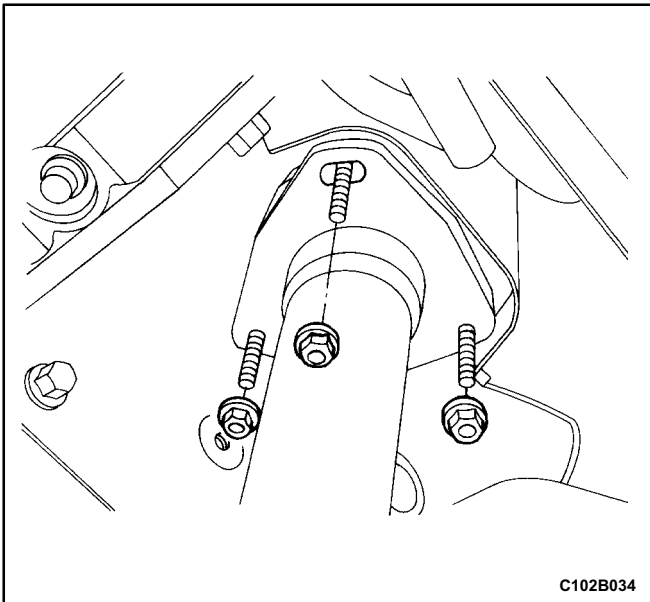


C102B026

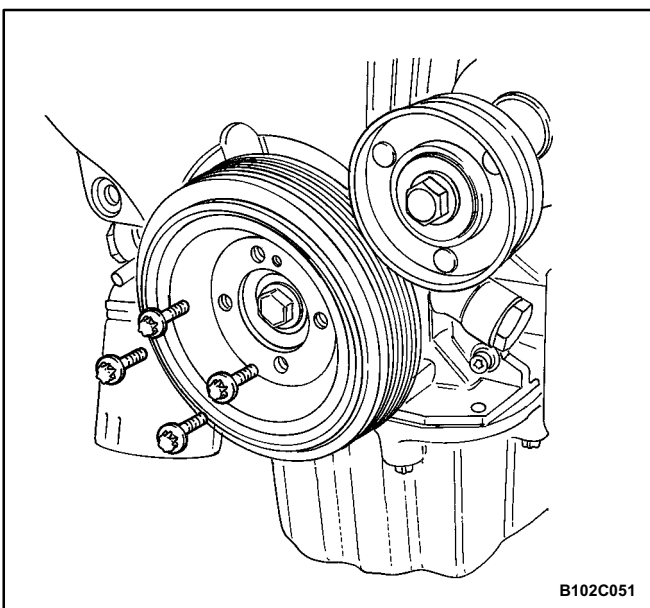
25. Disconnect all of the necessary vacuum lines including the brake booster vacuum hose.
26. Disconnect the fuel return line at the fuel pressure regulator.
27. Disconnect the fuel feed line at the fuel filter.
28. Remove the fuel rail and injector channel cover as an assembly. Refer to *Section 1F, Engine Controls*.



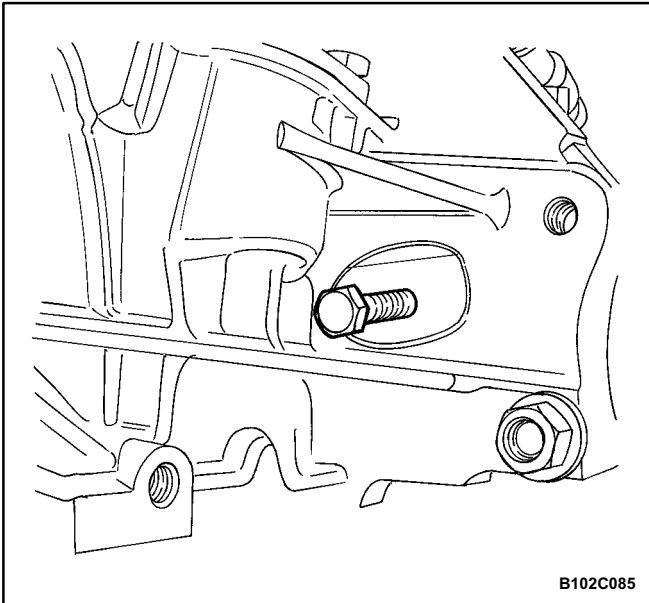
29. Disconnect the throttle cable from the throttle body and the intake manifold bracket.
30. Disconnect the coolant hose at the throttle body.
31. Disconnect the heater hoses at the coolant pipe and the coolant manifold.
32. Disconnect the coolant bypass hose from the cylinder head.
33. Disconnect the coolant surge tank hose from the coolant pipe.
34. Disconnect the lower radiator hose from the coolant pipe.
35. Disconnect the starter solenoid "S" terminal wire and power lead.
36. Remove the A/C compressor. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System*.



37. Remove the exhaust flex pipe retaining nuts from the exhaust manifold studs.
38. Remove the exhaust flex pipe retaining nuts from the catalytic converter.
39. Remove the exhaust flex pipe.
40. Remove the center member. Refer to *Section 9N, Frame and Underbody*.

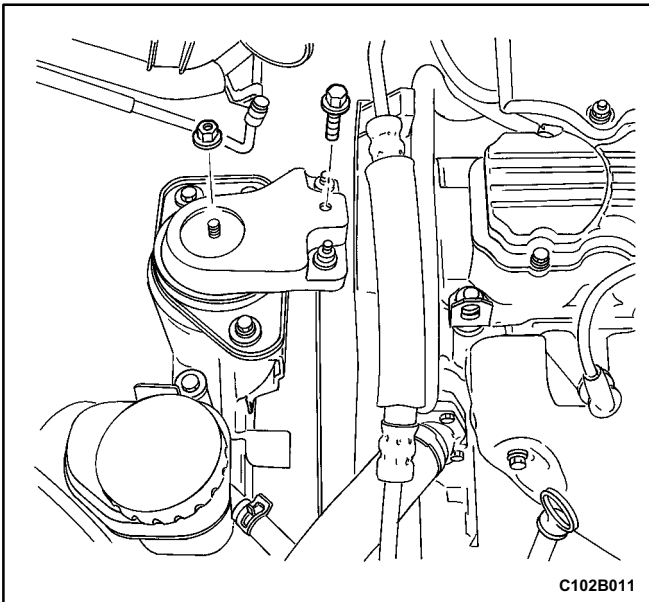


41. Remove the crankshaft pulley bolts.
42. Remove the crankshaft pulley.
43. Disconnect the vacuum lines at the charcoal canister purge solenoid.
44. Disconnect the electrical connector at the charcoal canister purge solenoid.
45. Disconnect the electrical connector at the oil pressure switch.
46. Disconnect the crankshaft position sensor connector.



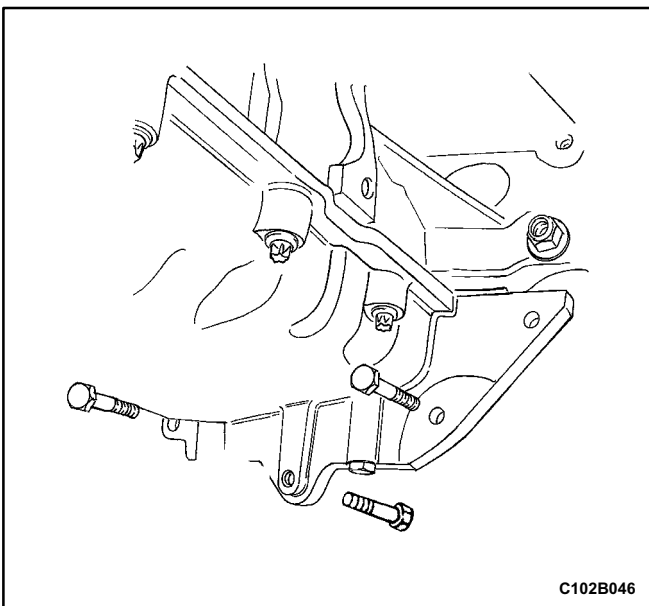
B102C085

47. Remove the transaxle torque converter bolts, if automatic transaxle equipped.
48. Remove the transaxle bell housing bolts and the oil pan flange bolts.
49. Support the transaxle with a floor jack.
50. Install the engine lifting device.



C102B011

51. Disconnect the right side engine mount bracket from the engine mount by removing the retaining bolts/nuts.
52. Remove the right side engine mount bracket from the engine block and the frame mount.
53. Separate the engine block from the transaxle.
54. Remove the engine.



C102B046

Installation Procedure

1. Install the engine into the engine compartment.
2. Align the engine alignment pins to the transaxle.
3. Install the transaxle bell housing bolts.

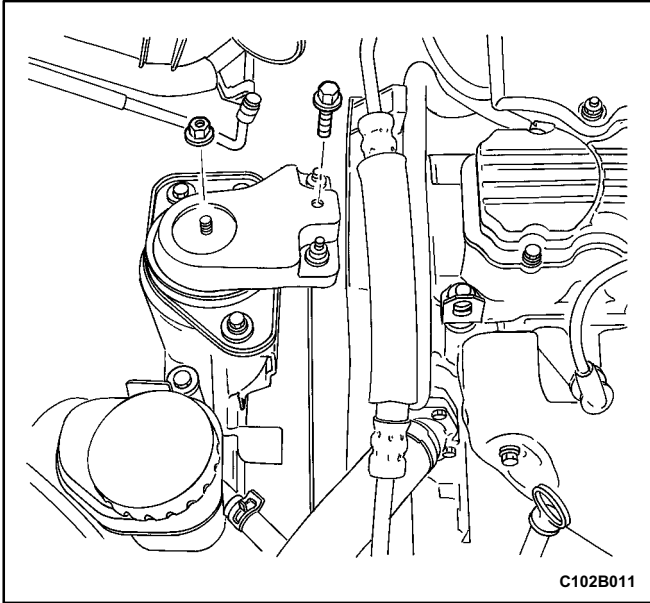
Tighten

Tighten the transaxle bell housing bolts to 75 N•m (55 lb•ft).

4. Install the oil pan flange-to-transaxle bolts.

Tighten

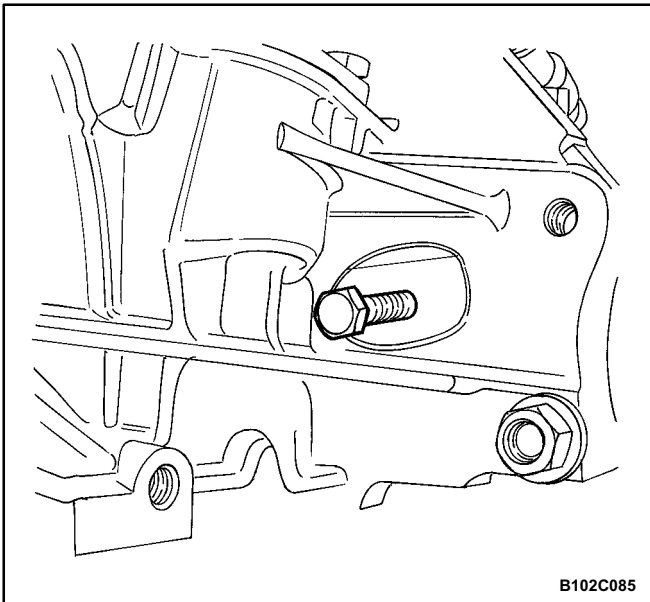
Tighten the oil pan flange-to-transaxle retaining bolts to 40 N•m (30 lb•ft).



5. Install the right side engine mount bracket to the engine block mount and the frame mount.
6. Install the right side engine mount bracket retaining bolts/nuts.

Tighten

Tighten the right side engine mount bracket retaining bolts/nuts to 60 N•m (44 lb•ft).

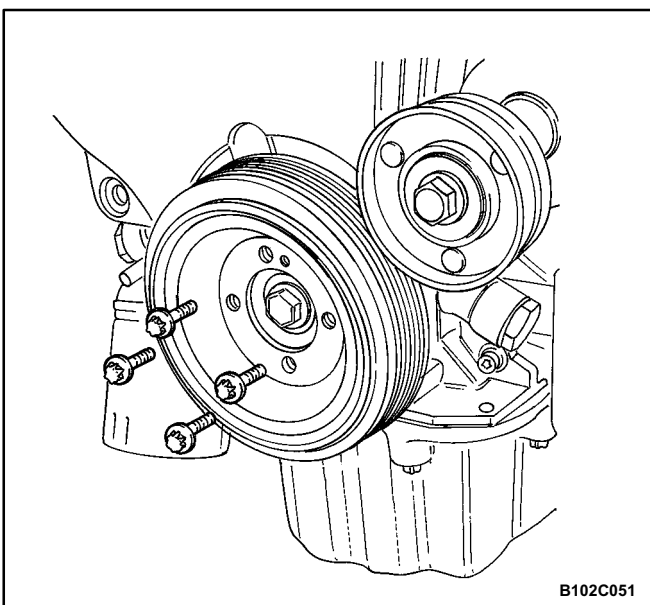


7. Remove the floor jack used for support of the transaxle.
8. Remove the engine lifting device.
9. Install the transaxle torque converter bolts, if automatic transaxle equipped.

Tighten

Tighten the transaxle torque converter bolts to 60 N•m (44 lb•ft).

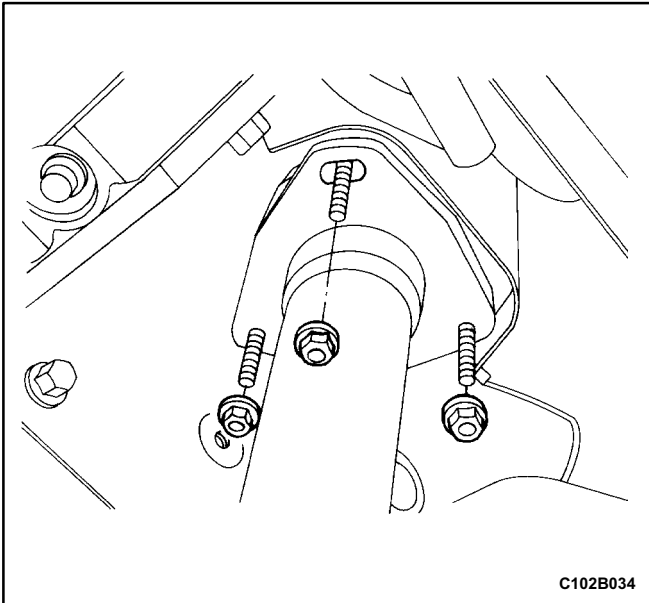
10. Install the center member. Refer to *Section 9N, Frame and Underbody*.



11. Connect the vacuum lines at the charcoal canister purge solenoid.
12. Connect the electrical connector to the charcoal canister purge solenoid.
13. Connect the oil pressure switch connector.
14. Install the crankshaft pulley.
15. Install the crankshaft pulley bolts.

Tighten

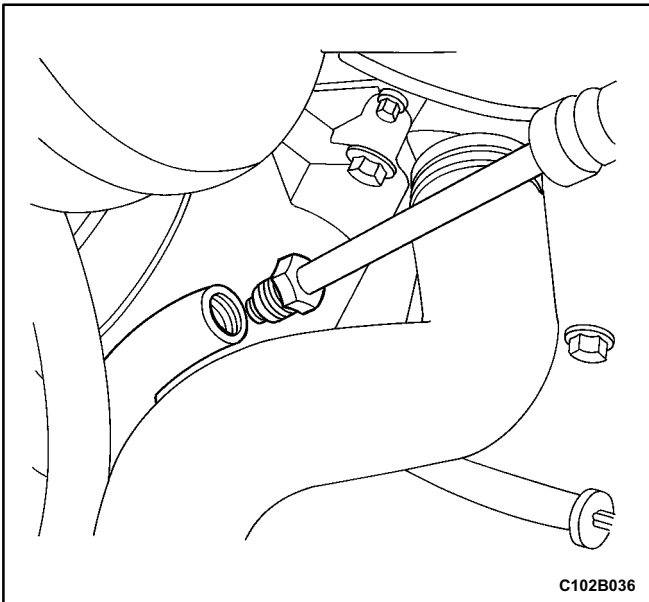
Tighten the crankshaft pulley bolts to 20 N•m (15 lb•ft) using a torque wrench.



16. Connect the crankshaft position sensor connector.
17. Install the exhaust flex pipe.
18. Install the exhaust flex pipe retaining nuts to the exhaust manifold studs.

Tighten

Tighten the exhaust flex pipe-to-exhaust manifold retaining nuts to 22 N•m (16 lb•ft).

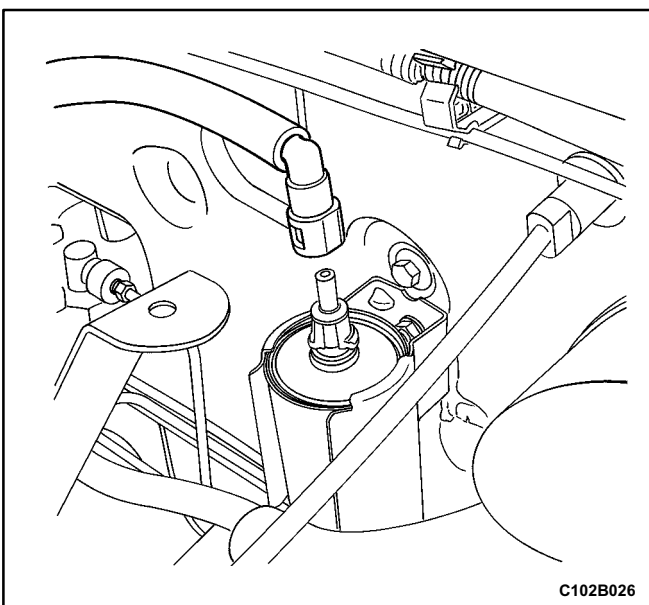


19. Install the exhaust flex pipe retaining nuts to the catalytic converter.

Tighten

Tighten the exhaust flex pipe-to-catalytic converter retaining nuts to 30 N•m (22 lb•ft).

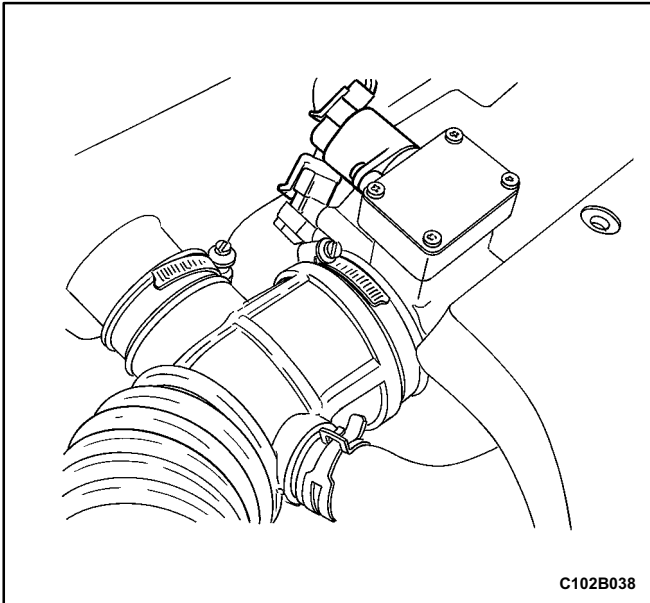
20. Connect the power steering pressure hose.
21. Connect the power steering return hose.
22. Install the A/C compressor. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System*.



23. Install the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.
24. Install the right front wheel well splash shield. Refer to *Section 9R, Body Front End*.
25. Install the right front wheel. Refer to *Section 2E, Tires and Wheels*.
26. Connect the fuel feed line to the fuel filter.
27. Connect the fuel return line to the fuel pressure regulator.
28. Install the fuel rail and injector channel cover as an assembly. Refer to *Section 1F, Engine Controls*.
29. Connect the air intake tube and the air filter housing assembly.
30. Install the air filter housing assembly bolts.

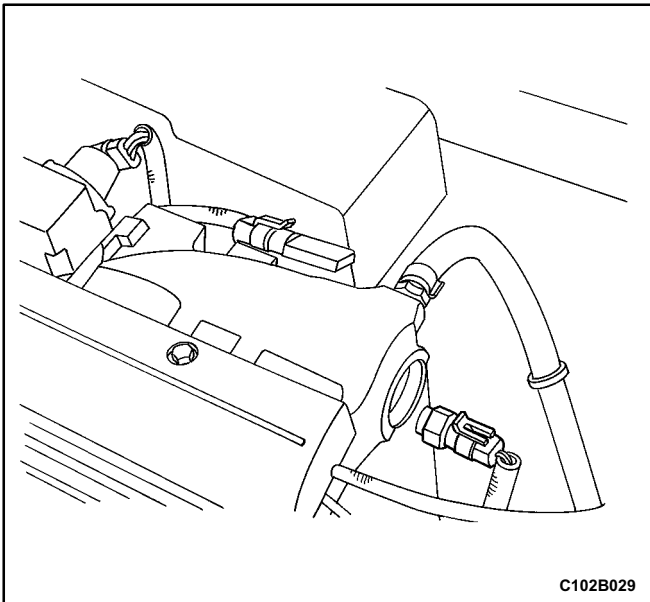
Tighten

Tighten the air filter housing bolts to 8 N•m (71 lb•in).



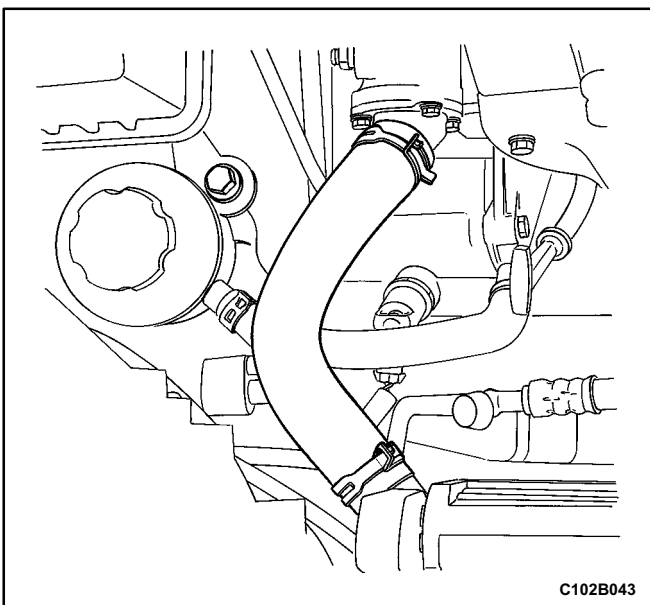
C102B038

31. Connect all of the necessary vacuum lines including the brake booster vacuum hose.
32. Connect the oxygen sensor connector.
33. Connect the starter solenoid "S" terminal wire and power lead.
34. Connect the alternator voltage regulator connector.
35. Connect the coolant temperature sensor connector.
36. Connect the engine coolant temperature sensor connector.
37. Connect the throttle position sensor connector.
38. Connect the idle air control valve connector.
39. Connect the manifold air temperature sensor connector.



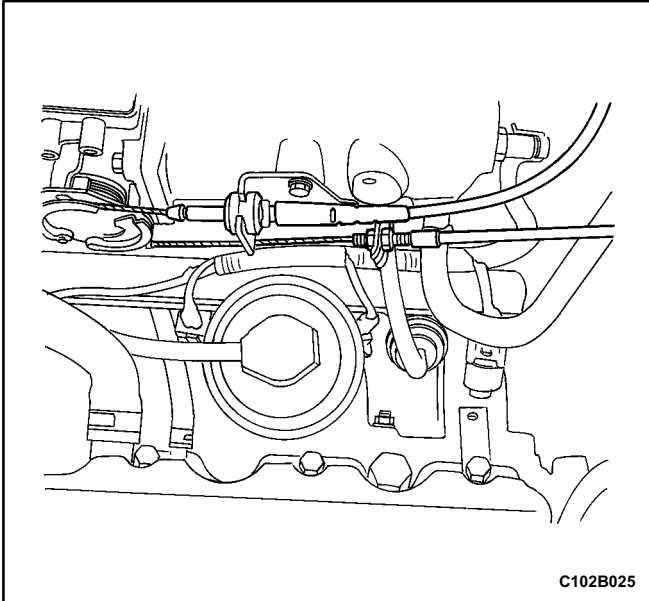
C102B029

40. Connect the electrical connector at the DIS ignition coil and the ECM ground terminal.
41. Install the air intake tube between the throttle body and the air filter housing.
42. Connect the manifold air temperature sensor connector.
43. Install the cooling system radiator and the engine cooling fans. Refer to *Section 1D, Engine Cooling*.



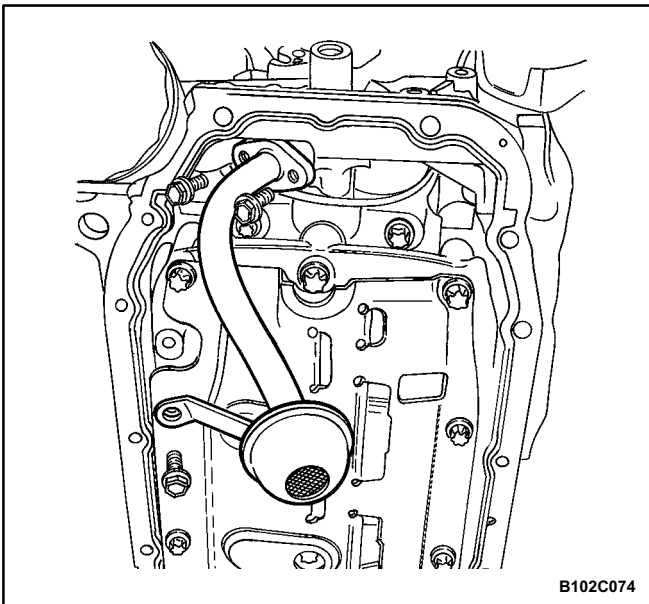
C102B043

44. Connect the lower radiator hose to the coolant pipe.
45. Connect the upper radiator hose to the thermostat housing.
46. Connect the heater hoses to the coolant pipe and the coolant manifold.
47. Connect the heater outlet hose to the coolant pipe.
48. Connect the coolant surge tank hose to the coolant pipe.
49. Connect the coolant hose to the throttle body.



C102B025

50. Connect the throttle cable to the throttle body and the intake manifold bracket.
51. Install the fuel pump fuse.
52. Connect the negative battery cable.
53. Refill the engine crankcase with engine oil.
54. Refill the engine coolant system. Refer to *Section 1D, Engine Cooling*.
55. Bleed the power steering system. Refer to *Section 6A, Power Steering*.
56. Refill the A/C refrigerant system. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System*.
57. Install the hood. Refer to *Section 9R, Body Front End*.



B102C074

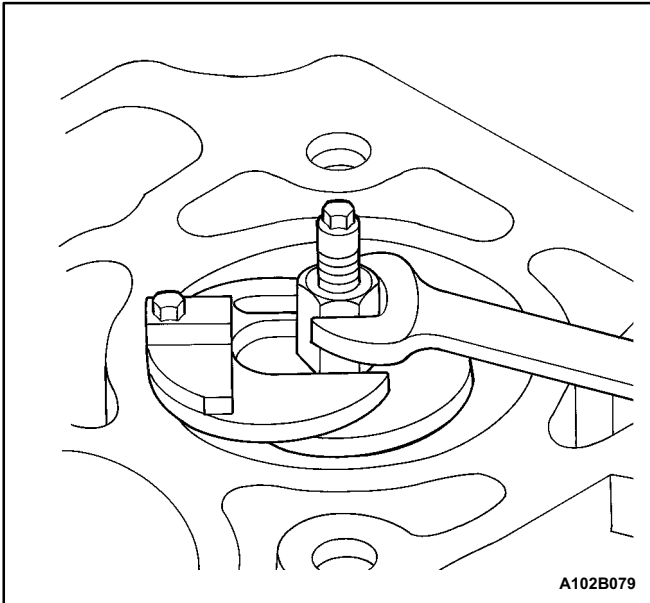
PISTONS AND RODS

Tools Required

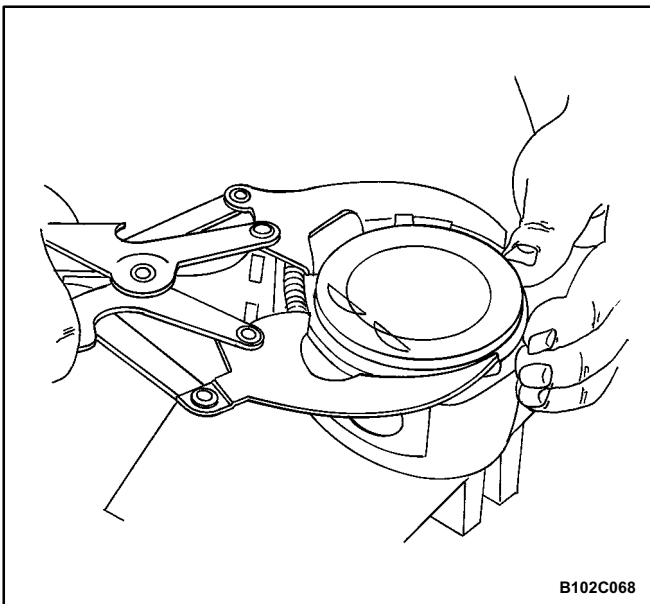
- J-8037 Universal Piston Ring Compressor
- J-8087 Cylinder Bore Check Gauge
- KM-427 Piston Pin Service Set
- KM-470-B Angular Torque Gauge

Removal Procedure

1. Remove the cylinder head with the intake manifold and exhaust manifold attached. Refer to "Cylinder Head and Gasket" in this section.
2. Remove the oil pan. Refer to "Oil Pan" in this section.
3. Remove the oil pump/pickup tube bolts.
4. Remove the oil pump/pickup tube.
5. Remove the engine block lower support and the splash shield bolts.
6. Remove the engine block lower support and the splash shield.

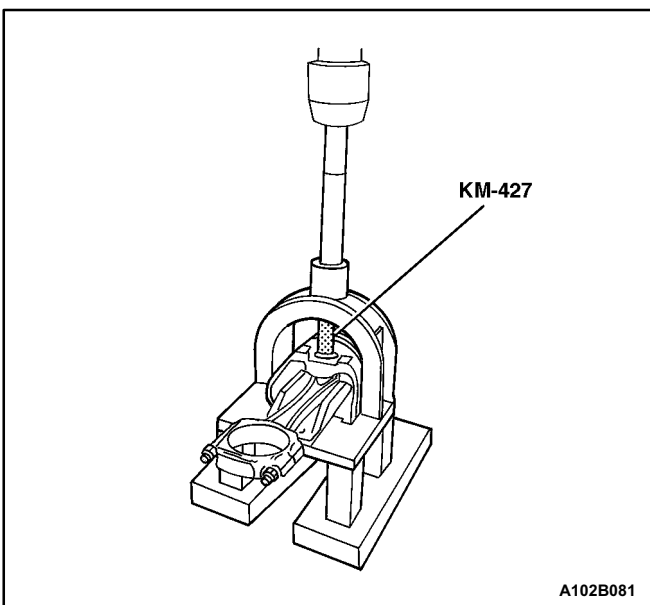


7. Move the piston to the bottom of the piston stroke.
8. Mark the connecting rod cap for position.
9. Remove the connecting rod cap bolts.
10. Remove the connecting rod cap and lower connecting rod bearing.
11. Remove the upper piston connecting rod bearing.
12. Ridge ream the cylinder wall.

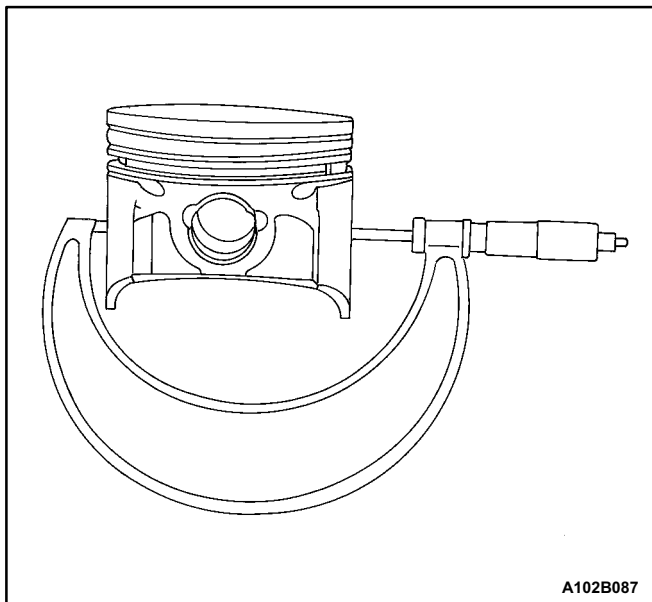


Caution: Use care when handling the piston. Worn piston rings are sharp and may cause injury.

13. Remove the piston.
14. Use a piston ring expander tool to expand the piston rings.
15. Remove the piston rings.

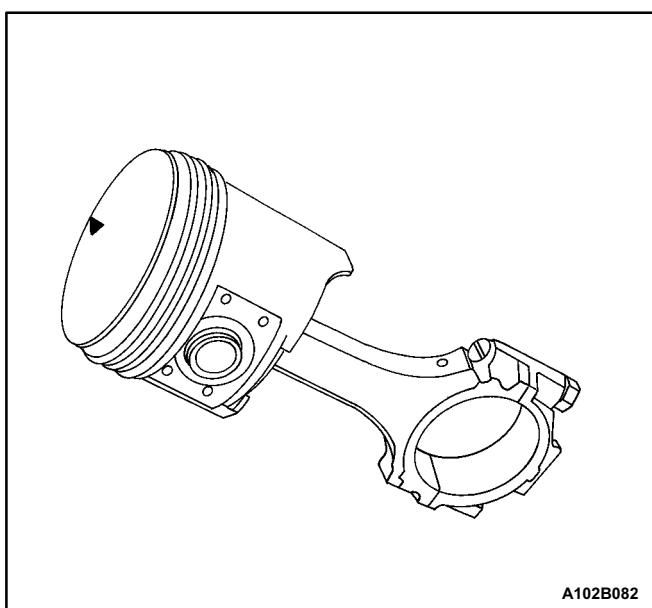


16. Remove the piston pin from the piston and connecting rod assembly using the piston pin service set KM-427.
17. Separate the piston from the connecting rod.

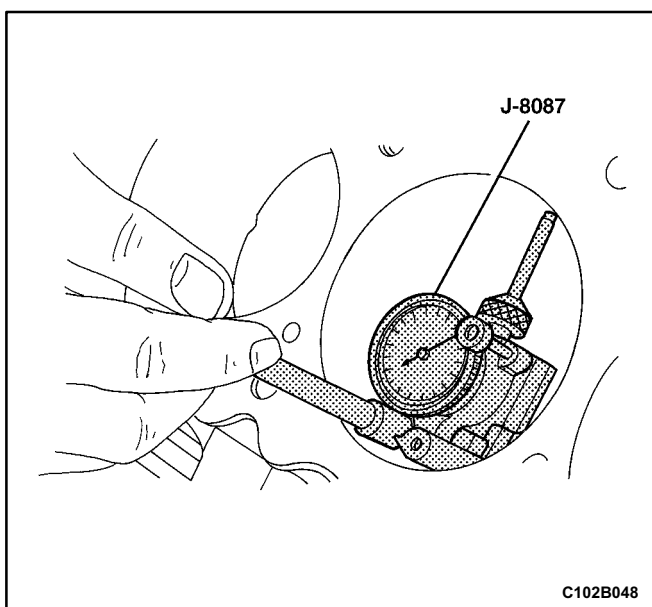


Inspection Procedure

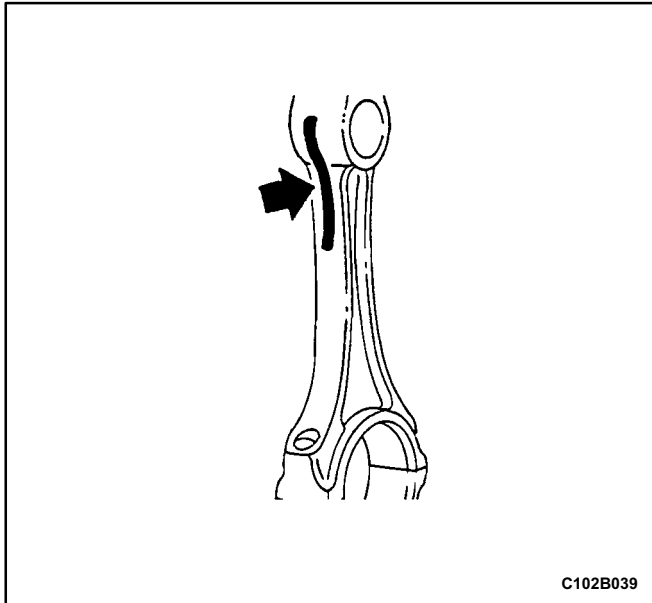
1. Inspect the connecting rod for bending or twisting. If the connecting rod is bent or twisted, replace the connecting rod.
2. Inspect the connecting rod bearings.
3. Inspect the connecting rod lower end for wear.
4. Inspect the connecting rod upper end for scoring.
5. Inspect the crankshaft rod bearing journal for wear. Refer to "Engine Specifications" in this section.
6. Inspect the piston for scoring, cracks, and wear.
7. Inspect the piston for taper using a micrometer.



8. Inspect the piston for fit to the connecting rod.



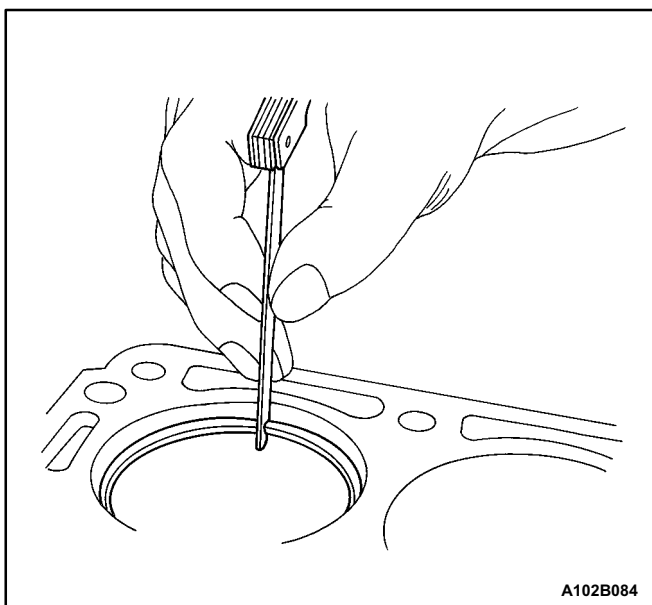
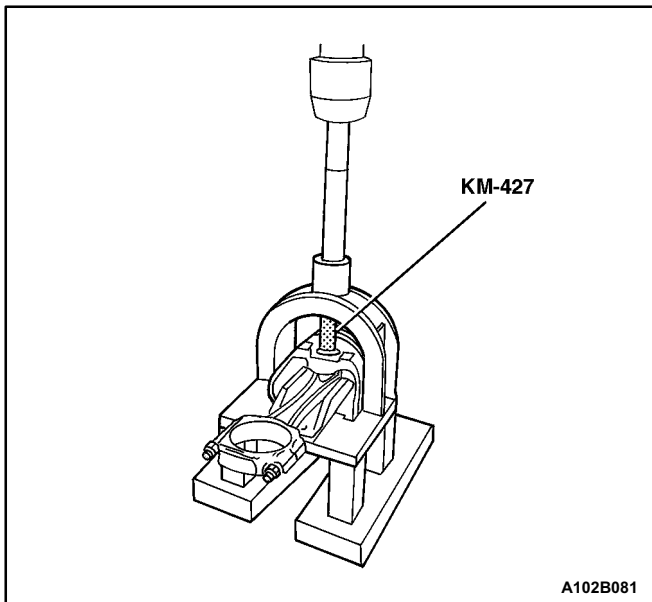
9. Inspect the engine block deck surface for flatness using a straight edge and a feeler gauge. Refer to "Engine Specifications" in this section.
10. Inspect the bearing bore for concentricity and alignment using the cylinder bore check gauge J-8087. Refer to "Engine Specifications" in this section. If the bearing bore is beyond specifications, replace the engine block.
11. Inspect the engine block cylinder bore for wear, runout, ridging and taper using a bore gauge. Refer to "Engine Specifications" in this section.
12. Inspect the engine block cylinder bore for glazing. Lightly hone the cylinder bore as necessary.



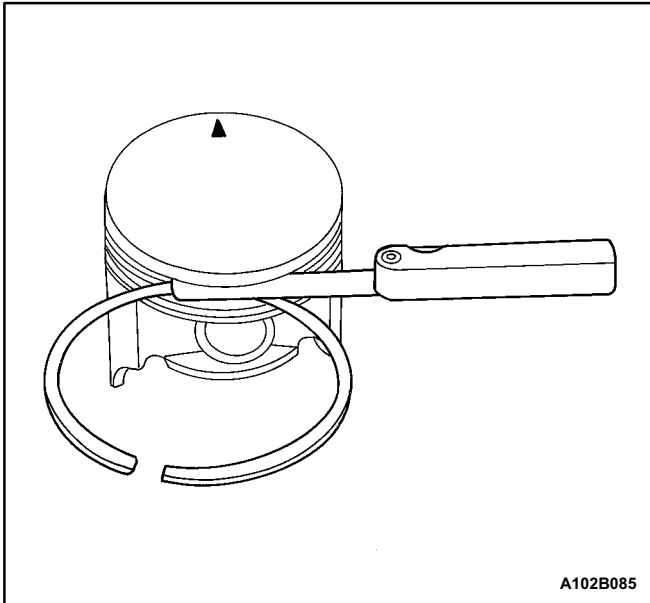
Installation Procedure

Important: In order to install the piston pin, heat the connecting rod to approximately 280°C (536°F) using a hot plate. This temperature must not be exceeded. Use thermocolor pencil to determine the temperature. When the color changes from green to black, the temperature is reached.

1. Align the notch on the piston and connecting rod so that the proper sides will be facing the front of the engine.
2. Install the piston pin guide through the piston and the connecting rod.
3. Coat the piston pin with clean oil.
4. Install the piston pin into the opposite side of the piston.
5. Install the piston pin into the piston and connecting rod assembly using the piston pin service set KM-427.

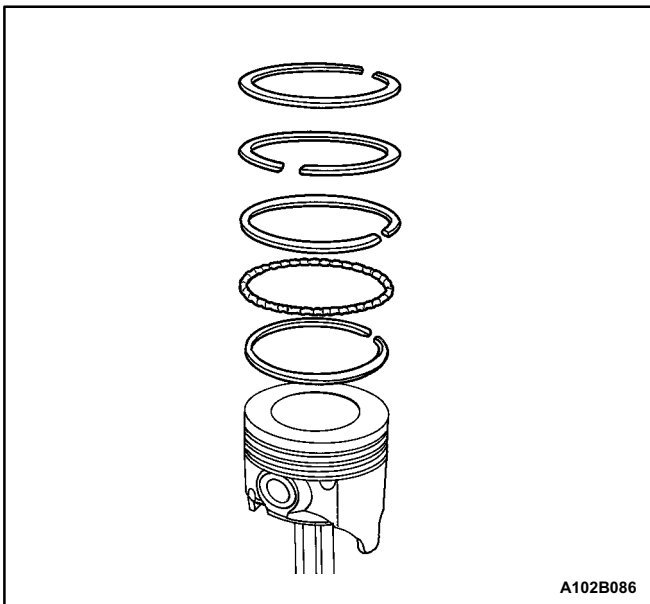


6. Select a set of new piston rings.
7. Measure the piston ring gap using a feeler gauge. Refer to "Engine Specifications" in this section.
8. Increase the piston ring gap by carefully filing off excess material if the piston ring gap is below specifications.



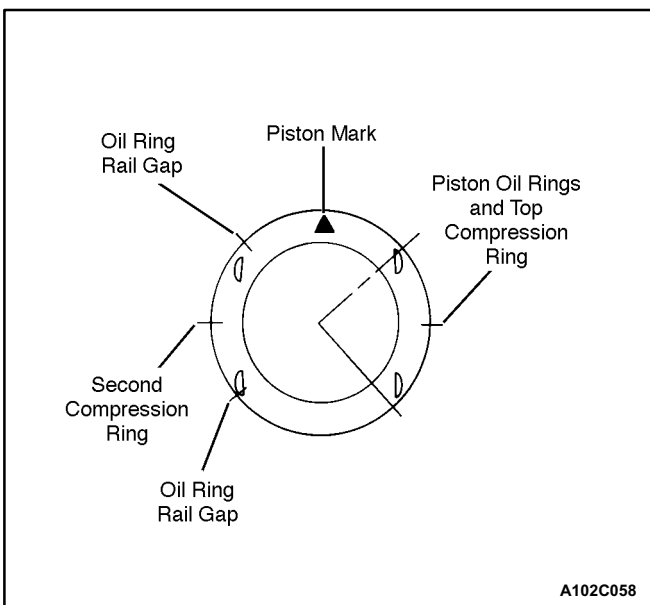
A102B085

9. Measure the piston ring side clearance using a feeler gauge. Refer to "Engine Specifications" in this section.
10. If the piston ring is too thick, try another piston ring.
11. If no piston ring can be found that fits to specifications, the piston ring may be ground to size with emery paper placed on a sheet of glass.



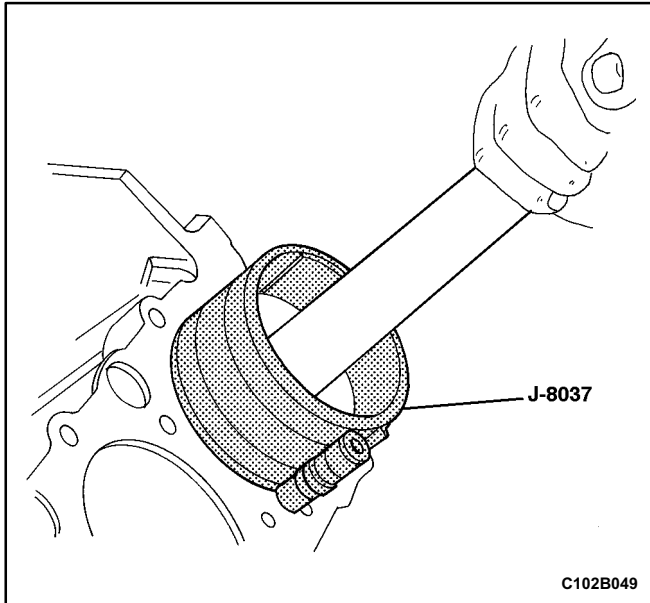
A102B086

12. Install a piston oil ring, the expander, then the second piston oil ring to the bottom ring groove of the piston.
13. Install the second compression ring to the middle ring groove of the piston.
14. Install the top compression ring to the top ring groove of the piston.

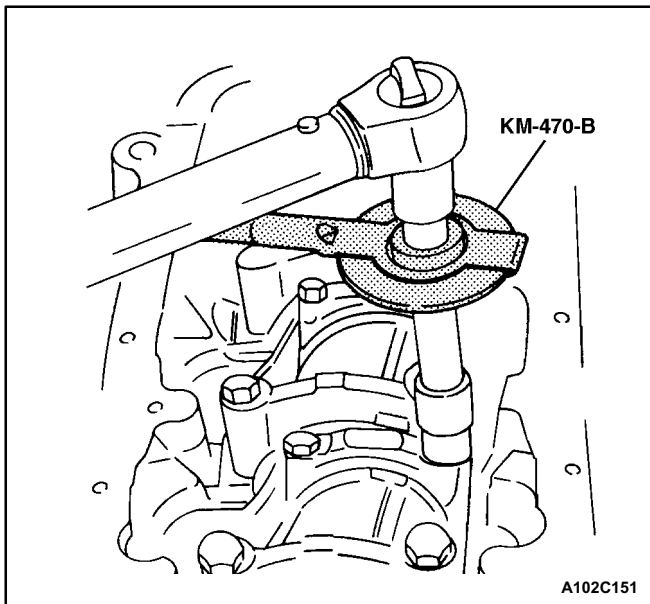


A102C058

15. Use a piston ring expander to install the piston rings. Do not expand the piston rings beyond the expansion necessary for installation.
16. Stagger the piston oil rings, the oil ring rail gaps, the second compression ring, and the top compression ring in relation to the notch on the top of the piston.



17. Lubricate the cylinder wall and the piston rings with clean engine oil.
18. Install the piston using the universal piston ring compressor J-8037 and a wood handle. Guide the lower connecting rod end to prevent damaging the crankshaft journal.
19. Install the connecting rod cap and bearings. Refer to "Crankshaft Bearings and Connecting Rod Bearings - Gauging Plastic" in this section.



20. Install the connecting rod bearing cap bolts.

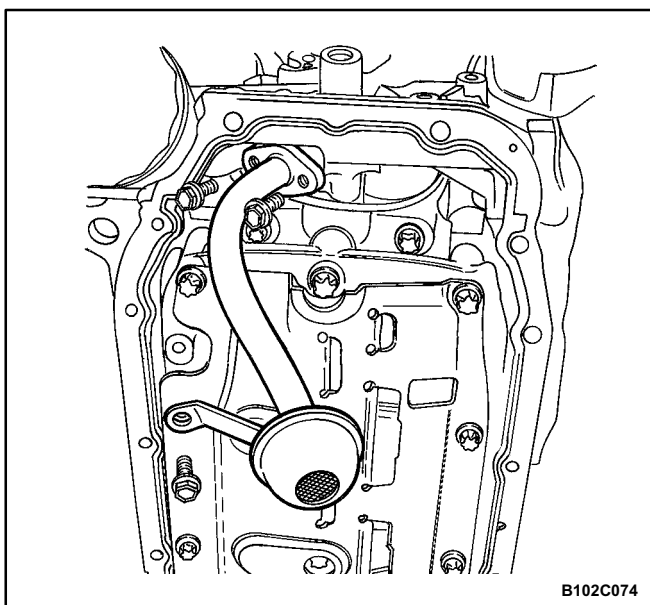
Tighten

Tighten the connecting rod bearing cap bolts to 35 N•m (26 lb•ft). Using the angular torque gauge KM-470-B, tighten the bolts one turn of 45 degrees plus one turn of 15 degrees.

21. Install the engine block lower support bracket and splash shield bolts.

Tighten

Tighten the engine block lower support bracket and splash shield bolts to 40 N•m (30 lb•ft).



22. Install the oil pump/pickup tube.
23. Install the oil pump/pickup tube bolts.

Tighten

Tighten the oil pump/pickup tube bolts to 8 N•m (71 lb•in).

24. Install the oil pan. Refer to "Oil Pan" in this section.
25. Install the cylinder head with the intake manifold and exhaust manifold attached. Refer to "Cylinder Head and Gasket" in this section.

UNIT REPAIR

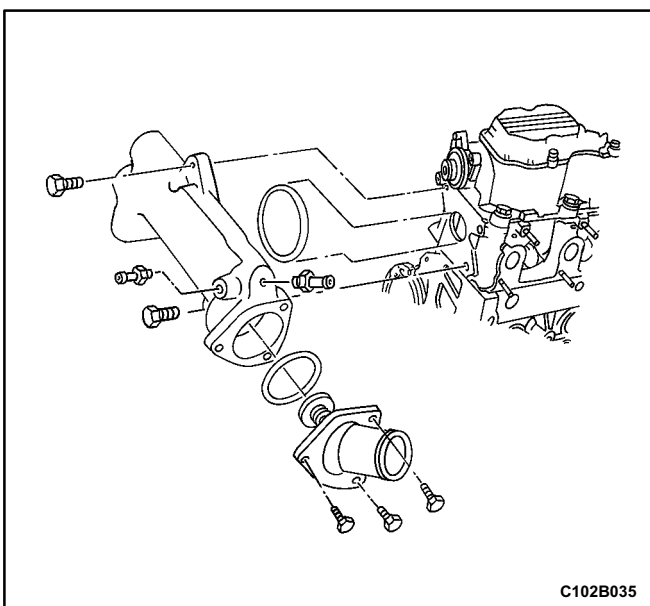
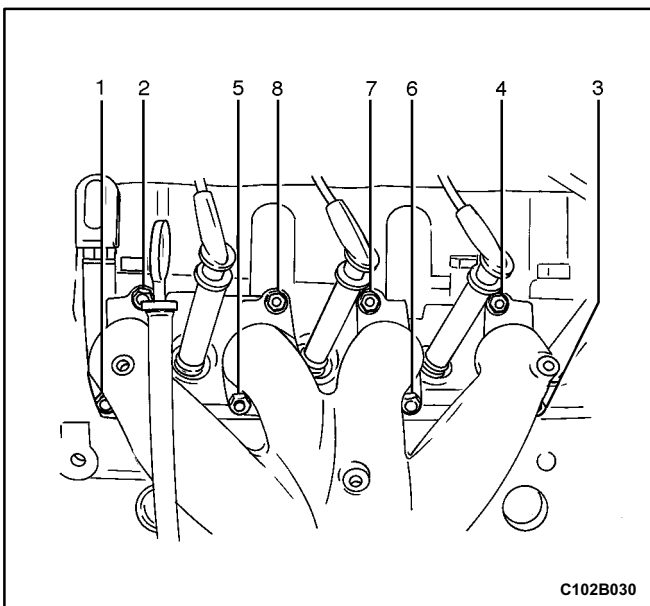
CYLINDER HEAD AND VALVE TRAIN COMPONENTS

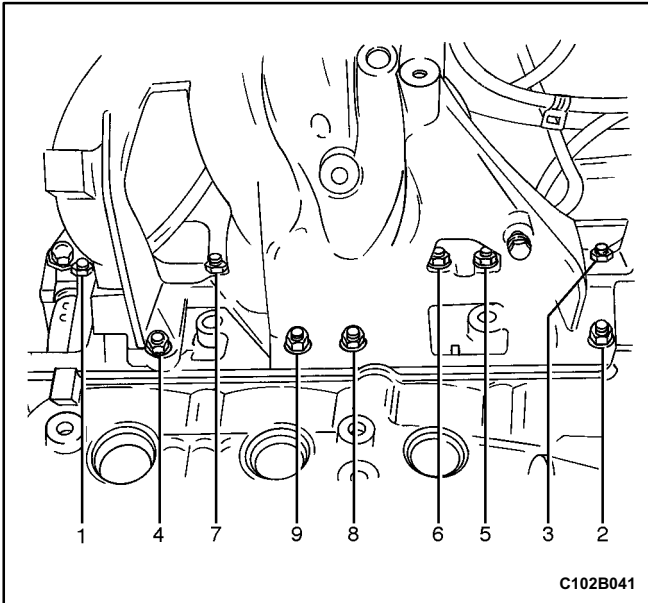
Tools Required

MKM-571-B Gauge
 KM-340-0 Cutter Set
 KM-340-7 Guide Drift
 KM-340-13 Cutter
 KM-340-26 Cutter
 KM-348 Valve Spring Compressor
 KM-512 Valve Stem Projection Gauge
 KM-664 Valve Guide Reamer Set
 KM-253 Reamer
 KM-254 Reamer
 KM-255 Reamer

Disassembly Procedure

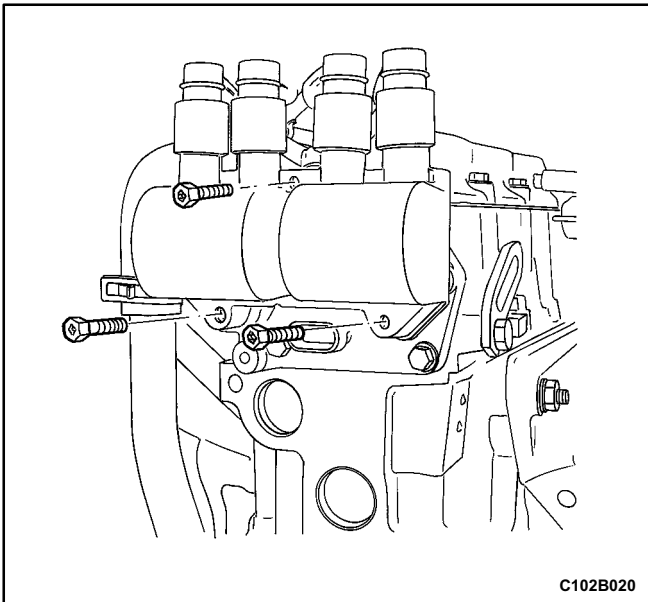
1. Remove the cylinder head with the intake manifold and the exhaust manifold attached. Refer to "Cylinder Head and Gasket" in this section.
 2. Remove the coolant temperature sensor.
 3. Remove the exhaust manifold heat shield bolts.
 4. Remove the exhaust manifold heat shield.
 5. Remove the exhaust manifold retaining nuts in the sequence shown.
 6. Remove the exhaust manifold.
 7. Remove the exhaust manifold gasket.
 8. Remove the exhaust manifold studs.
9. Remove the thermostat housing mounting bolts.
 10. Remove the thermostat housing assembly.
 11. Remove the fuel rail assembly. Refer to *Section 1F, Engine Controls*.
 12. Remove the coolant manifold mounting bolts and the housing.





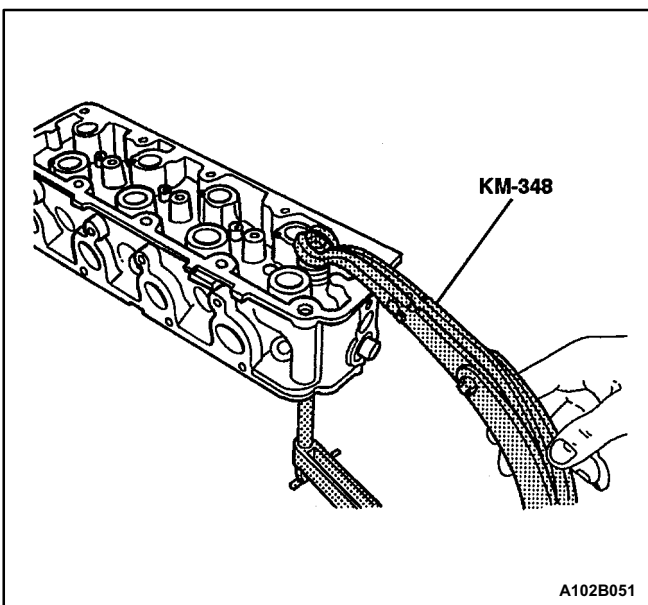
C102B041

13. Remove the intake manifold retaining nuts in the sequence shown.
14. Remove the intake manifold.
15. Remove the intake manifold gasket.



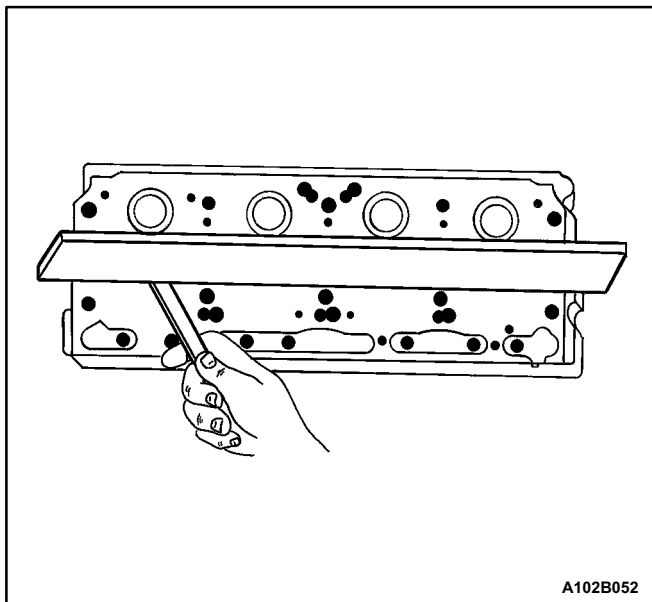
C102B020

16. Remove the DIS ignition coil mounting bolts.
17. Remove the DIS ignition coil ignition wires.
18. Remove the intake manifold studs.
19. Remove the spark plugs.

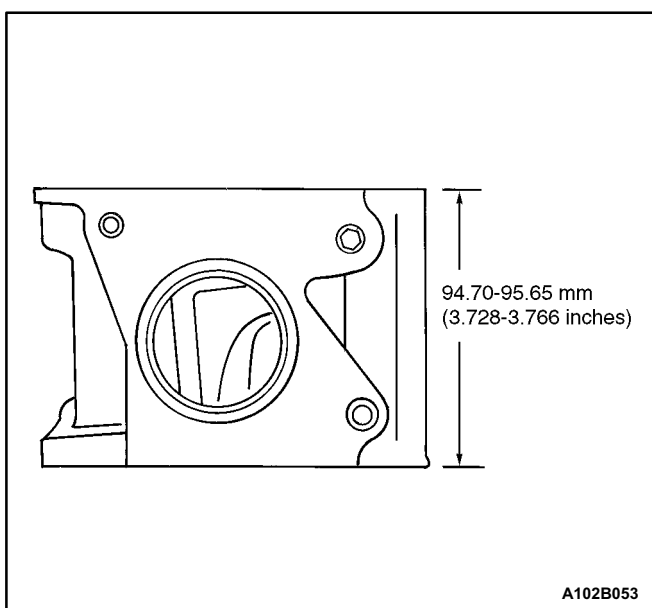


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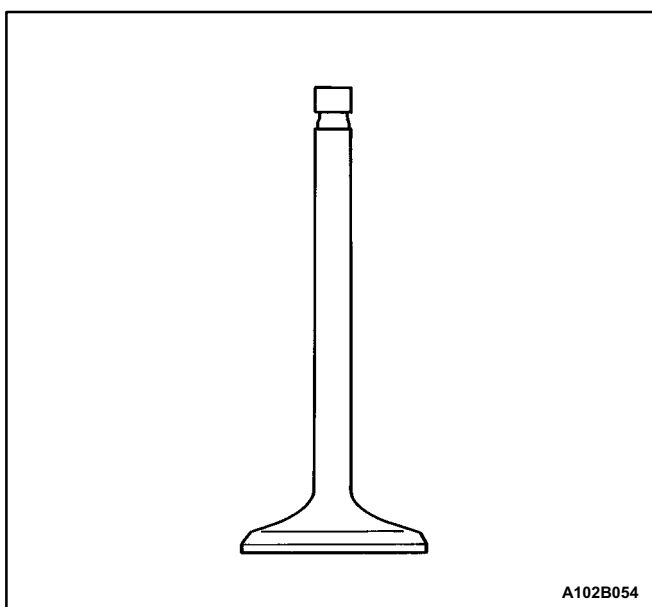
20. Compress the valve springs with the valve spring compressor KM-348.
21. Remove the valve retainers.
22. Remove the valve spring compressor KM-348.
23. Remove the valve spring caps.
24. Remove the valve springs. Maintain the original position of the valve springs for installation.
25. Remove the valves. Maintain the original position of the valves for installation.
26. Remove the valve stem seals.
27. Remove the camshaft carrier alignment pins.



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A102B053



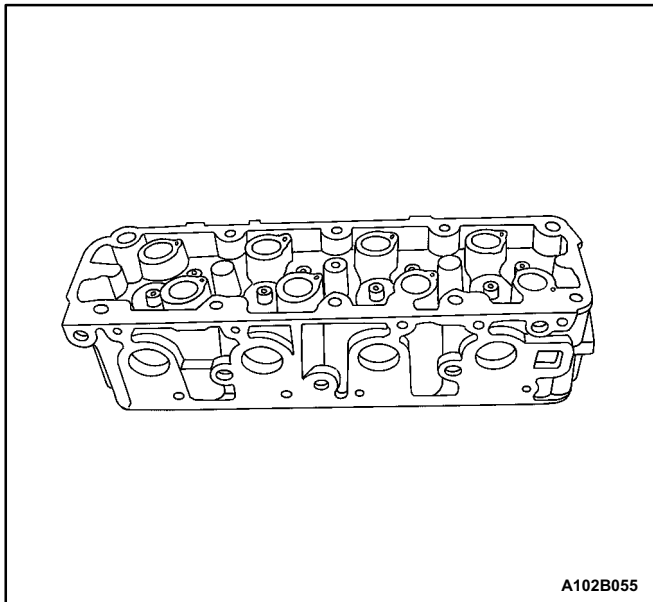
A102B054

Cylinder Head Inspection

1. Clean the sealing surfaces.
2. Inspect the cylinder head gasket and mating surfaces for leaks, corrosion and blowby.
3. Inspect the cylinder head for cracks.
4. Inspect the length and width of the cylinder head using a feeler gauge and a straight edge.
5. Check the sealing surfaces for deformation and warpage. The cylinder head sealing surfaces must be flat within 0.025 mm (0.001 inch) maximum.
6. Measure the height of the cylinder head from sealing surface to sealing surface. The cylinder head height should be 94.70 to 95.65 mm (3.728 to 3.766 inches). If the cylinder head height is less than 94.70 mm (3.728 inches), replace the cylinder head.
7. Inspect all threaded holes for damage.
8. Inspect the valve seats for excessive wear and burned spots.

Valve Inspection

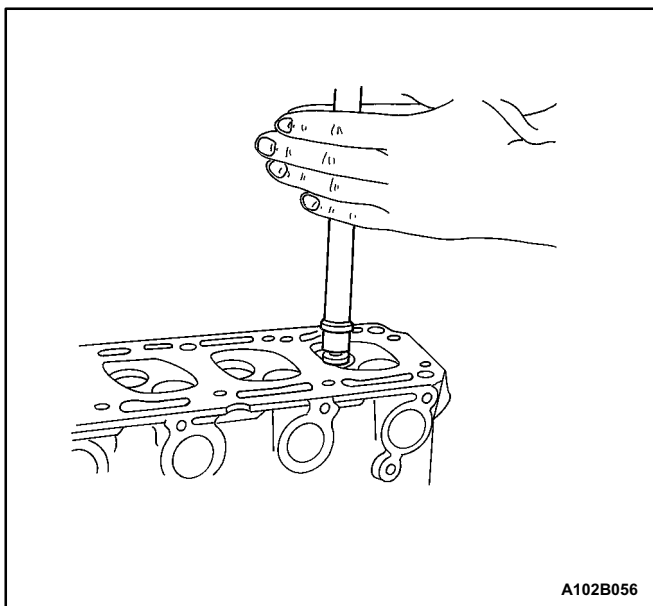
1. Inspect valve stem tip wear.
2. Inspect the valve retainer grooves and oil seal grooves for chips and wear.
3. Inspect the valves for burns or cracks.
4. Inspect the valve stem for burrs and scratches.
5. Inspect the valve stem. The valve stem must be straight.
6. Inspect the valve face for grooving. If the groove is so deep the refacing would result in a sharp edge, replace the valve.
7. Inspect the valve spring. If the valve spring ends are not parallel, replace the valve spring.
8. Inspect the valve spring seating surface of the valve rotators for wear or gouges. Replace as required.



A102B055

Cleaning Procedure

1. Clean the cylinder head.
2. Clean the valve guides.
3. Clean all of the threaded holes.
4. Clean the valves of carbon, oil, and varnish.

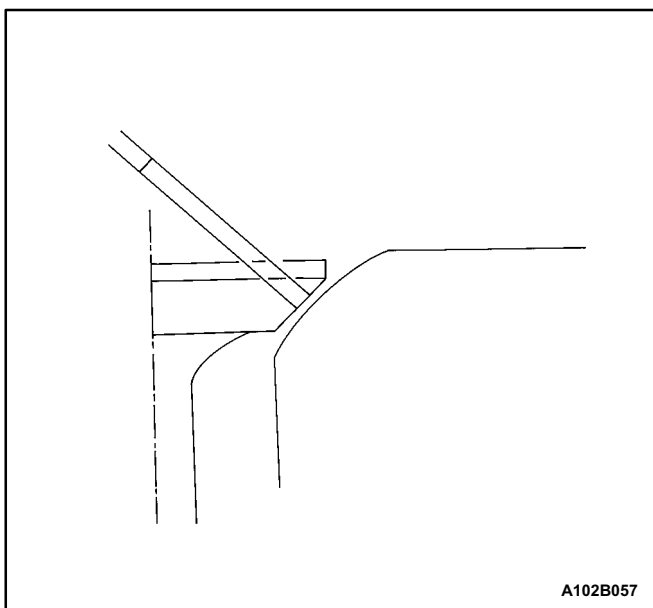


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Cylinder Head Overhaul

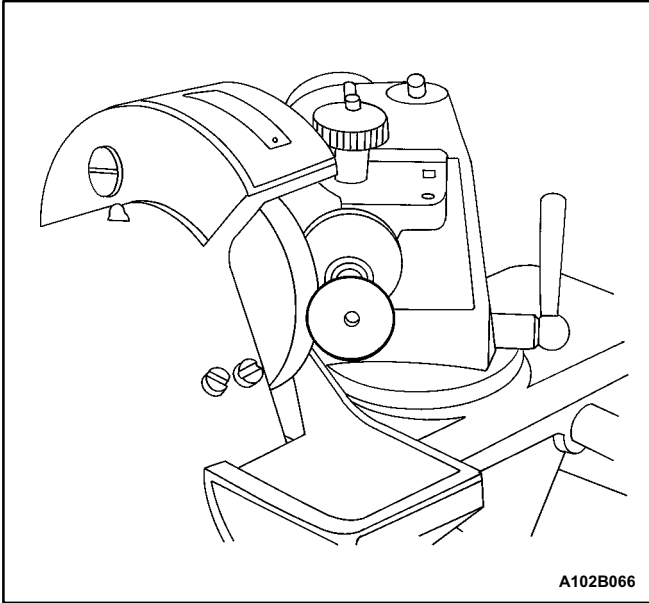
Valve Grind-in

1. Lubricate the valve stem using a fine-grained paste.
2. Lift the valve rhythmically from the seat with a commercially available valve grinding tool in order to distribute the paste.



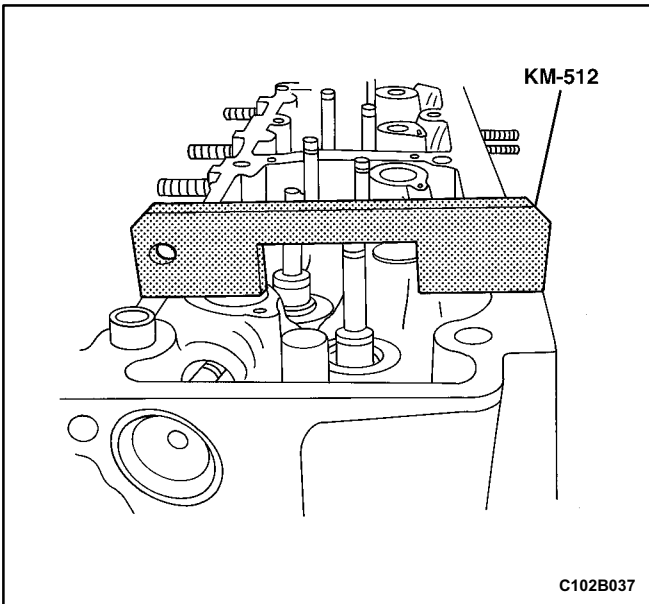
A102B057

3. Check the contact pattern on the valve head and in the cylinder head.
4. Clean the valves, the valve guides, and the cylinder head.

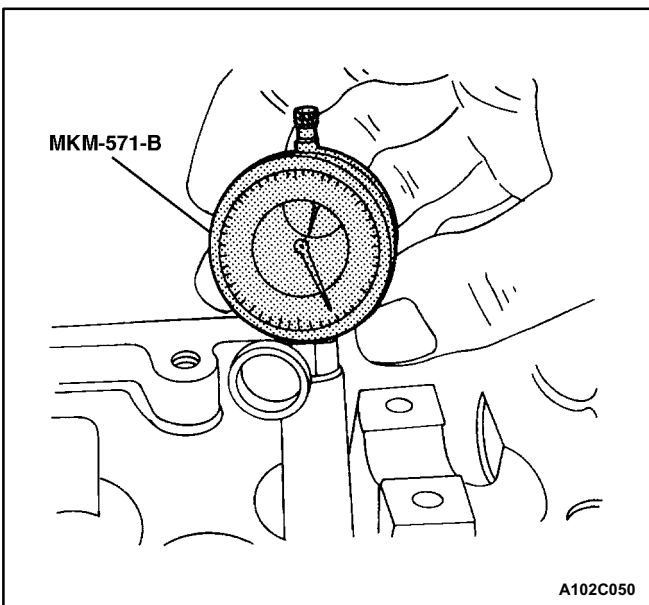


Valve Grind

1. Ensure that there are no crater line burns on the valve cone.
2. The valve may be reground only two times. Do not grind the valve stem end.
3. Ensure that the angle at the valve face is 45 degrees.
4. Inspect the assembly height of the intake valves and the exhaust valves.



5. Check the valve stem projection using valve stem projection gauge KM-512.



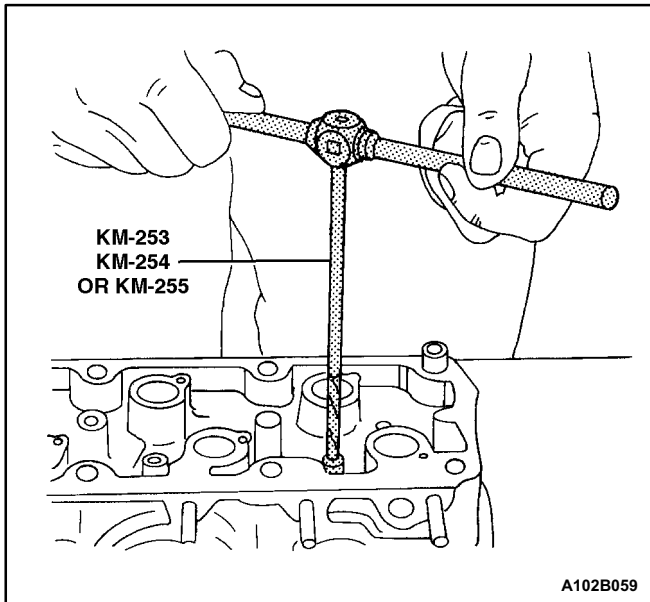
Valve Guide - Ream

1. Measure the diameter of the valve guide using gauge MKM-571-B and a commercially available inside micrometer.

Important: Valve oversizes may already have been fitted in production.

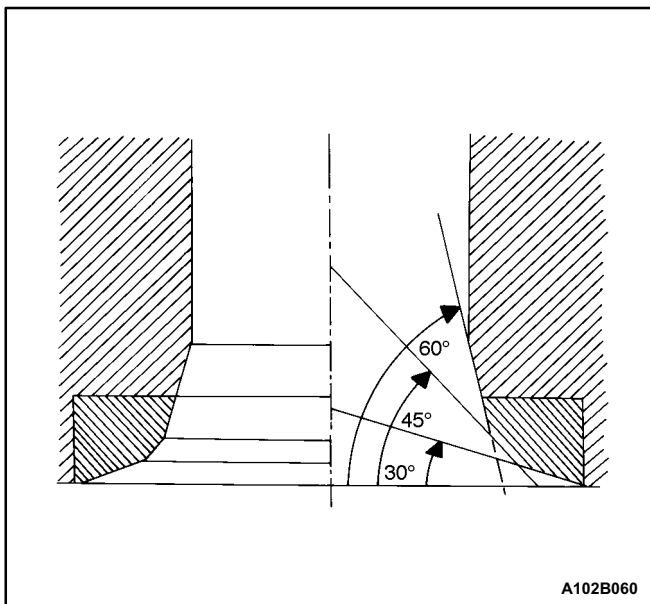
2. An oversize code is on the valve guide and the valve stem end. The following table gives the correct size, reamer, and production code for each service code.

Size	Reamer	Production Code	Service Code
Normal		-	K
0.075	KM-253	1	K1
0.150	KM-254	2	K2
0.250	KM-255		A



A102B059

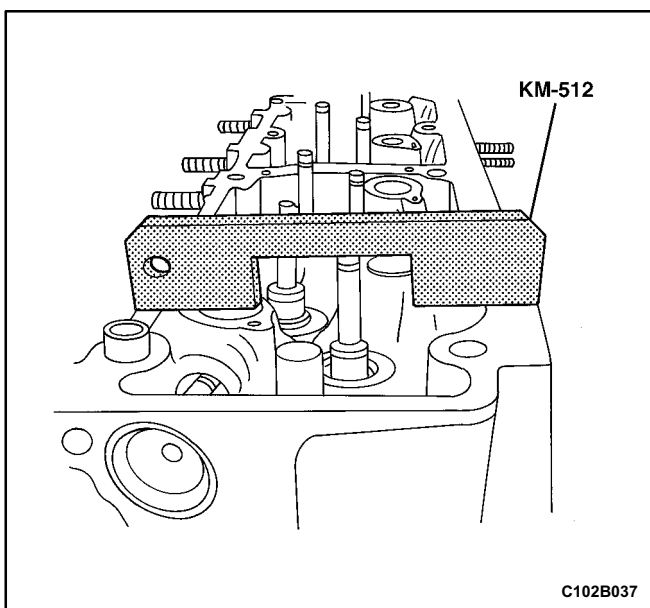
3. Ream the valve guide from the upper side of the cylinder head to the next oversize.
4. After reaming, cross out the code and emboss the valve guide with the new code.



A102B060

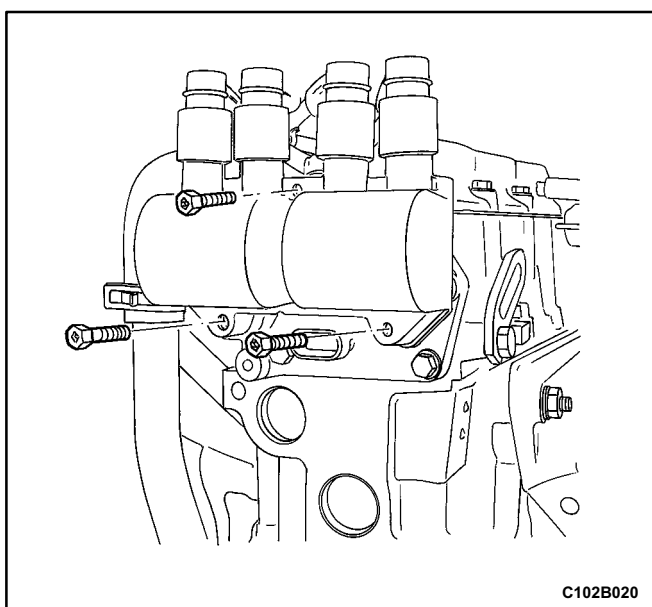
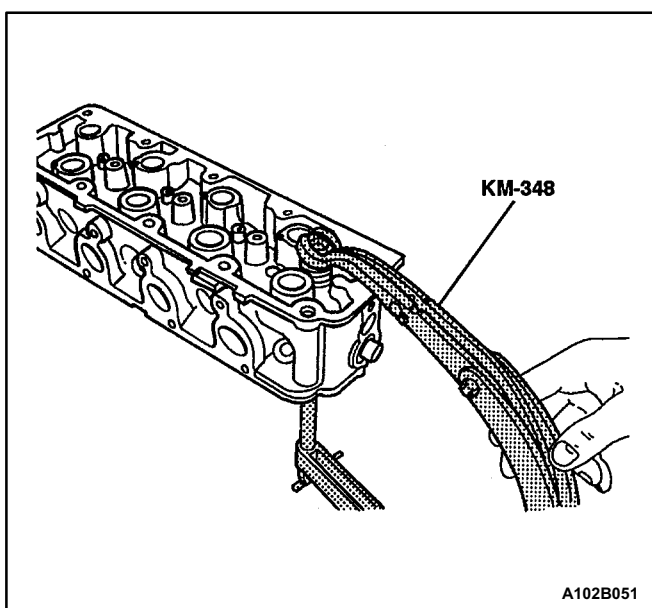
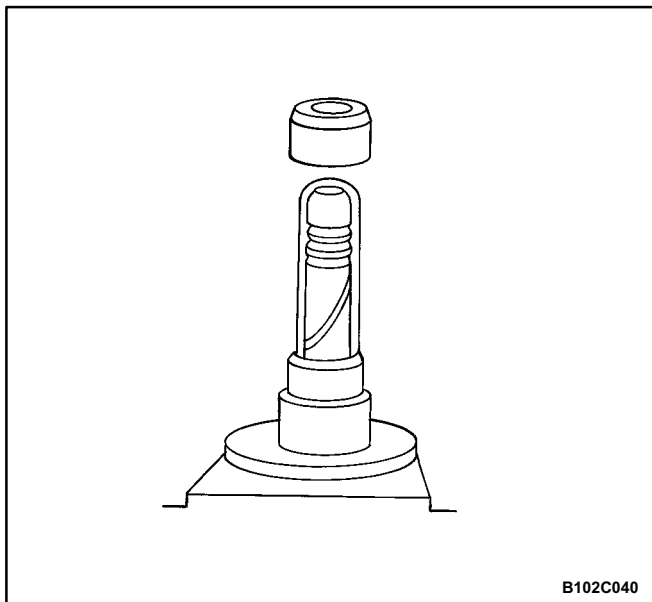
Valve Seat - Cut

1. Place the cylinder head on wooden blocks.
2. Cut the intake and the exhaust valve seats using the guide drift KM-340-7 as follows:
 - Valve seat: A 45 degree surface using cutter KM-340-13.
 - Upper correction angle: A 30-degree surfaced using cutter KM-340-13.
 - Lower correction angle: A 60 degree surface using cutter KM-340-26.



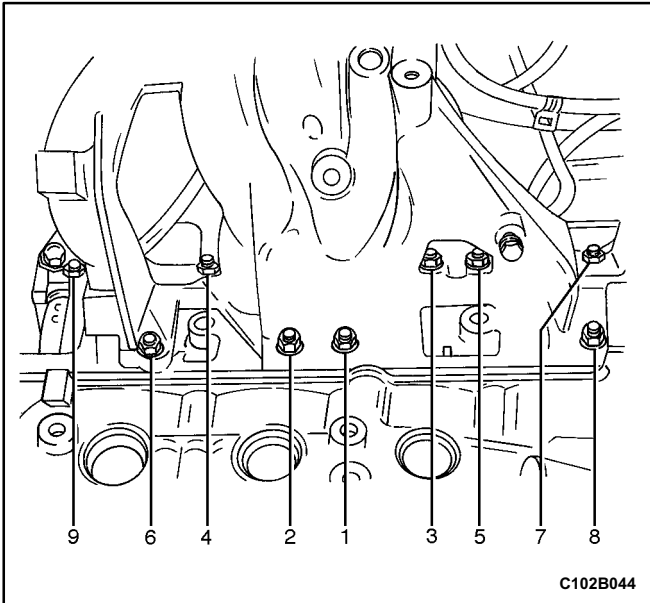
C102B037

3. Clean the chippings from the cylinder head.
4. Inspect the dimension for the valve seat width.
 - Intake: 1.2 to 1.4 mm (0.047 to 0.055 inch).
 - Exhaust: 1.4 to 1.8 mm (0.055 to 0.070 inch).
5. Inspect the assembly height of the intake valves and the exhaust valves. If the dimension is exceeded, install new valves. Inspect the assembly height of the intake valves and the exhaust valves again. If the valve assembly height is still too large despite replacing the valves, replace the cylinder head.
6. If the dimension is exceeded, install new valves and then check the valve stem projection again. Refer to "Valve-Grind" and "Valve Grind-In" in this section.
7. If the valve stem projection is still too large despite replacing the valves, replace the cylinder head.



Assembly Procedure

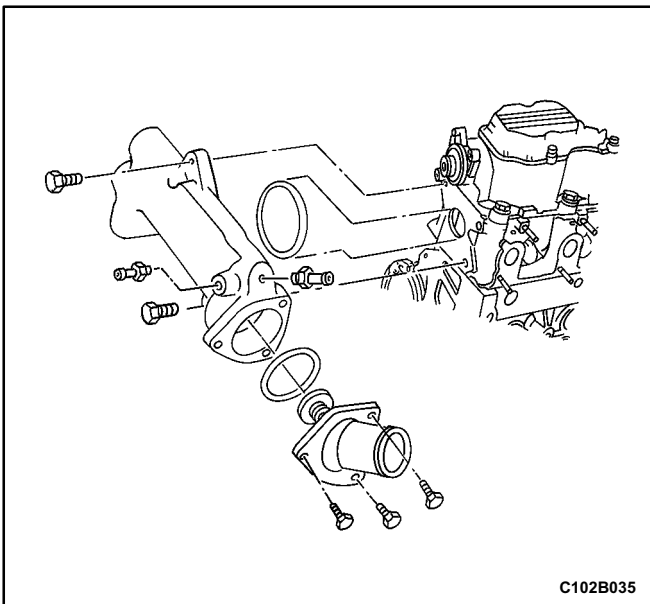
1. Coat the valves with engine oil.
 2. Insert the valves in the cylinder head in their original positions.
 3. Insert the valve spring seats.
 4. Push the accompanying assembly sleeve onto the valve stem.
 5. Insert the new valve stem seat.
 6. Carefully drive the valve stem seal onto the stop with light taps.
 7. Install the valve springs in their original positions.
 8. Install the valve spring caps.
9. Compress the valve springs with the valve spring compressor KM-348.
 10. Install the valve retainers.
 11. Remove the valve spring compressor KM-348.
 12. Lubricate the valve lash adjusters with engine oil.
 13. Install the valve lash adjusters.
14. Install the spark plugs.
- Tighten**
- Tighten the spark plugs to 20 N•m (15 lb•ft).
15. Install the DIS ignition coil mounting bracket.
 16. Install the DIS ignition coil mounting bracket bolts.
- Tighten**
- Tighten the DIS ignition coil mounting bracket bolts to 10 N•m (89 lb•in).
17. Install the coolant temperature sensor.
- Tighten**
- Tighten the coolant temperature sensor to 25 N•m (18 lb•ft).



18. Install the intake manifold studs.
19. Install the intake manifold gasket.
20. Install the intake manifold.
21. Install the intake manifold retaining nuts in the sequence shown.

Tighten

Tighten the intake manifold retaining nuts to 22 N•m (16 lb•in).



22. Install the fuel rail assembly. Refer to *Section 1F, Engine Controls*.
23. Install the coolant manifold assembly.
24. Install the coolant manifold mounting bolts.

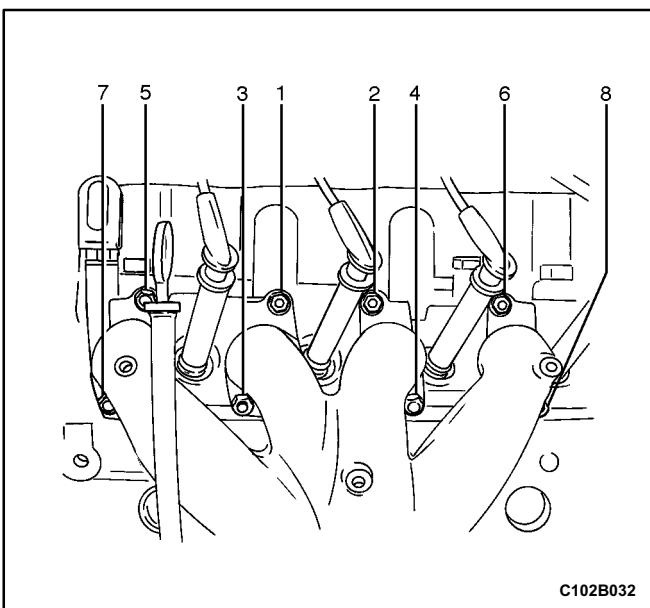
Tighten

Tighten the coolant manifold mounting bolts to 15 N•m (11 lb•ft).

25. Install the thermostat housing and mounting bolts.

Tighten

Tighten the thermostat housing mounting bolts to 15 N•m (11 lb•ft).



26. Install the exhaust manifold studs.
27. Install the exhaust manifold gasket.
28. Install the exhaust manifold.
29. Install the exhaust manifold retaining nuts in the sequence shown.

Tighten

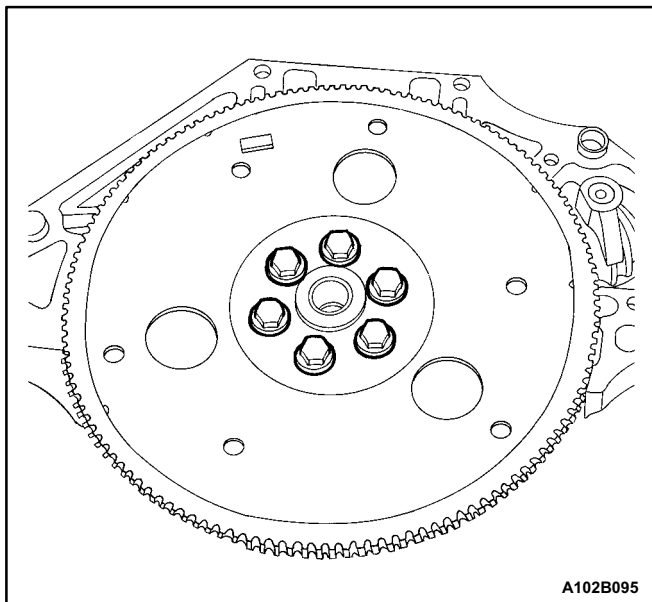
Tighten the exhaust manifold retaining nuts to 22 N•m (16 lb•ft).

30. Install the exhaust manifold heat shield.
31. Install the exhaust manifold heat shield bolts.

Tighten

Tighten the exhaust manifold heat shield bolts to 8 N•m (71 lb•in).

32. Install the cylinder head with the intake manifold and the exhaust manifold attached. Refer to "Cylinder Head and Gasket" in this section.



CRANKSHAFT

Tools Required

KM-412 Engine Overhaul Stand

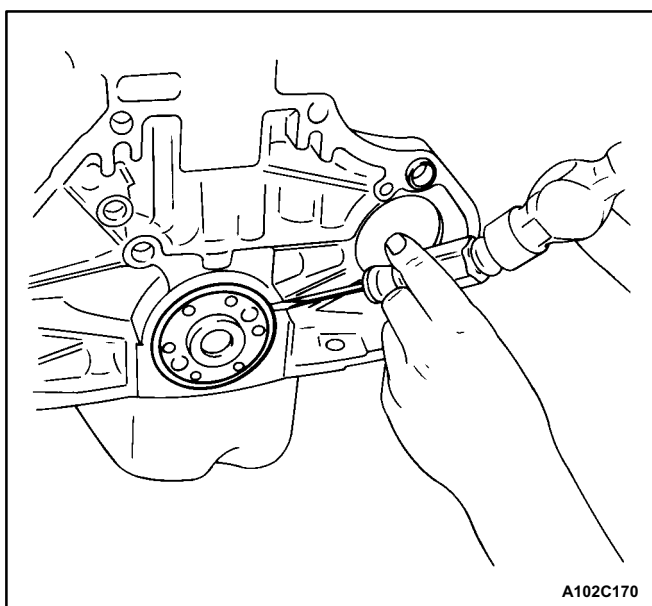
KM-470-B Angular Torque Gauge

J-36792 or KM-635 Crankshaft Rear Oil Seal Installer

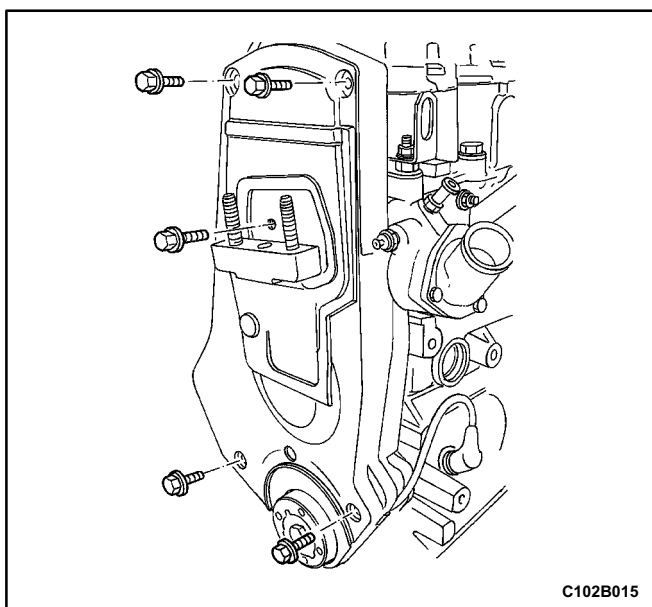
Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts. Such damage can cause premature engine wear.

Disassembly Procedure

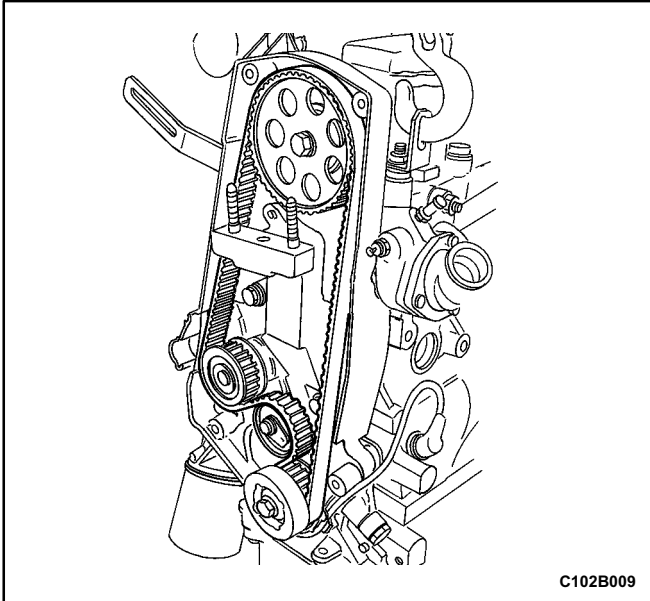
1. Remove the engine. Refer to "Engine" in this section.
2. Remove the flywheel bolts or the flexible plate bolts.
3. Remove the flywheel or the flexible plate.



4. Remove the crankshaft rear oil seal.
5. Mount the engine assembly on the engine overhaul stand KM-412.

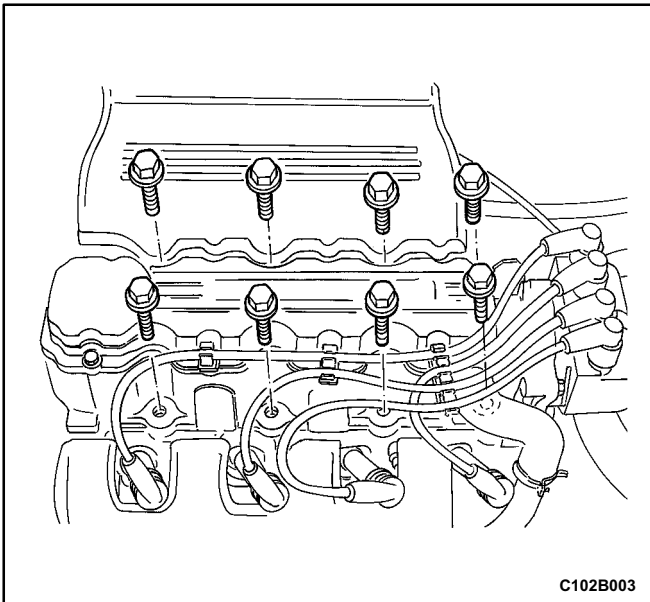


6. Remove the front timing belt cover bolts.
7. Remove the front timing belt cover.
8. Remove the crankshaft pulley bolts.
9. Remove the crankshaft pulley.



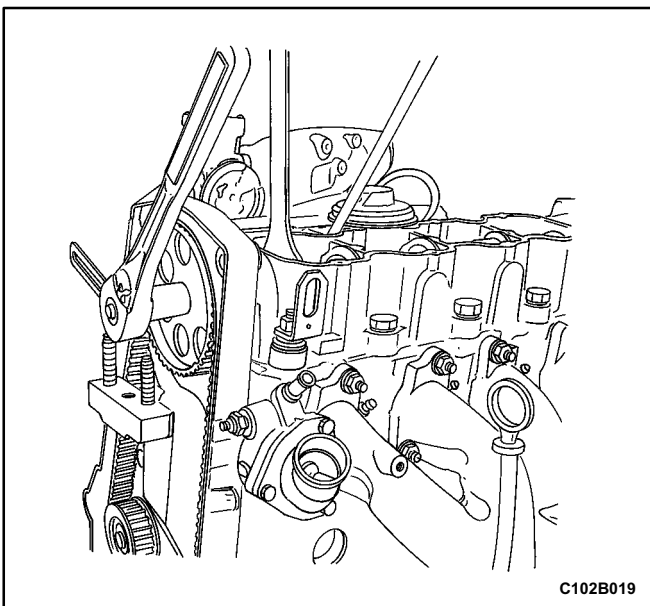
C102B009

10. Loosen the timing belt automatic tensioner bolt.
11. Rotate the timing belt automatic tensioner hexkey clockwise to release the tension.
12. Remove the timing belt.
13. Remove the right side engine mount retaining bolts/nuts.
14. Remove the right side engine mount.



C102B003

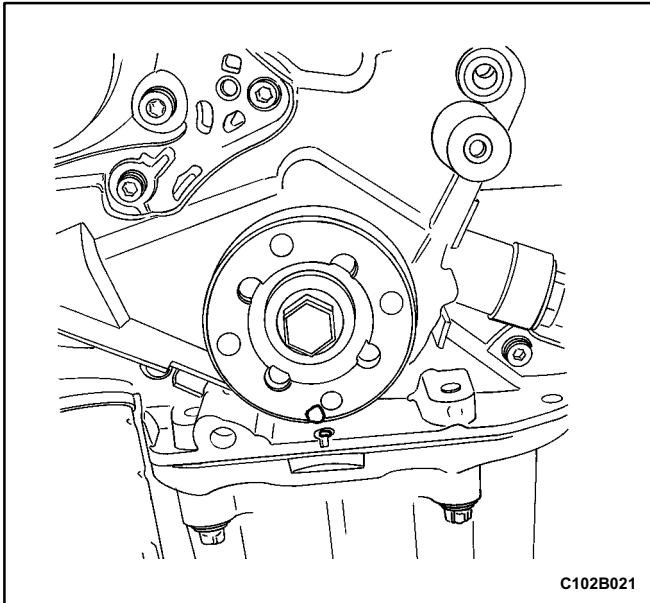
15. Disconnect the crankcase breather tubes from the valve cover.
16. Disconnect the ignition wires from the spark plugs.
17. Remove the valve cover bolts.
18. Remove the valve cover and the valve cover gasket.



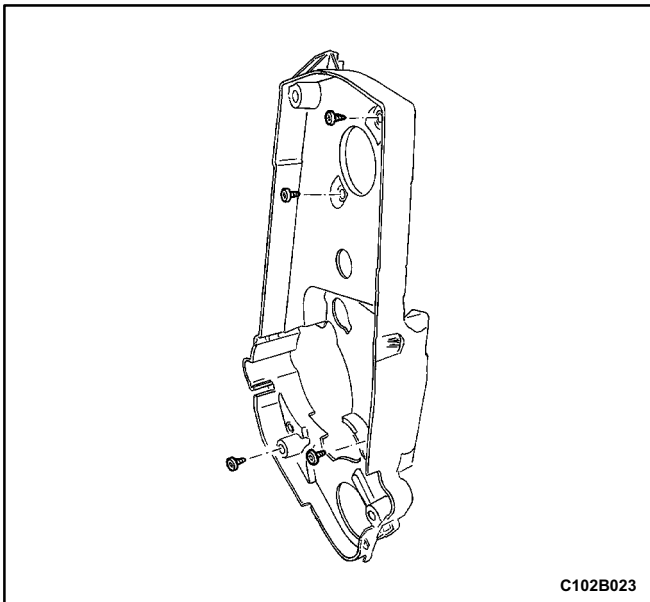
C102B019

Notice: Take extreme care to prevent any scratches, nicks or damage to the camshaft. Such damage can cause premature engine wear.

19. While holding the camshaft firmly in place, remove the camshaft bolt.
20. Remove the camshaft gear.

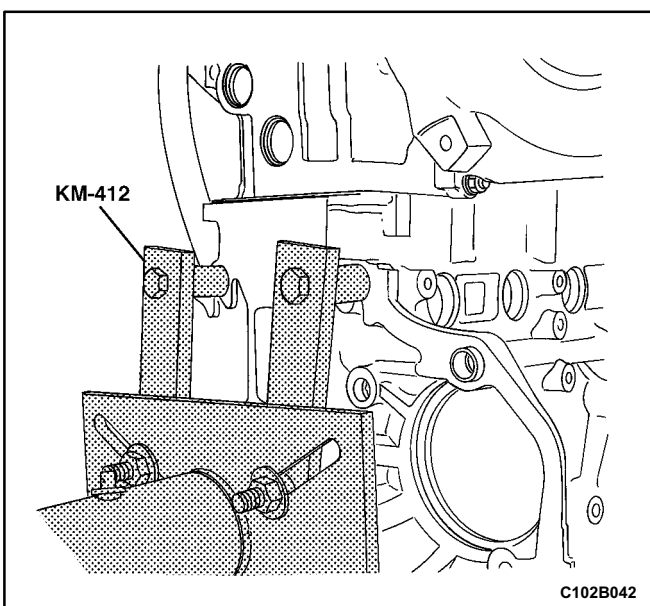


21. Remove the crankshaft timing belt gear.

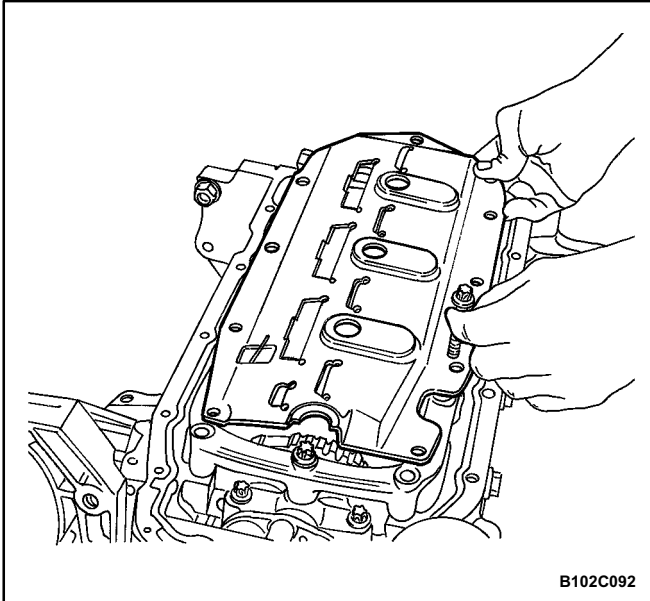


Important: Remove the knock sensor wire from its track prior to removing the rear timing belt cover.

22. Remove the rear timing belt cover bolts and the rear timing belt cover.

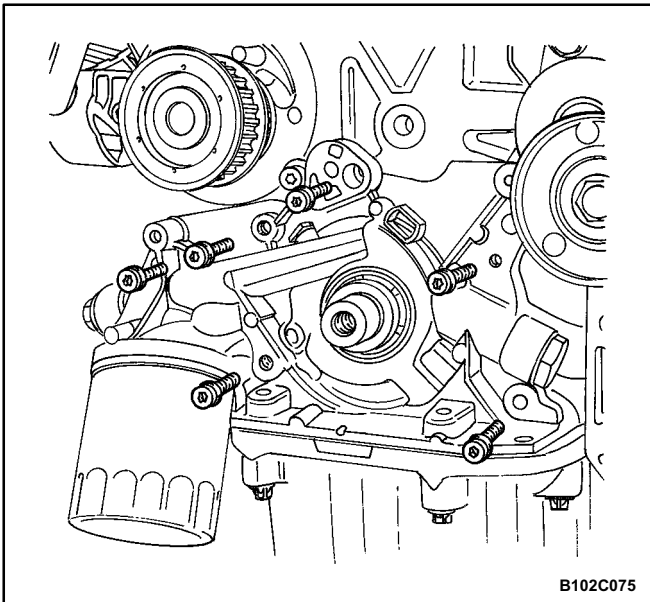


23. Rotate the engine on the engine overhaul stand KM-412.



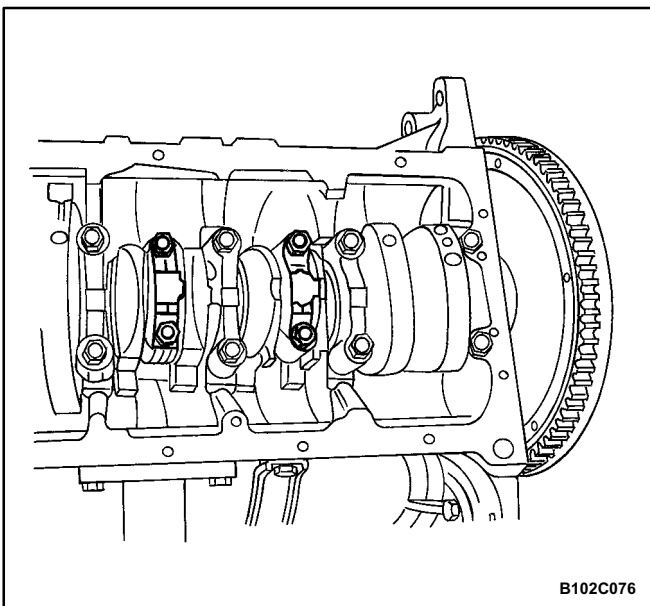
B102C092

24. Remove the oil pan retaining bolts.
25. Remove the oil pan.
26. Remove the oil pump/pickup tube bolts.
27. Remove the oil pump/pickup tube.
28. Remove the engine block lower support bracket splash shield bolts.
29. Remove the splash shield.
30. Remove the engine block lower support bracket bolts.
31. Remove the engine block lower support bracket.



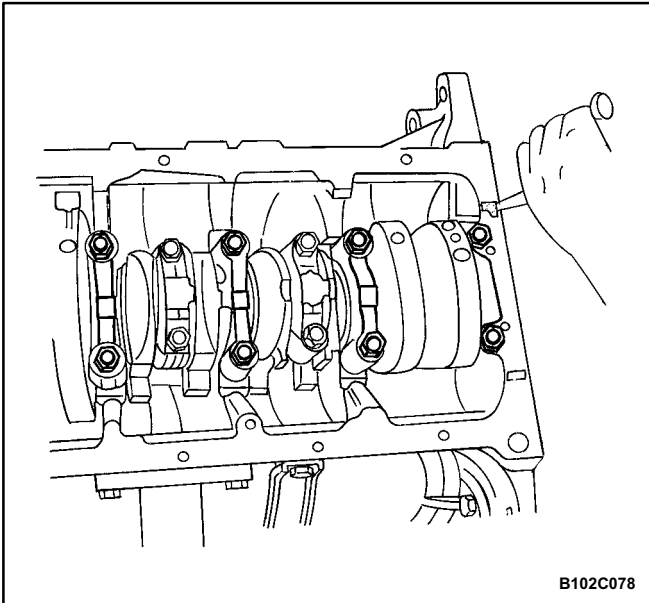
B102C075

32. Remove the oil pump retaining bolts.
33. Remove the oil pump.



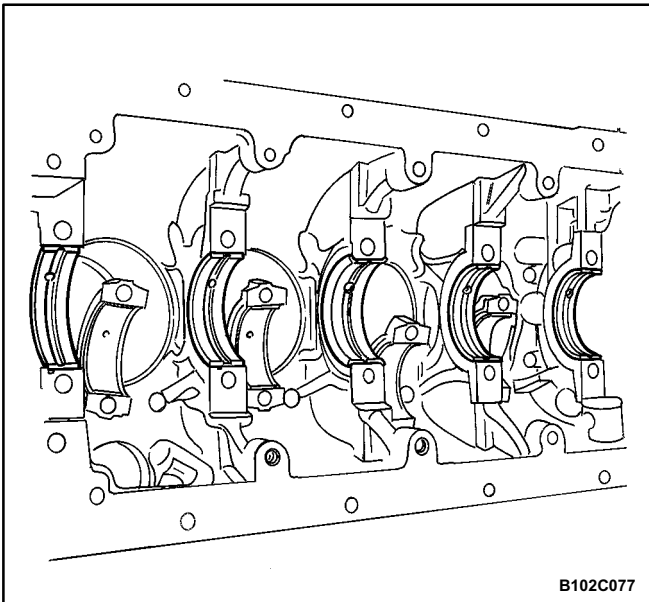
B102C076

34. Mark the order of the rod bearing caps.
35. Remove the connecting rod cap bolts for all of the pistons.
36. Remove the connecting rod bearing caps and the lower connecting rod bearings.



B102C078

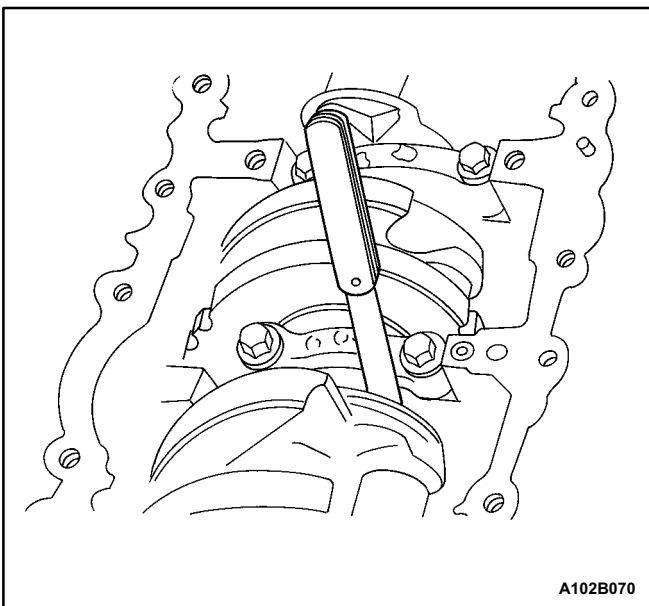
37. Mark the order of the crankshaft bearing caps.
38. Remove the crankshaft bearing cap bolts.
39. Remove the crankshaft bearing caps and the lower crankshaft bearings.
40. Remove the crankshaft.
41. Clean the parts as needed.



B102C077

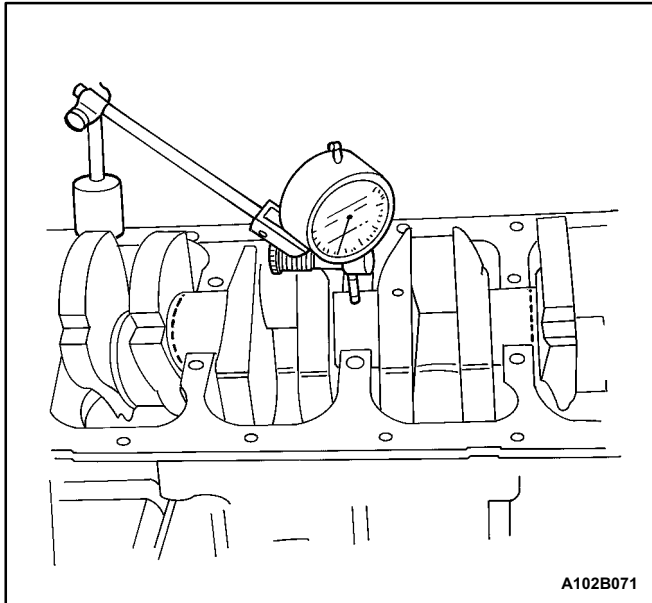
Assembly Procedure

1. Coat the crankshaft bearings with engine oil.
2. If replacing the crankshaft, transfer the pulse pickup sensor disc to the new crankshaft.



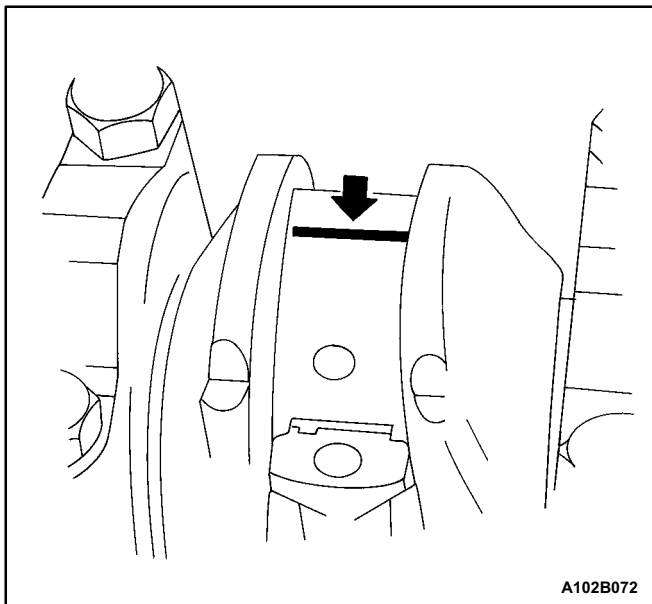
A102B070

3. Install the crankshaft.
4. Install the lower crankshaft bearings in the bearing caps.
5. Inspect the crankshaft end play with the crankshaft bearings installed.
6. Check for permissible crankshaft end play. Refer to "Engine Specifications" in this section.



A102B071

7. With the crankshaft mounted on the front and the rear crankshaft bearings, check the middle crankshaft journal for permissible out-of-round (runout). Refer to "Engine Specifications" in this section.



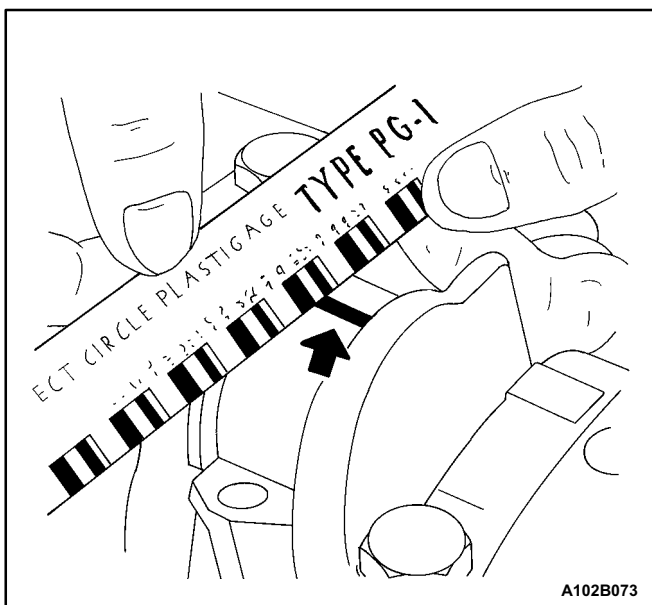
A102B072

Important: Grease the crankshaft journals and lubricate the crankshaft bearings slightly so that the plastic gauging thread does not tear when the crankshaft bearing caps are removed.

8. Inspect all of the crankshaft bearing clearances using a commercially available plastic gauging (ductile plastic threads).
9. Cut the plastic gauging threads to the length of the bearing width. Lay them axially between the crankshaft journals and the crankshaft bearings.
10. Install the crankshaft bearing caps and the bolts.

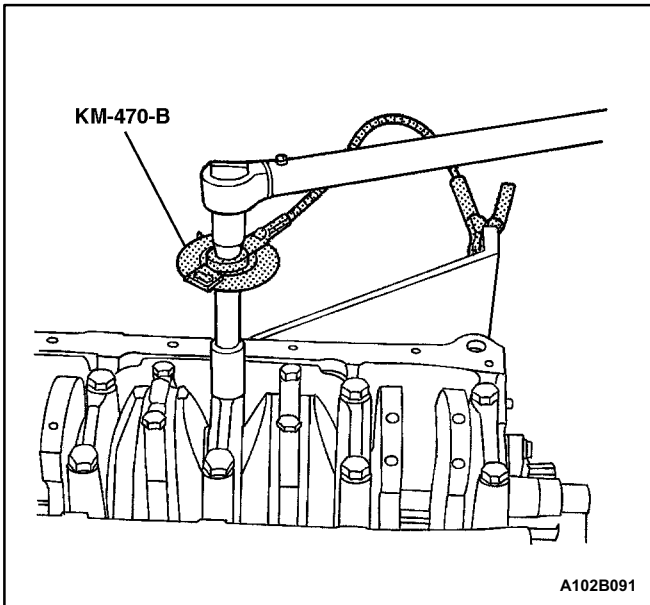
Tighten

Tighten the crankshaft bearing cap bolts to 35 N•m (26 lb•ft) using a torque wrench. Use the angular torque gauge KM-470-B to tighten the crankshaft bearing cap bolts another 45 degrees.



A102B073

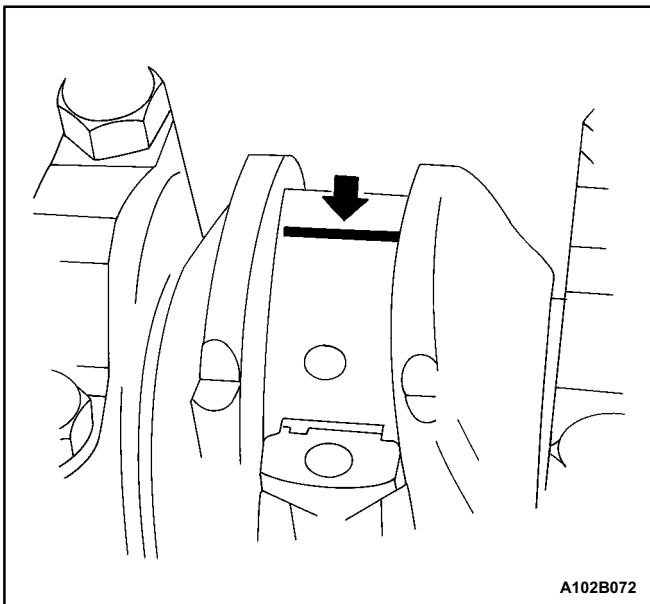
11. Remove the crankshaft bearing cap bolts and the caps.
12. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
13. Inspect the bearing clearance for permissible tolerance ranges. Refer to "Engine Specifications" in this section.



14. Apply a bead of adhesive sealing compound to the grooves of the crankshaft bearing caps.
15. Install the crankshaft bearing caps to the engine block.
16. Tighten the crankshaft bearing caps using new bolts.

Tighten

Tighten the crankshaft bearing cap bolts to 35 N•m (26 lb•ft) using a torque wrench. Use the angular torque gauge KM-470-B to tighten the crankshaft bearing cap bolts another 45 degrees.

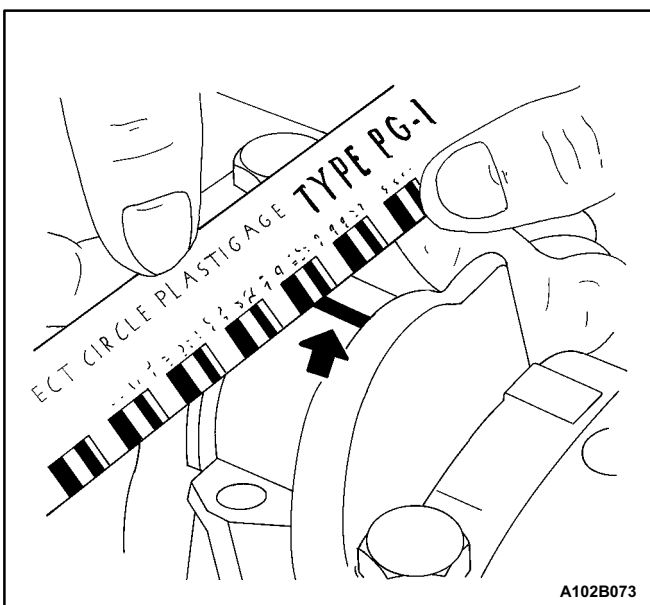


Important: Grease the connecting rod journals and lubricate the connecting rod bearings slightly so that the plastic gauging thread does not tear when the connecting rod bearing caps are removed.

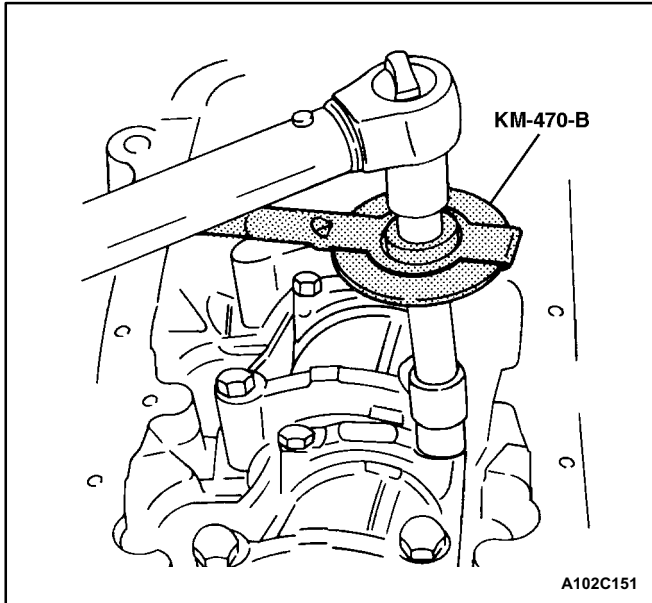
17. Inspect all of the connecting rod bearing clearances using a commercially available plastic gauging (ductile plastic threads).
18. Cut the plastic gauging threads to the length of the connecting rod bearing width. Lay them axially between the connecting rod journals and the connecting rod bearings.
19. Install the connecting rod bearing caps with the bolts.

Tighten

Tighten the connecting rod bearing cap bolts to 35 N•m (26 lb•ft) using a torque wrench. Use the angular torque gauge KM-470-B to tighten the connecting rod bearing cap bolts another 45 degrees plus 15 degrees.



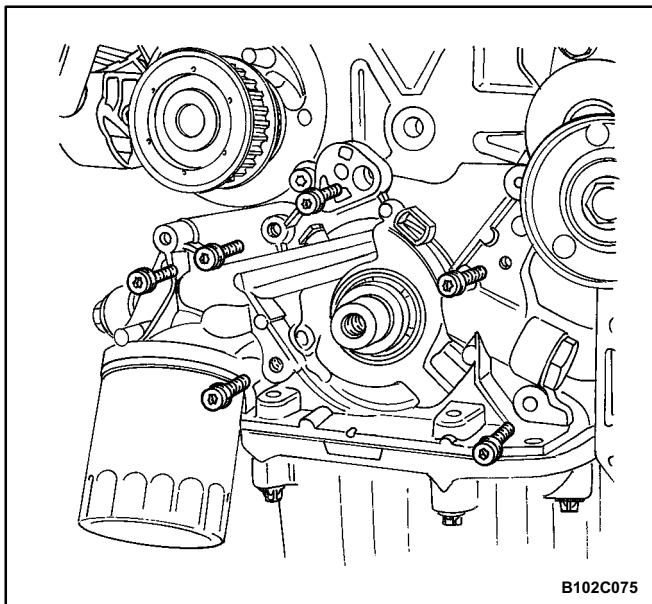
20. Remove the connecting rod bearing caps.
21. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
22. Inspect the bearing clearance for permissible tolerance ranges. Refer to "Engine Specifications" in this section.



23. Install the connecting rod bearing caps to the connecting rods.
24. Tighten the connecting rod bearing caps using new bolts.

Tighten

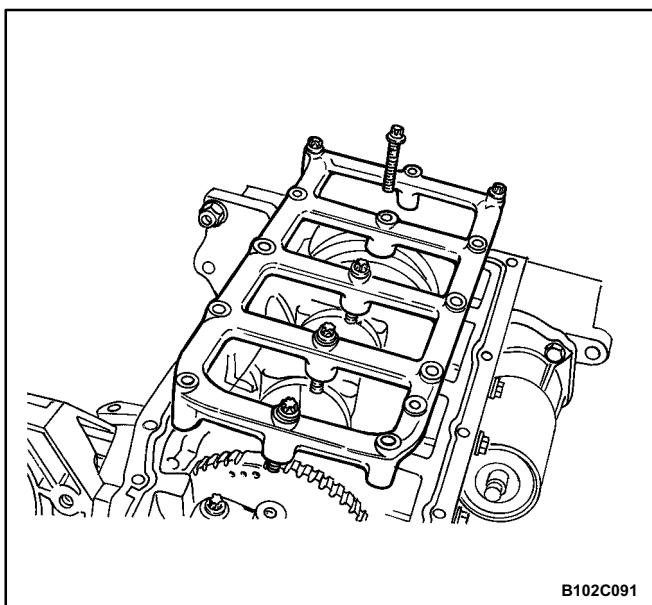
Tighten the connecting rod bearing cap bolts to 35 N•m (26 lb•ft) using a torque wrench. Use the angular torque gauge KM-470-B to tighten the connecting rod bearing cap bolts another 45 degrees plus 15 degrees.



25. Install the oil pump
26. Install the oil pump retaining bolts.

Tighten

Tighten the oil pump retaining bolts to 10 N•m (89 lb•in).



27. Install the engine block lower support bracket with the bolts.

Tighten

Tighten the engine block lower support bracket bolts to 40 N•m (30 lb•ft).

28. Install the engine block lower support bracket splash shield with the bolts.

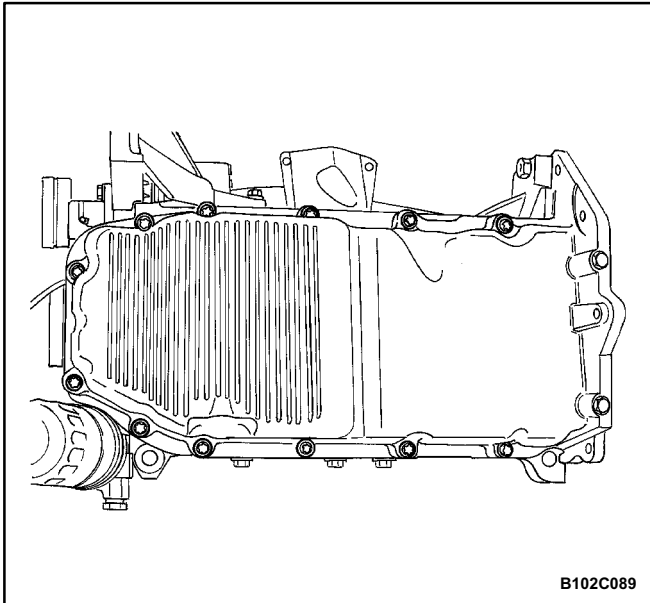
Tighten

Tighten the engine block lower support bracket splash shield bolts to 40 N•m (30 lb•ft).

29. Install the oil pump/pickup tube with the bolts.

Tighten

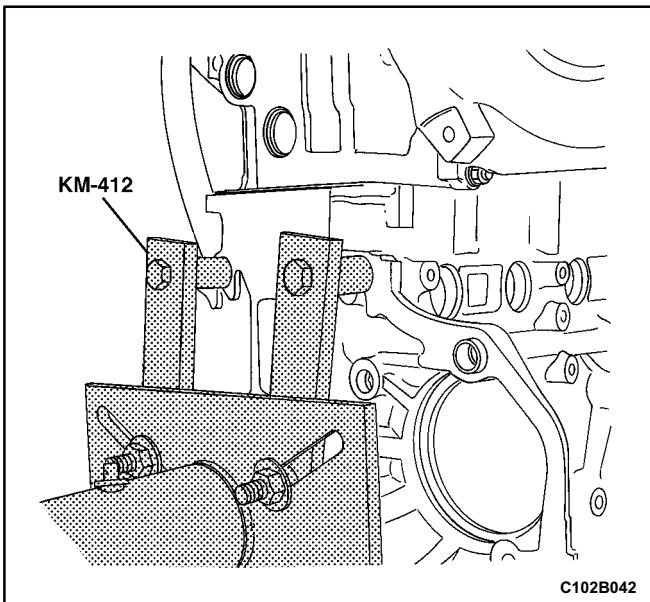
Tighten the oil pump/pickup tube bolts to 8 N•m (71 lb•in).



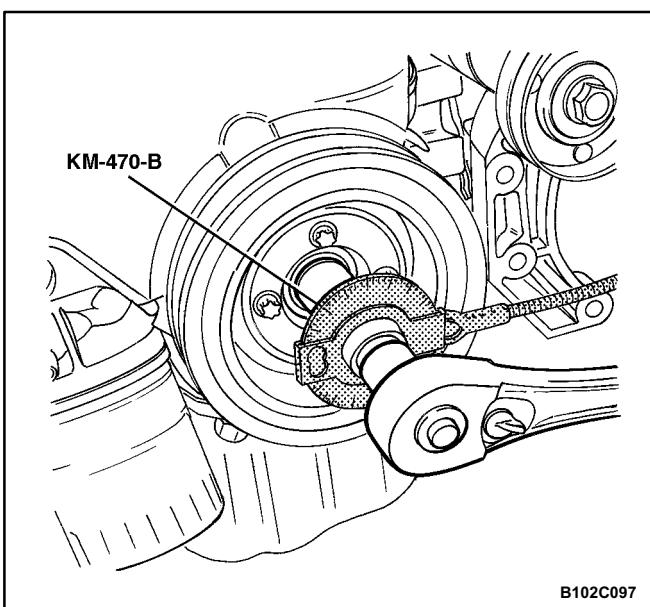
30. Coat the new oil pan gasket with sealant.
31. Install the oil pan gasket to the oil pan.
32. Install the oil pan.
33. Install the oil pan retaining bolts.

Tighten

Tighten the oil pan retaining bolts to 10 N•m (89 lb•in).



34. Rotate the engine on the engine overhaul stand KM-412.



35. Install the rear timing belt cover with the bolts.

Tighten

Tighten the rear timing belt cover bolts to 6 N•m (53 lb•in).

36. Install the crankshaft timing belt drive gear with the bolt.

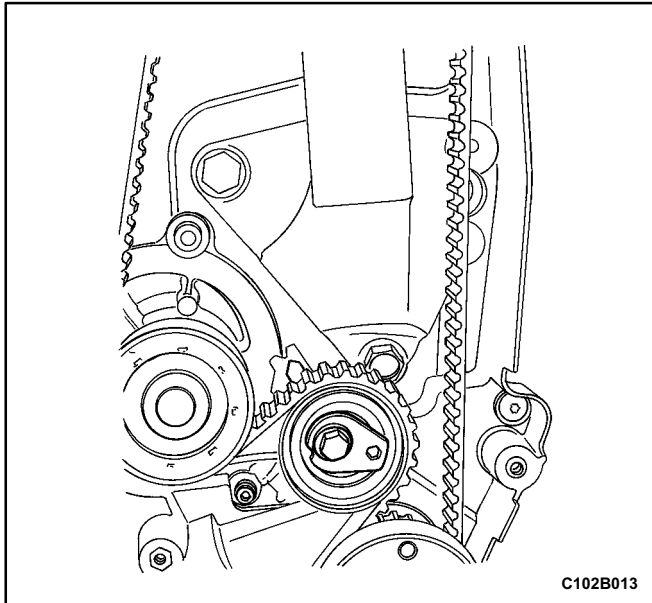
Tighten

Tighten the crankshaft timing belt drive gear bolt to 95 N•m (70 lb•ft). Then use the angular torque gauge KM-470-B to tighten the crankshaft timing belt drive gear bolt another 30 degrees plus 15 degrees.

37. Install the right side engine mount with the retaining bolts/nuts.

Tighten

Tighten the right side engine mount retaining bolts/nuts to 60 N•m (44 lb•ft).



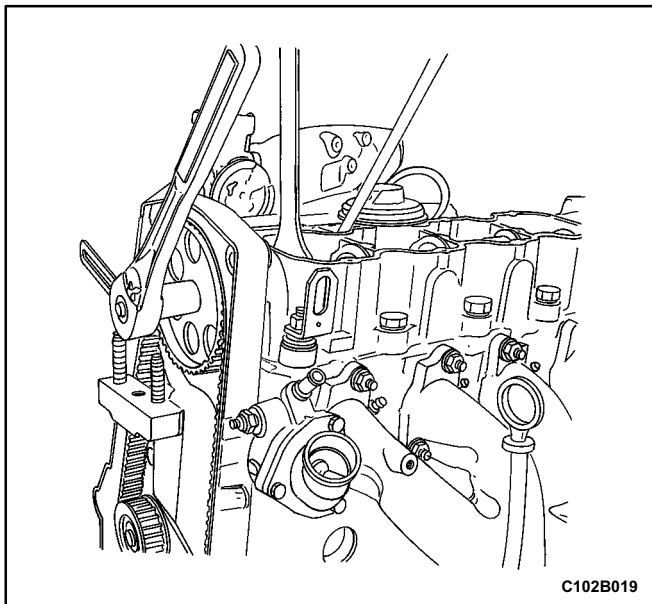
C102B013

38. Install the timing belt automatic tensioner with the bolt.

Tighten

Tighten the timing belt automatic tensioner bolt to 25 N•m (18 lb•ft).

Important: Route the knock sensor wire into its track prior to proceeding.



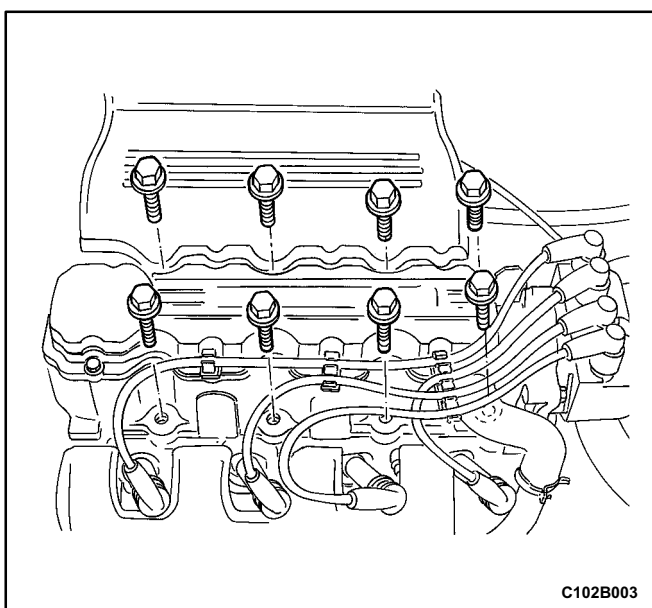
C102B019

Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshaft. Such damage can cause premature engine wear.

39. Install the camshaft gear.
40. Install the camshaft gear retaining bolt while holding the camshaft firmly in place.

Tighten

Tighten the camshaft gear retaining bolt to 45 N•m (33 lb•ft).

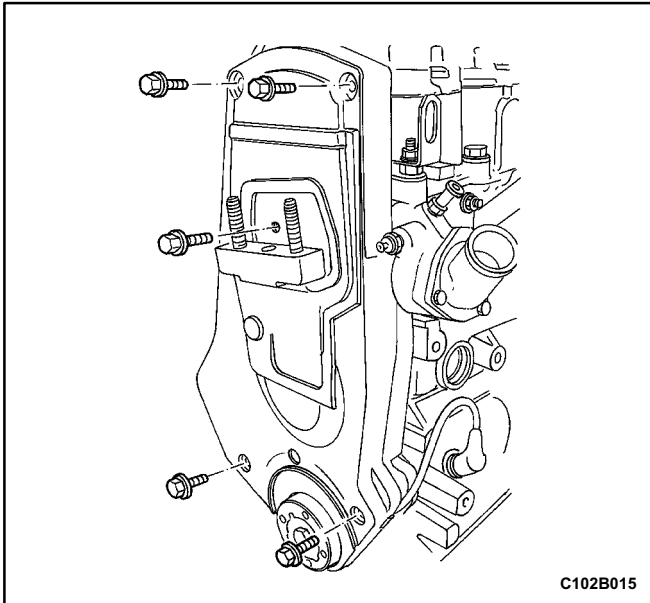


C102B003

41. Install the timing belt. Refer to "Timing Belt" in this section.
42. Adjust the timing belt tension. Refer to "Timing Belt Check and Adjust" in this section.
43. Install the valve cover gasket and the valve cover.
44. Install the valve cover bolts.

Tighten

Tighten the valve cover bolts to 8 N•m (71 lb•in).

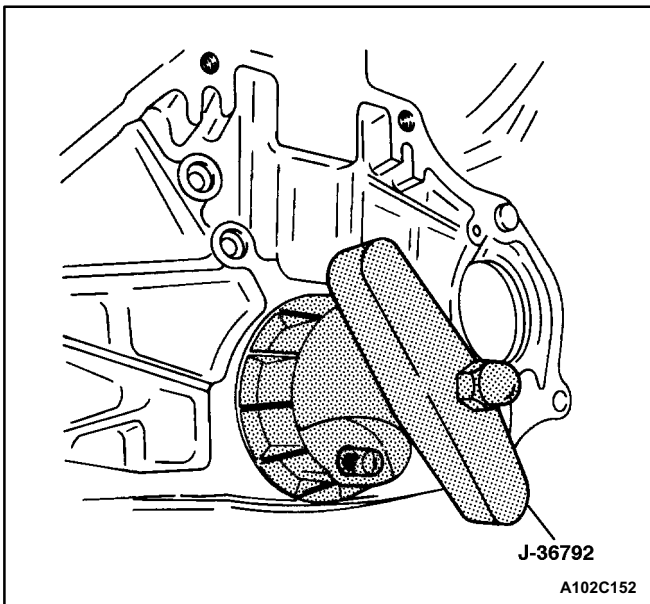


45. Connect the ignition wires to the spark plugs.
46. Connect the crankcase breather tube to the valve cover.
47. Install the front timing belt cover with the bolts.

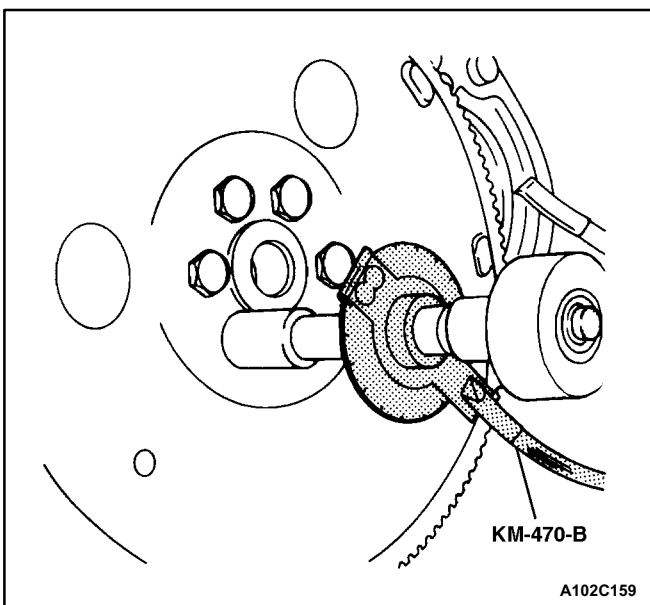
Tighten

Tighten the front timing belt cover bolts to 6 N•m (53 lb•in).

48. Install the engine lifting device.
49. Remove the engine from the engine overhaul stand KM-412.



50. Install a new crankshaft rear oil seal using installer J-36792 or KM-635.



51. Install the flywheel or the flexible plate with the bolts.

Tighten

Tighten the flywheel bolts to 65 N•m (48 lb•ft). Use the angular torque gauge KM-470-B to tighten the flywheel bolts another 30 degrees plus 15 degrees. For the automatic transmission, tighten the flexible plate bolts to 65 N•m (48 lb•ft).

52. Install the engine. Refer to "Engine" in this section.

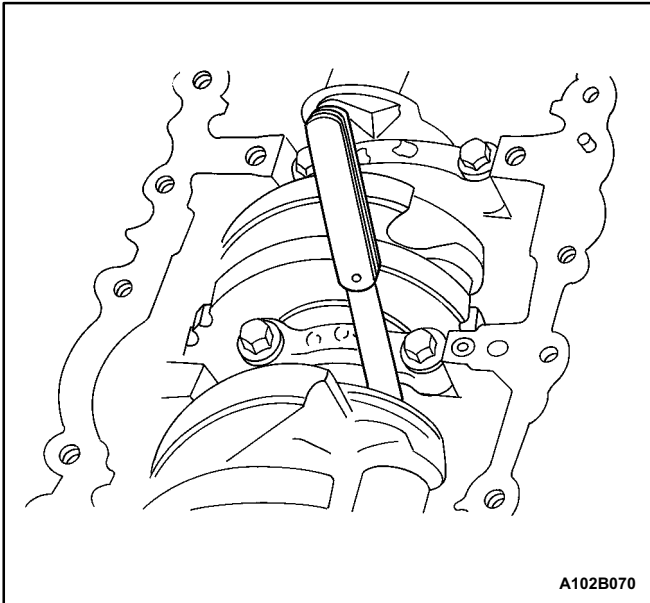
CRANKSHAFT BEARINGS AND CONNECTING ROD BEARINGS- GAUGING PLASTIC

Tools Required

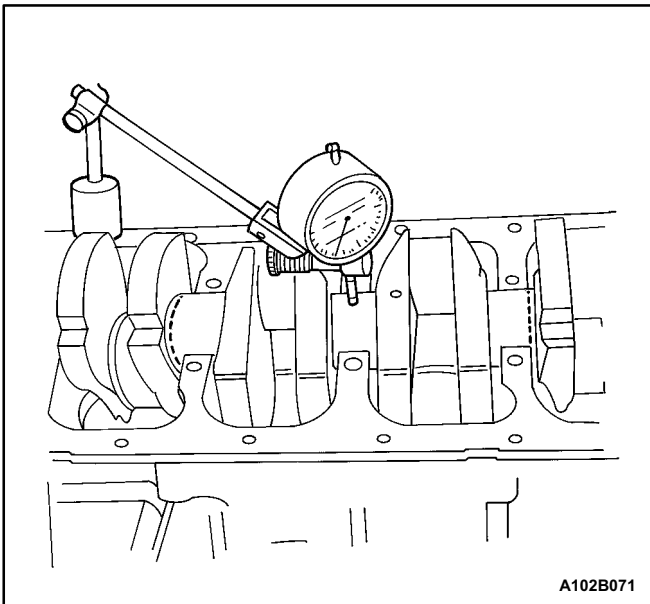
KM-470-B Angular Torque Gauge

Inspection Procedure - Crankshaft

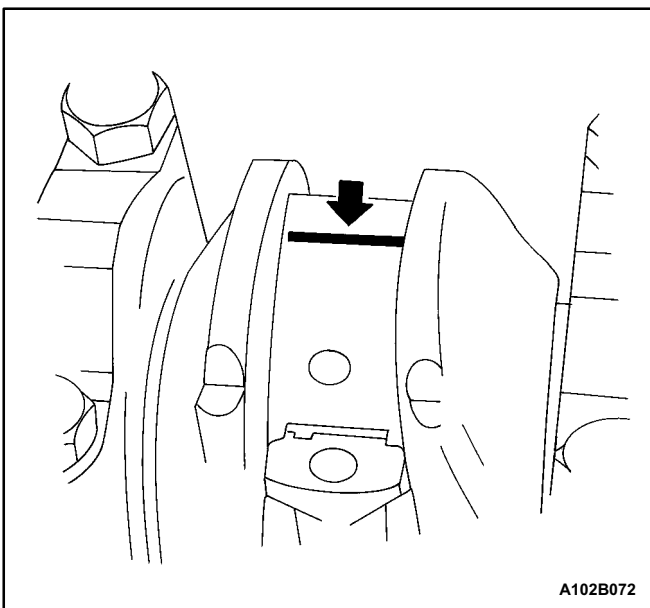
1. Coat the crankshaft bearings with engine oil.
2. Install the upper crankshaft bearings into the engine block crankshaft journals.
3. Install the lower crankshaft bearings into the crankshaft bearing caps.
4. Install the crankshaft.
5. Inspect the crankshaft end play with the crankshaft bearings installed.
6. Check for permissible crankshaft end play. Refer to "Engine Specifications" in this section.
7. With the crankshaft mounted on the front and the rear crankshaft bearings, check the middle crankshaft bearings, check the middle crankshaft journal for permissible out-of-round (runout). Refer to "Engine Specifications" in this section.



A102B070



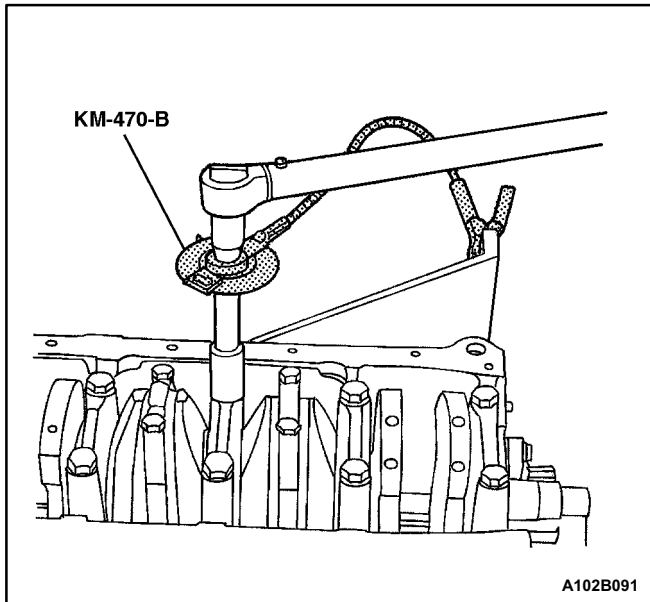
A102B071



A102B072

Important: Grease the crankshaft journals and lubricate the crankshaft bearings slightly so that the plastic gauging thread does not tear when the crankshaft bearing caps are removed.

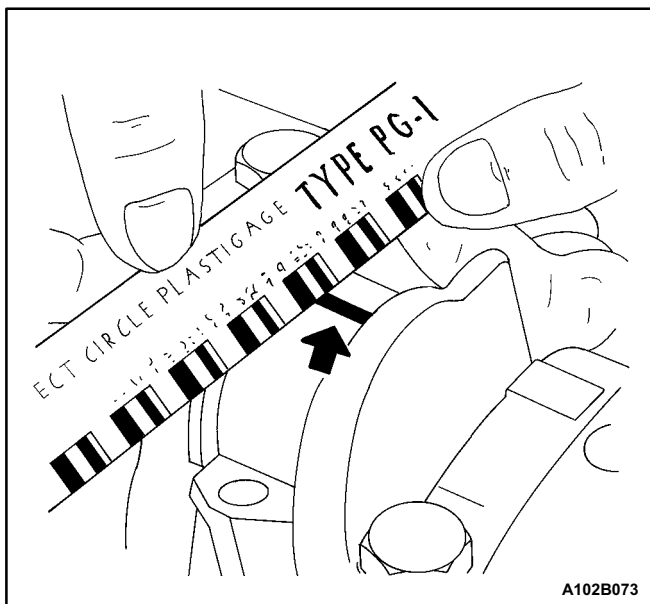
8. Inspect all of the crankshaft bearing clearances using a commercially available plastic gauging (ductile plastic threads).
9. Cut the plastic gauging threads to the length of the bearing width. Lay them axially between the crankshaft journals and the crankshaft bearings.



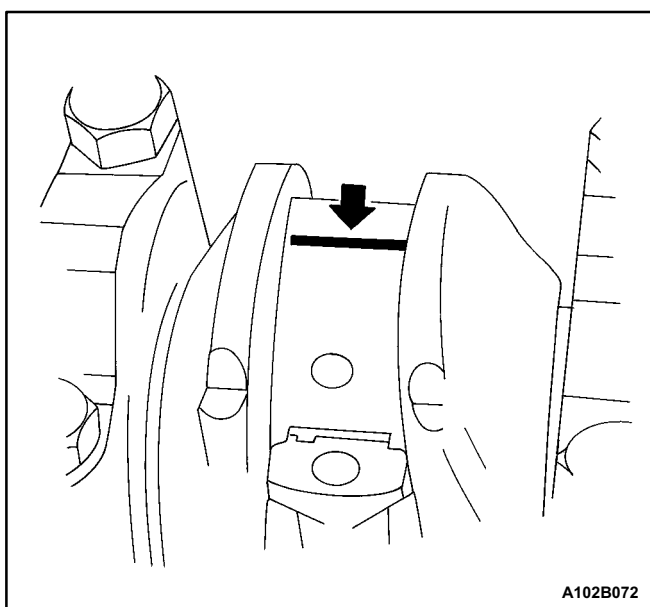
10. Install the crankshaft bearing caps with the bolts.

Tighten

Tighten the crankshaft bearing cap bolts to 35 N•m (26 lb•ft). Using the angular torque gauge KM-470-B, tighten the crankshaft bearing cap bolts another 45 degrees.



11. Remove the crankshaft bearing caps.
 12. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
 13. Inspect the bearing clearances for permissible tolerance ranges. Refer to "Engine Specifications" in this section.

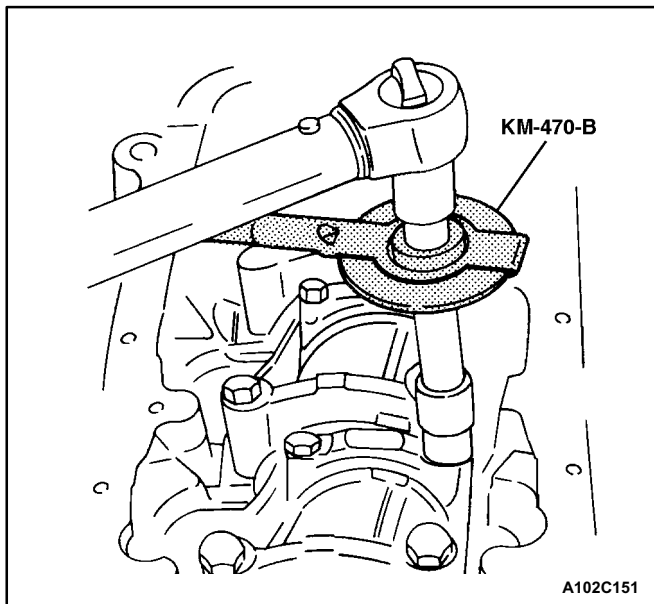


Inspection Procedure - Connecting Rods

1. Coat the connecting rod bearings with engine oil.
2. Install the upper connecting rod bearings into the connecting rod journals.
3. Install the lower connecting rod bearings into the connecting rod bearing caps.

Important: Grease the connecting rod journals and lubricate the connecting rod bearings slightly so that the plastic gauging thread does not tear when the connecting rod bearing caps are removed.

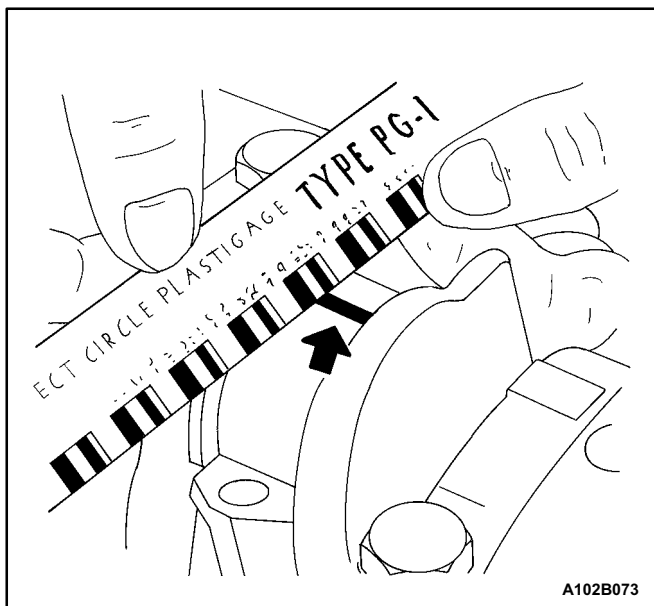
4. Inspect all of the connecting rod bearing clearances using a commercially available plastic gauging (ductile plastic threads).
5. Cut the plastic gauging threads to the length of the bearing width. Lay them axially between the connecting rod journals and the connecting rod bearings.



6. Install the connecting rod bearing caps with the bolts.

Tighten

Tighten the connecting rod cap bolts to 35 N•m (26 lb•ft). Using the angular torque gauge KM-470-B, tighten the connecting rod cap bolts another 45 degrees plus 15 degrees.



7. Remove the connecting rod bearing caps.
8. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
9. Inspect the bearing clearance for permissible tolerance ranges. Refer to "Engine Specifications" in this section.

GENERAL DESCRIPTION AND SYSTEM OPERATION

CYLINDER HEAD AND GASKET

The cylinder head is made of an aluminum alloy. The cylinder head uses crossflow intake and exhaust ports. A spark plug is located in the center of each combustion chamber.

CRANKSHAFT

The crankshaft has eight integral weights which are cast with it for balancing. Oil holes run through the center of the crankshaft to supply oil to the connecting rods, the bearings, the pistons, and the other components. The end thrust load is taken by the thrust washers installed at the center journal.

TIMING BELT

The timing belt coordinates the crankshaft and the single overhead camshaft and keeps it synchronized. The timing belt also turns the coolant pump. The timing belt and the pulleys are toothed so that there is no slippage between them. An automatic tensioner pulley maintains the timing belt's correct tension. The timing belt is made of a tough reinforced rubber similar to that used on the serpentine drive belt. The timing belt requires no lubrication.

OIL PUMP

The oil pump draws engine oil from the oil pan and feeds it under pressure to the various parts of the engine. An oil strainer is mounted before the inlet of the oil pump to remove impurities which could clog or damage the oil pump or the other engine components. When the crankshaft rotates, the oil pump driven gear rotates. This causes the space between the gears to constantly open and narrow, pulling oil in from the oil pan when the space opens and pumping the oil out to the engine as it narrows.

At high engine speeds, the oil pump supplies a much higher amount of oil than required for lubrication of the engine. The oil pressure regulator prevents too much oil from entering the engine lubrication passages. During normal oil supply, a coil spring and valve keep the bypass closed, directing all of the oil pumped to the

engine. When the amount of oil being pumped increases, the pressure becomes high enough to overcome the force of the spring. This opens the valve of the oil pressure regulator, allowing the excess oil to flow through the valve and drain back to the oil pan.

OIL PAN

The engine oil pan is mounted to the bottom of the cylinder block. The oil pan houses the crankcase and is made of cast aluminum.

Engine oil is pumped from the oil pan by the oil pump. After the oil passes through the oil filter, the oil is fed through two paths to lubricate the cylinder block and cylinder head. In one path, the oil is pumped through the oil passages in the crankshaft to the connecting rods, then to the pistons and the cylinders. It then drains back to the oil pan. In the second path, the oil is pumped through passages to the camshaft. The oil passes through the internal passageways in the camshafts to lubricate the valve assemblies before draining back to the oil pan.

EXHAUST MANIFOLD

A single four port, rear takedown manifold is used with this engine. The manifold is designed to direct escaping exhaust gases out of the combustion chambers with a minimum of backpressure. The oxygen sensor is mounted to the exhaust manifold.

INTAKE MANIFOLD

The intake manifold has four independent long ports and utilizes an inertial supercharging effect to improve engine torque at low and moderate speeds.

CAMSHAFT

This engine is a single overhead camshaft (SOHC). The camshaft sits in a carrier on the top of the engine and operates the intake and the exhaust valves. Engine oil travels to the camshaft under pressure, where it lubricates the camshaft bearings. The oil returns to the oil pan through drain holes in the cylinder head. The camshaft lobes are machined into the solid camshaft to precisely open and close the intake and the exhaust valves the correct amount at the correct time. The camshaft lobes are oiled by splash action from pressurized oil escaping from the camshaft bearings.