SECTION 1C

2.0L DOHC 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 DOHC	2.2L DOHC
General Data:		
Engine Type	4 Cylinder (In-Line)	←
Displacement	1,998 cm^3 (121 in^3)	2,198 cm^3 (134.1 in^3)
Bore Stroke	86 x 86 mm (3.38in x 3.38 in.)	86 x 94.6mm (3.38in x 3.72in.)
Compression Ratio	9.6:1	←
Firing Order	1-3-4-2	←
Cylinder Bore:		
Diameter	85.975 ~ 86.025 mm (3.384 ~ 3.386 in.)	←
Out of Round (Maximum)	0.013 mm (0.0005 in.)	←
Cylinder Bore Taper (Maximum)	0.013 mm (0.0005 in.)	←
Piston Protusion	0.5 mm Max (0.019 in.)	←
Oversize (Measure Replacement Piston before Re-boring)	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.)	←
Piston:		
Diameter	85.955 ~ 86.485 mm (3.384 ~ 3.404 in.)	←
Clearance to Bore	0.030 ~ 0.050 mm (0.00118 ~ 0.0020 in.)	←
Piston Protrusion	0.5 mm Max (0.019 in.)	←
Piston Taper	0.013 mm (0.0005 in.)	←
Piston Rings:		
Ring, End Gap, Top Compression	0.3 ~ 0.5 mm (0.011 ~ 0.019 in.)	←
Ring, End Gap, Second Compression	0.3 ~ 0.5 mm (0.011 ~ 0.019 in.)	←
Oil	0.4 ~ 1.4 mm (0.0015 ~ 0.055 in.)	←
Piston Pin:		
Diameter	20.9970 ~ 20.9985 mm (0.82665 ~ 0.82671 in.)	←
Pin Offset	0.8 mm (0.03 in.) Toward Thrust Side	←

ENGINE SPECIFICATIONS (Cont'd)

Application	2.0L DOHC	2.2L DOHC
Clearance: In Piston	0.0035 ~ 0.0140 mm (0.00013 ~ 0.00055 in.)	←
Clearance: 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 (1.6714 ~ 1.7114 in.)	←
Crankshaft:		
Main Journal	-	-
Diameter (All)	57.974 ~ 57.995 mm (2.2824 ~ 2.2832 in.)	←
Radial Runout (Shaft Support on No. 1 and No. 5 Bearings Measured at No. 3 Journal)	0.03 ~ 0.061 mm (0.00118 ~ 0.00240 in.)	←
Main Bearing Clearance (All)	0.015 ~ 0.061 mm (0.00059 ~ 0.00240 in.)	←
End Play	0.070 ~ 0.302 mm (0.0027 ~ 0.0118 in.)	←
Service Oversize, Available in 2 sizes	0.25 and 0.5 mm (0.00098 and 0.019 in.)	←
Connecting Rod Journal:		
Diameter (All)	48.981 ~ 48.987 mm (1.9283 ~ 1.9286 in.)	←
Out of Round (Maximum)	0.004 mm (0.00015 in.)	←
Rod Bearing Play	0.006 ~ 0.031 mm (0.00023 ~ 0.00122 in.)	←
Rod Bearing Clearance	0.019 ~ 0.063 mm (0.0007 ~ 0.0024 in.) (Production 0.013 ~ 0.041 mm 0.0005 ~ 0.0016 in.)	←
Cylinder Head:		
Valve Stem Protrusion	39.8 mm Max (1.566 in.)	←
Valve Guide Height	13.7 ~ 14.0 mm (0.53 ~ 0.55 in.)	←
Overall Height	134.0 ± 0.025 mm (5.275 ~ 0.0009 in.)	←
Minimum Overall Height After Machining	133.9 mm (5.271 in.)	←

ENGINE SPECIFICATIONS (Cont'd)

Application	2.0L DOHC	2.2L DOHC
Valve System:		
Valve Lash Compensators	Hydraulic	←
Seat Runout (Maximum, All)	0.03 mm (0.001 in.)	←
Face Runout (Maximum, All)	0.03 mm (0.001 in.)	←
Valve Stem Diameter Intake	5.970 ~ 5.955 mm (0.235 ~ 0.234 in.)	←
Exhaust	5.960 ~ 5.945 mm (0.23464 ~ 0.2360 in.)	←
Valve Diameter Intake	32 ± 0.1 mm (1.2598 ± 0.0039 in.)	←
Exhaust	29 ± 0.1 mm (1.1417 ± 0.0039 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	40°	←
Valve Guide Inside Diameter	6.000 ~ 6.012 mm (0.236 ~ 0.237 in.)	←
Oil Pump:		
Gear Lash	0.10 ~ 0.20 mm (0.0040 ~ 0.008 in.)	←
Outer Gear to Body	0.11 ~ 0.19 mm (0.0043 ~ 0.0074 in.)	←
Outer Gear to Crescent	0.11 ~ 0.24 mm (0.0043 ~ 0.009 in.)	←
Inner Gear to Crescent	0.18 ~ 0.26 mm (0.007 ~ 0.010 in.)	←
End Clearance	0.03 ~ 0.10 mm (0.001 ~ 0.004 in.)	←
Sealants and Adhesives:		
Rear Main Bearing Cap	GE p/n RTV 159	←
Camshaft Carrier to Cylinder head	HN 1581 (Loctite® 515)	←
Oil Pan Bolts	HN 1256 (Loctite® 542)	←
Oil Pump Bolts	HN 1256 (Loctite® 542)	←
Oil Pan Pickup Tube Bolts	HN 1256 (Loctite® 542)	←
Oil Gallery Plug	HN 1256 (Loctite® 542)	←
Coolant Jacket Caps and Plugs (Freeze Plugs)	HN 1756 (Loctite® 176)	←
Exhaust Manifold Studs/Nuts	Anti-seize Compound (HMC Spec HN1325)	←

2.0L DOHC FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb•Ft	Lb•In
A/C Compressor Hose Assembly Bolt	33	24	-
Air Filter Housing Bolts	8	-	71
Alternator to Intake Manifold Strap Bracket Bolt	20	15	-
Alternator-to-Intake Manifold Support Bracket Bolts	35	26	-
Automatic Tensioner Bolt	25	18	-
Camshaft Bearing Cap Bolts	8	-	71
Canister Purge Solenoid Bracket Bolt	5	-	44
Connecting Rod Cap Bearing Bolts	35 + 45° + 15°	26 + 45° + 15°	-
Coolant Bypass Housing Bolts	15	11	-
Coolant Pump Retaining Bolts	20	15	-
Coolant Temperature Sensor	25	18	-
Crankshaft Bearing Cap Bolts	50 +45° +15°	37 + 45°	-
Crankshaft Position Sensor Retaining Bolt	13	-	115
Crankshaft Pulley Bolts	20	15	-
Crankshaft Timing Belt Drive Gear Bolt	130 +40° +50°	96 + 40° + 50°	-
Cylinder Head Bolts	25 + 90°+ 90°+ 90°	18 + 90°+ 90°+ 90°	-
DIS Ignition Coil and EGR Mounting Bracket Bolts	25	18	-
Engine Block Lower Support Bracket/Splash Shield Bolts	35	26	-
Engine Mount Bolts	60	44	-
Engine Mount Bracket-to-Engine Mount Retaining Bolts	60	44	-
Engine Mount Bracket Retaining Bolts and Nut	60	44	-
Engine Mount Bracket-to-Engine Block Bolts	90	66	-
Engine Mount Bracket-to-Engine Block Nuts	90	66	-
Engine Mount Retaining Bolts	60	44	-
Engine to Intake Manifold Support Bracket	20	15	-
Exhaust Camshaft Gear Bolt	50 +60°+15°	37 +60°+15°	-
Exhaust Flex Pipe-to-Catalytic Converter Retaining Nuts	30	22	-
Exhaust Flex Pipe-to-Exhaust Manifold Retaining Nuts	22	16	-
Exhaust Flex Pipe Support Bracket Bolts	30	22	-
Exhaust Gas Recirculation Valve Bolts	20	15	-
Exhaust Manifold Heat Shield Bolts	15	11	-
Exhaust Manifold Retaining Nuts	15	11	-
Exhaust Support Bracket Bolts	30	22	
Flexible Plate Bolts	65	48	-

2.0L DOHC FASTENER TIGHTENING SPECIFICATIONS (Cont'd)

Application	N•m	Lb•Ft	Lb•In
Flywheel Bolts	65 + 30° + 15°	48 + 30° + 15°	-
Front Timing Belt Cover Bolts	6	-	53
Fuel Rail Retaining Bolts	25	18	-
Ignition Coil Mounting Bolts	10	-	89
Intake Camshaft Gear Bolt	50 +60°+15°	37 +60°+15°	-
Intake Manifold Retaining Nuts and Bolts	18	13	-
Intake Manifold Support Bracket Lower Bolts	20	15	-
Intake Manifold Support Bracket Upper Bolts	20	15	-
Oil Pan Drain Plug	35	26	-
Oil Pan Flange-to-Transaxle Bolts	40	30	-
Oil Pan Retaining Bolts	10	-	89
Oil Pump Retaining Bolts	10	-	89
Oil Pump Pickup Tube Bolts	8	-	71
Oil Pump Pickup Tube Support Bracket Bolt	10	-	89
Oil Pump Rear Cover Bolts	6	-	53
Power Steering Hose Clamp Bolt	8	-	71
Rear Timing Belt Cover Bolts	6	-	53
Resonator Retaining Bolts	8	-	71
Spark Plug Cover Bolts	3	-	27
Spark Plugs	20	15	-
Thermostat Housing Mounting Bolts	15	11	-
Throttle Cable Bracket Bolts	8	-	71
Timing Belt Automatic Tensioner Bolt	25	18	-
Timing Belt Idler Pulley Nuts	25	18	-
Transaxle Bell Housing Bolts	75	55	-
Transaxle Torque Converter Bolts	60	44	-
Valve Cover Bolts	8	-	71

2.2L DOHC FASTENER TIGHTENING SPECIFICATIONS

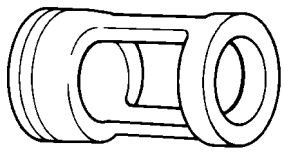
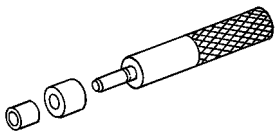
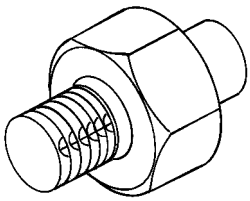
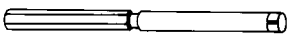
Application	N•m	Lb•Ft	Lb•In
Air Filter Housing Bolts	8	-	71
Auxiliary Catalytic Converter-to-Connecting Pipe Nuts	40	30	-
Auxiliary Catalytic Converter-to-Exhaust Manifold Nuts	40	30	-
Camshaft Bearing Cap Bolts	8	-	71
Canister Purge Solenoid Bracket Bolt	5	-	44
Connecting Rod Cap Bearing Bolts	35 +45°+15°	26 +45°+15°	-
Coolant Bypass Housing Bolts	15	11	-
Connecting Pipe Mounting Bracket Nuts	30	22	-
Crankshaft Bearing Cap Bolts	50 +45°+15°	37 +45°+15°	-
Crankshaft Pulley Bolts	20	15	-
Crankshaft Timing Belt Drive Gear Bolt	130 + 40°～50°	96 + 40°～50°	-
Cylinder Head Bolts	25 + 90°+90°+ 90°	18 + 90°+90°+ 90°	-
Direct Ignition System and EGR Mounting Bracket Bolts	25	18	-
Engine Block Lower Support Bracket/Splash Shield Bolts	35	26	-
Engine Mount Bolts	60	44	-
Engine Mount Bracket-to-Engine Block Nuts/Bolts	90	66	-
Exhaust Camshaft Gear Bolt	50 +60°+15°	37 +60°+15°	-
Exhaust Manifold Heat Shield Bolts	15	11	-
Exhaust Manifold Retaining Nuts	15	11	-
Flexible Plate Bolts	65	48	-
Flywheel Bolts	65 +30°+15°	48 +30°+15°	-
Front Muffler Pipe-to-Main Catalytic Converter Nuts	30	22	-
Front Timing Belt Cover Bolts	6	-	53
Generator-to-Intake Manifold Strap Bracket Bolts	20	15	-
Generator-to-Intake Manifold Support Bracket Bolts	35	26	-
Intake Camshaft Gear Bolt	50 +60°+15°	37 +60°+15°	-
Intake Manifold Retaining Nuts and Bolts	18	13	-
Intake Manifold Support Bracket Lower Bolt	20	15	-
Intake Manifold Support Bracket Upper Bolts	20	15	-

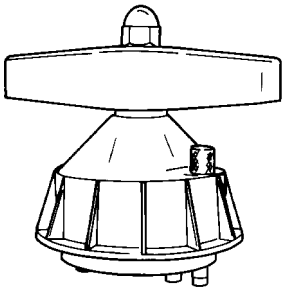
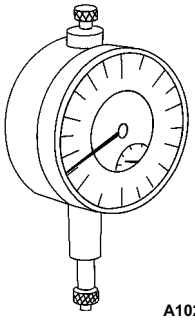
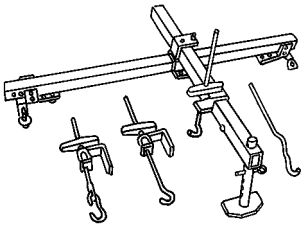
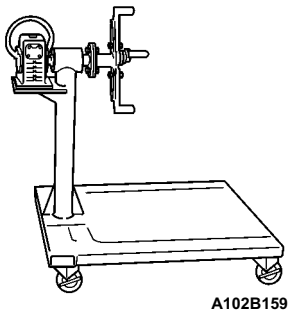
2.2L DOHC FASTENER TIGHTENING SPECIFICATIONS (Cont'd)

Application	N•m	Lb•Ft	Lb•In
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	30	-
Oil Pump Rear Cover Bolts	6	-	53
Oil Pump Retaining Bolts	10	-	89
Oil Pump Pickup Tube Bolts	8	-	71
Power Steering Hose Clamp Bolt	8	-	71
Pulse Pickup Sensor Disc	13	-	115
Rear Timing Belt Cover Bolts	6	-	53
Resonator Retaining Bolts	8	-	71
Safety Relief Valve Bolt	30	22	-
Spark Plug Cover Bolts	3	-	27
Spark Plugs	20	15	-
Thermostat Housing Mounting Bolts	15	11	-
Throttle Cable Bracket Bolts	8	-	71
Timing Belt Automatic Tensioner Bolt	25	18	-
Timing Belt Idler Pulley Nuts	25	18	-
Transaxle Bell Housing Bolts	75	55	-
Transaxle Torque Converter Bolts	60	44	-
Valve Cover Bolts	8	-	71

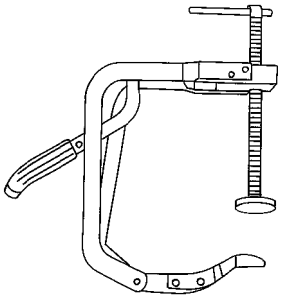
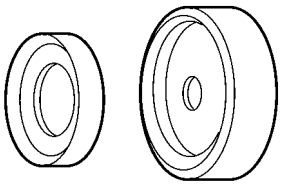
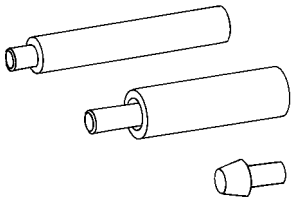
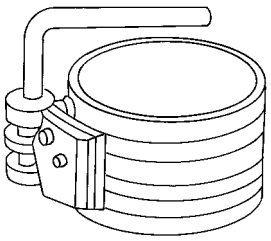
SPECIAL TOOLS

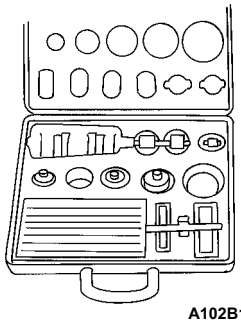
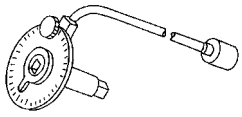
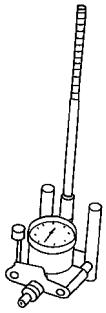
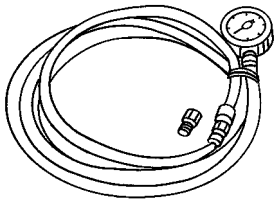
SPECIAL TOOLS TABLE

 A102C153	**KM-653 Adapter**
 B102C045	**KM-535 Installer**
 B102C044	**KM135 Adapter**
 A102C154	**KM-805 Valve Guide Reamer**

 A102C155	**J-36972 Crankshaft Rear Oil Seal Installer**
 A102B154	**MKM-571-B Gauge**
 A102B152	**J-28467-B Engine Assembly Lift Support**
 A102B159	**KM-412 Engine Overhaul Stand**

SPECIAL TOOLS TABLE (Cont'd)

 A102B157	**KM-348 Spring Compressor**
 A102B160	**KM-635 Crankshaft Rear Oil Seal Installer**
 A102B153	**KM427 Piston Pin Service Set**
 C102B004	**J-8037 Universal Piston Ring Compressor**

 A102B156	**KM-340-0 Cutter Set**
 A102B161	**KM-470-B Angular Torque Gauge**
 C102B005	**J-8087 Cylinder Bore Check Gauge**
 A202B005	**KM-498-B Pressure Gauge**

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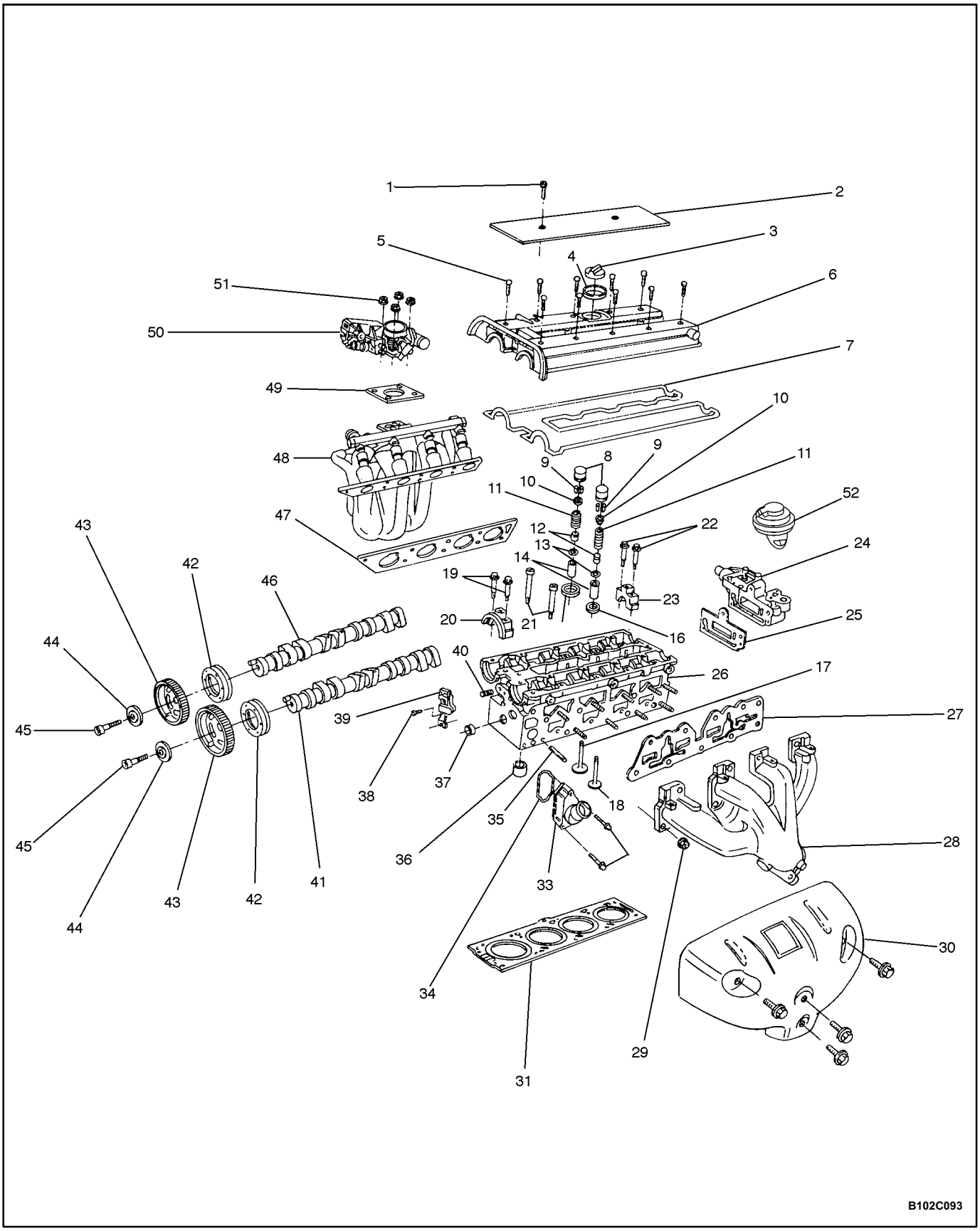
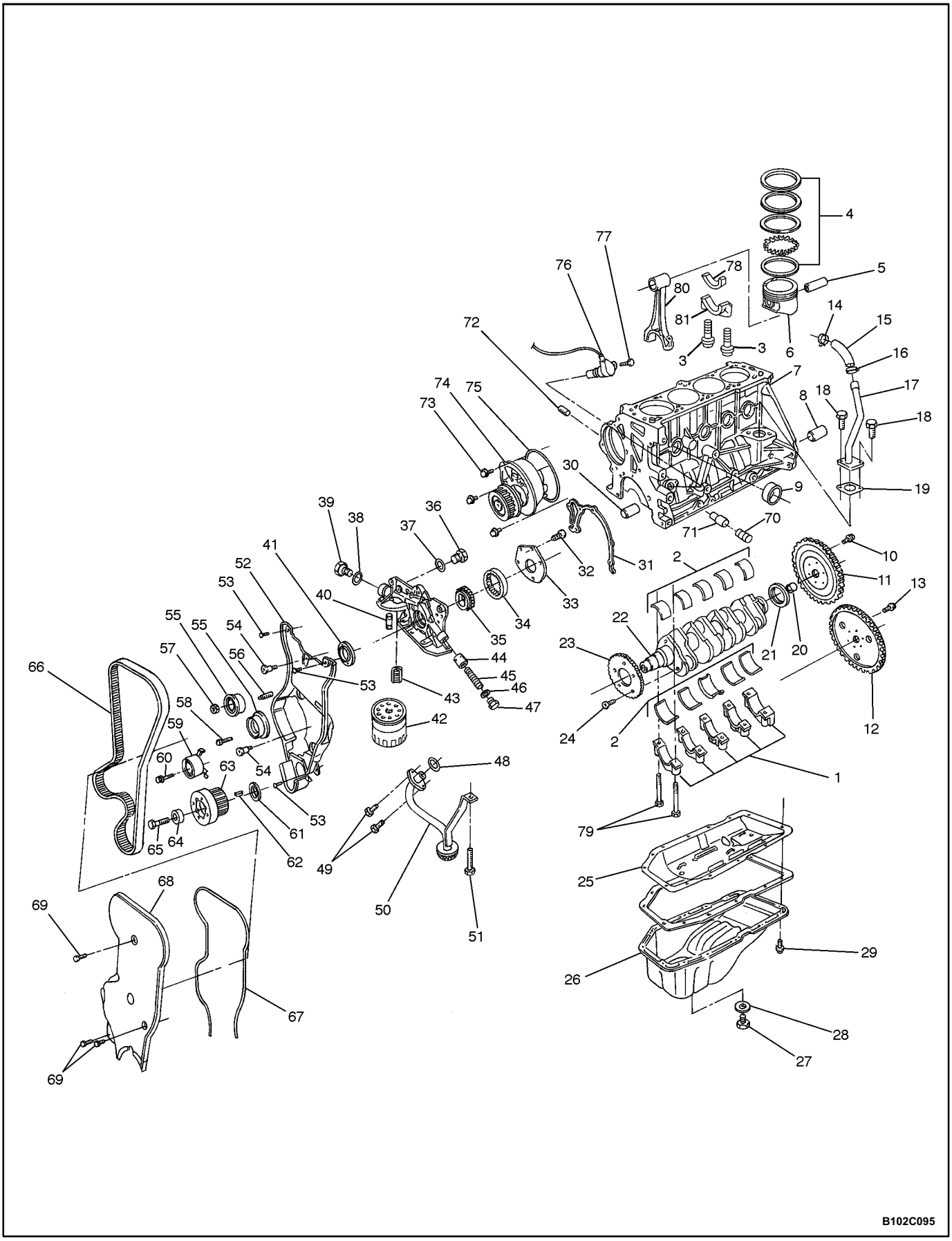
COMPONENT LOCATOR

UPPER END

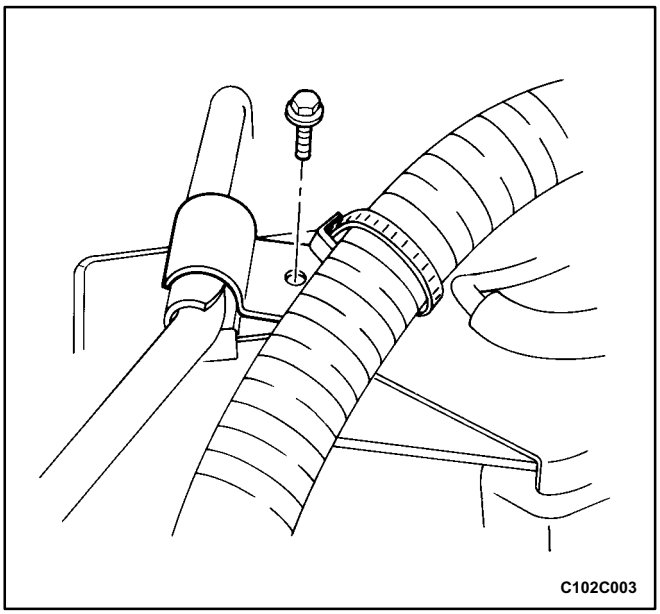


1 Bolt
2 Spark Plug Cover
3 Oil Cap
4 Oil Cap Seal
5 Bolt
6 Valve Cover
7 Valve Cover Gasket
8 Valve Lash Adjuster
9 Retainer
10 Valve Cap
11 Valve Spring
12 Valve Stem Seal
13 Valve Spring Seat
14 Valve Guide
15 Valve Spring Seat
16 Exhaust Seat
17 Inlet Valve
18 Exhaust Valve
19 Bolt
20 Front Bearing Cap
21 Head Bolt
22 Bolt
23 Bearing Cap
24 EGR Adapter
25 EGR Adapter Gasket
26 Cylinder Head
27 Exhaust Manifold Gasket
28 Exhaust Manifold
29 Nut
30 Exhaust Manifold Heat Shield
31 Cylinder Head Gasket
32 Bolt
33 Thermostat Housing
34 Thermostat Housing Gasket
35 Stud
36 Sleeve
37 Plug
38 Bolt
39 Camshaft Position Sensor
40 Oil Gallery Plug
41 Exhaust Camshaft
42 Seal Ring
43 Camshaft Gear
44 Washer
45 Camshaft Gear Bolt
46 Intake Camshaft
47 Intake Manifold Gasket
48 Intake Manifold
49 Throttle Body Gasket
50 Throttle Body
51 Nut
52 EGR Valve

LOWER END



1 Main Bearing Caps
2 Bearings, Main
3 Connecting Rod Bolt
4 Piston Ring Set
5 Piston Pin
6 Piston
7 Engine Block
8 Sleeve
9 Water Jacket Cap
10 Bolt (Manual Transaxle)
11 Flywheel (Manual Transaxle)
12 Flexible Plate (Automatic Transaxle)
13 Bolt (Automatic Transaxle)
14 Clamp
15 Hose
16 Clamp
17 Engine Vent Pipe
18 Bolt
19 Gasket
20 Transaxle Input Shaft Bearing
21 Rear Main Seal
22 Crankshaft
23 Ignition Transmit Disc
24 Bolt
25 Splash Pan and Gasket Assembly
26 Oil Pan
27 Drain Plug
28 Seal Ring
29 Bolt
30 Sleeve
31 Gasket
32 Bolt
33 Oil Pump Gear Cover
34 Ring Gear
35 Gear
36 Plug
37 Washer
38 Washer
39 Bypass Valve Plug
40 Special Screw
41 Seal
42 Oil Filter
43 Bypass Valve
44 Pressure Relief Valve Plunger
45 Pressure Relief Valve Spring
46 Washer
47 Pressure Relief Valve Plug
48 Ring Seal
49 Bolt
50 Oil Suction Pipe
51 Bolt
52 Rear Timing Belt Cover
53 Bolt
54 Special Bolt
55 Idler Pulley
56 Stud
57 Nut
58 Bolt
59 Tensioner
60 Bolt
61 Thrust Inner Washer
62 Woodruff Key
63 Crankshaft Gear
64 Thrust Outer Washer
65 Bolt
66 Camshaft Drive Belt
67 Seal
68 Front Timing Belt Cover
69 Bolt
70 Bushing Plug
71 Bushing
72 Oil Gallery Plug
73 Bolt
74 Water Pump
75 Seal Ring
76 Crankshaft Revolution Sensor
77 Bolt
78 Connecting Rod Bearings
79 Main Bearing Cap Bolts
80 Connecting Rod
81 Connecting Rod Cap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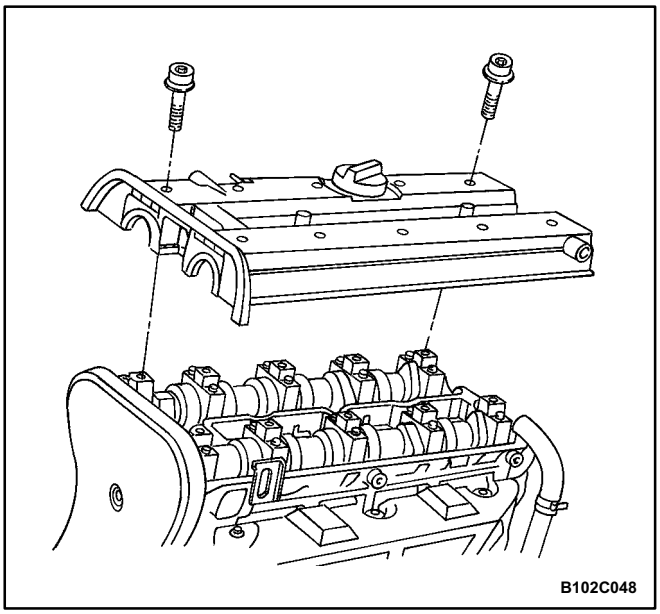
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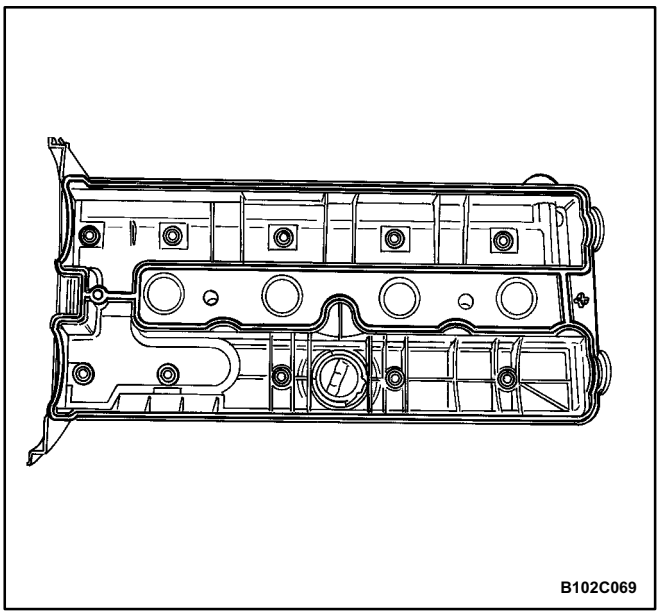
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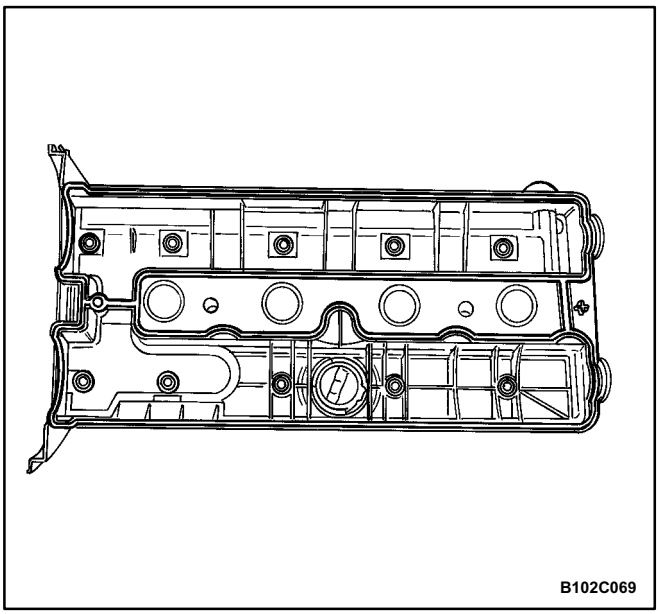
MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

VALVE COVER

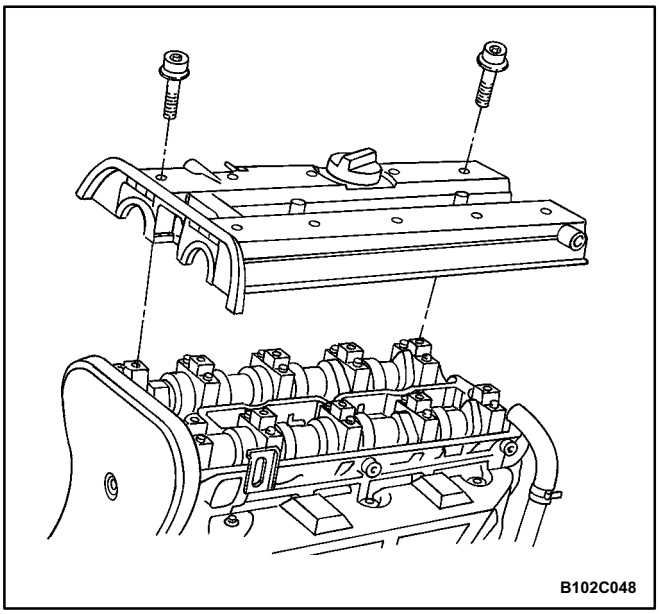
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the breather tube from the valve cover.
3. Disconnect all of the necessary vacuum lines.
4. Remove the spark plug cover bolts.
5. Remove the spark plug cover.
6. Disconnect the ignition wires from the spark plugs.
7. Remove the power steering hose clamp bolt and position power steering hose clamp clear of the re-pair area.
8. Disconnect the camshaft position (CMP) sensor connector (2.2L DOHC).
9. Remove the valve cover bolts.
10. Remove the valve cover washers.
11. Remove the valve cover.
12. Remove the valve cover gasket from the valve co-ver.


B102C069

Installation Procedure

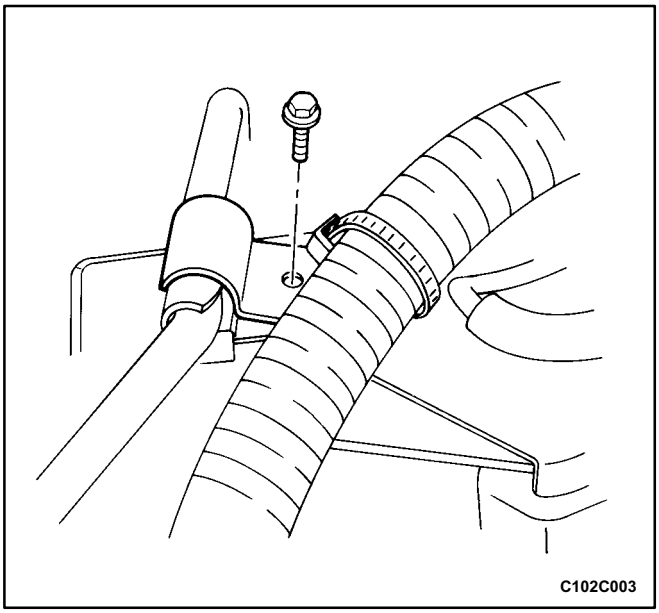
1. Apply a small amount of gasket sealant to the cor-ners of the front camshaft caps and the top of the rear valve cover-to-cylinder head seal.
2. Install the new valve cover gasket to the valve co-ver.


B102C048

3. Install the valve cover.
4. Install the valve cover washers.
5. Install the valve cover bolts.

Tighten

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


C102C003

6. Connect the ignition wires to the spark plugs.
7. Install the spark plug cover.
8. Install the spark plug cover bolts.

Tighten

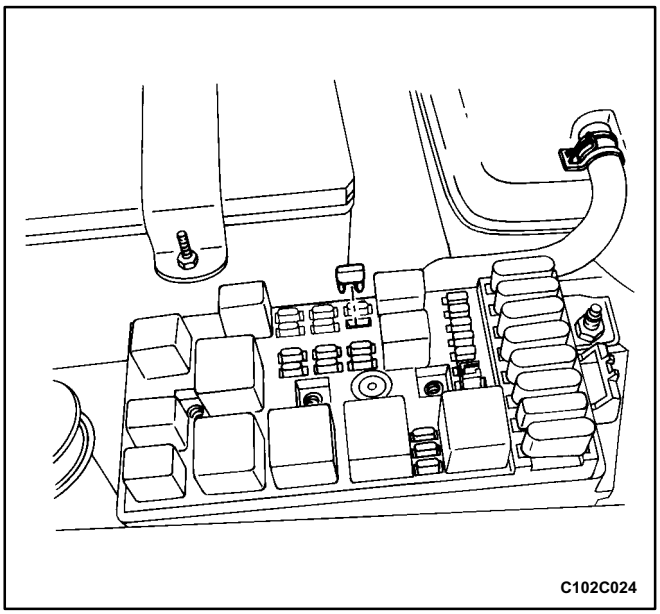
Tighten the spark plug cover bolts to 3 N•m (27 lb•in).

9. Connect all of the necessary vacuum lines.
10. Connect the breather tube to the valve cover.
11. Connect the camshaft position (CMP) sensor co-nnector (2.2L DOHC).
12. Position the power steering pressure hose in place and install the bolt.

Tighten

Tighten the power steering hose clamp bolt to 8 N•m (71 lb•in).

13. Connect the negative battery cable.


C102C024

CYLINDER HEAD AND GASKET

(Left-Hand Drive Shown, Right-Hand Drive Similar)

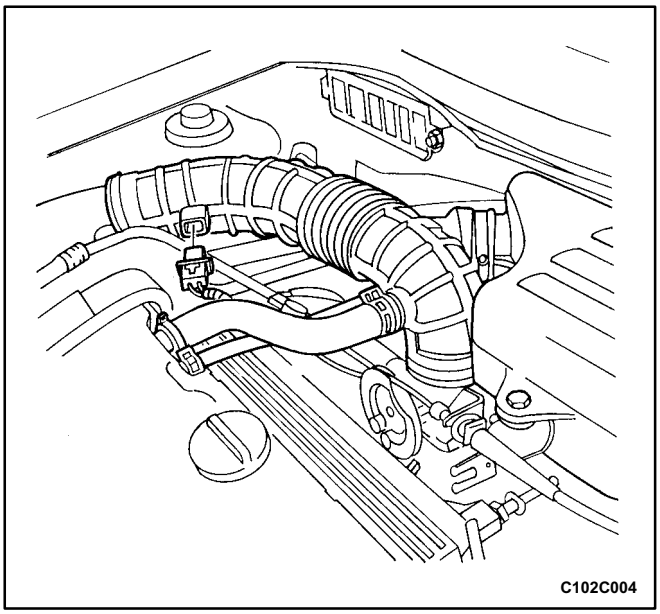
Tools Required

KM-470-B Angular Torque Gauge

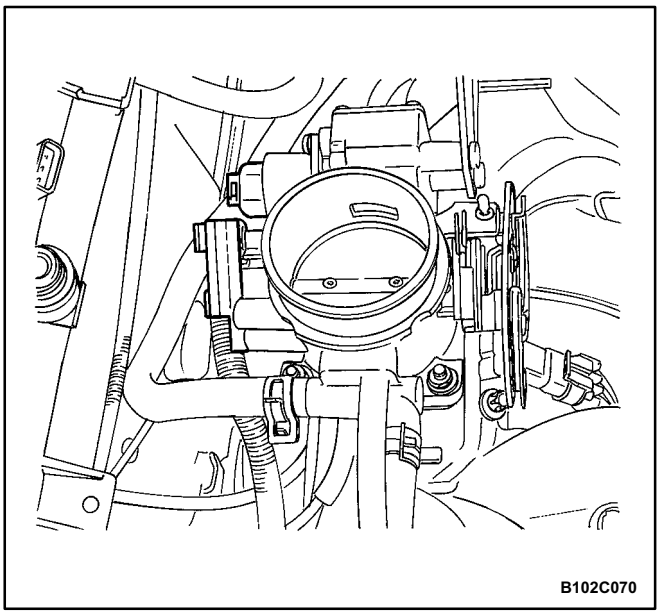
J-28467-B Engine Assembly Lift Support

Removal Procedure

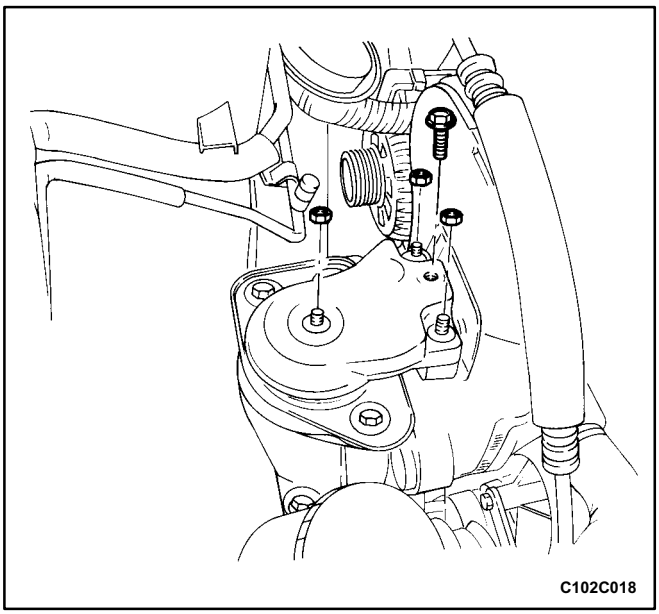
1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine for 10 seconds to rid the fuel system of fuel pressure.
3. Disconnect the negative battery cable.
4. Disconnect the ECM ground terminal
5. Drain the engine coolant. Refer to *Section 1D, En-gine Cooling.*


C102C004

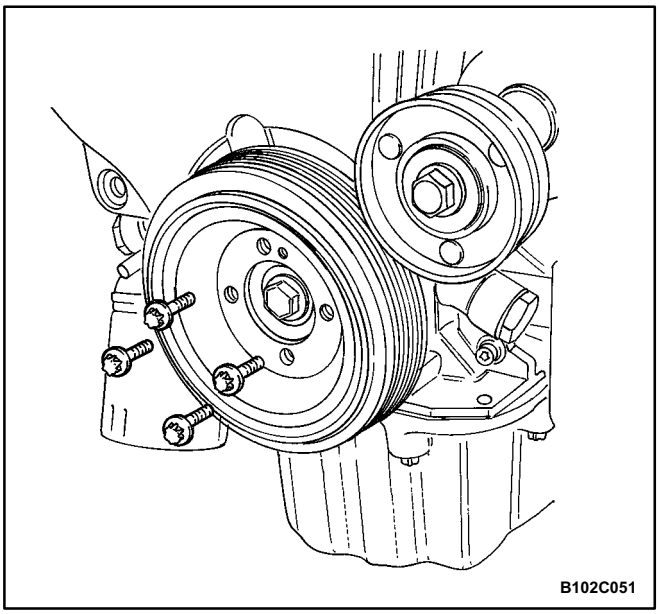
6. Disconnect the manifold air temperature sensor connector.
7. Disconnect the breather tube from the valve cover.
8. Remove the resonator retaining bolts and the re-sonator.
9. Remove the air intake tube.
10. Remove the canister purge solenoid bracket bolt and reposition the cannister purge solenoid clear of the repair area.


B102C070

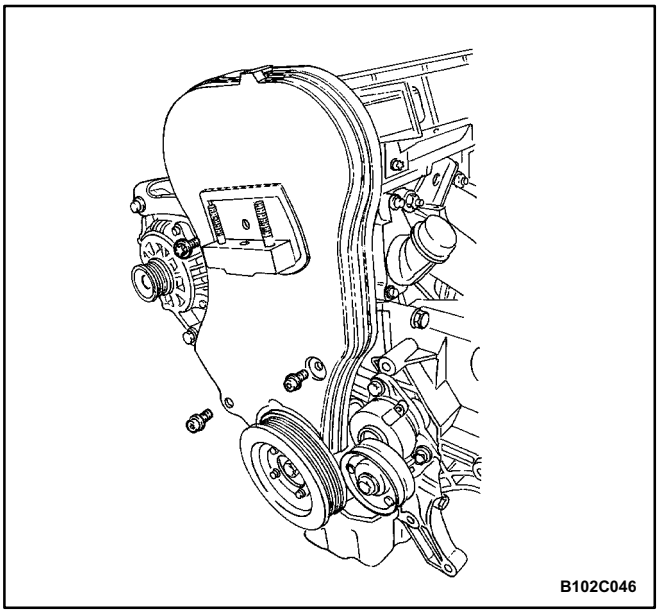
11. Disconnect the DIS ignition coil connector.
12. Disconnect the oxygen sensor connector.
13. Disconnect the idle air control valve (IAC) connec-tor.
14. Disconnect the throttle position sensor (TPS) co-nnector.
15. Disconnect the engine coolant temperature (ECT) sensor connector.
16. Disconnect the coolant temperature sensor (CTS) connector.
17. Disconnect the camshaft position (CMP) sensor connector (2.2L DOHC).


C102C018

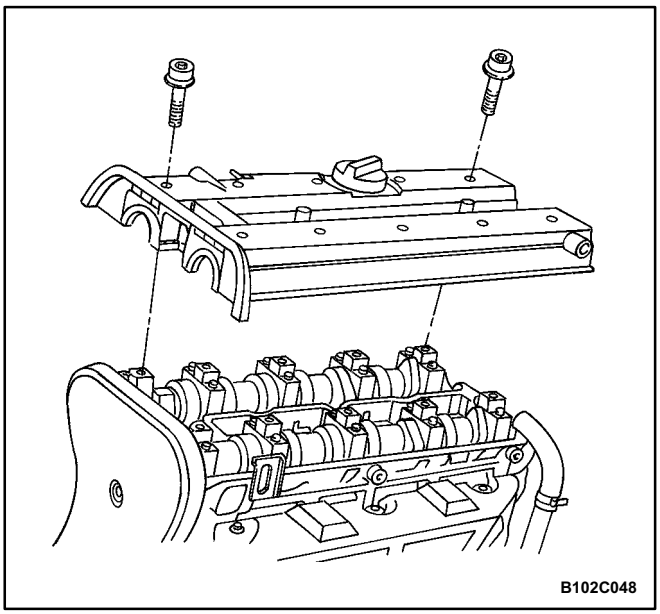
18. Remove the air filter housing bolts.
19. Remove the air filter housing.
20. Remove the right front wheel. Refer to *Section 2E, Tires and Wheels*.
21. Remove the right front wheel well splash shield. Refer to *Section 9R, Body Front End.*
22. Install the engine assembly lift support J-28467-B.
23. Remove the right engine mount bracket and bolts.


B102C051

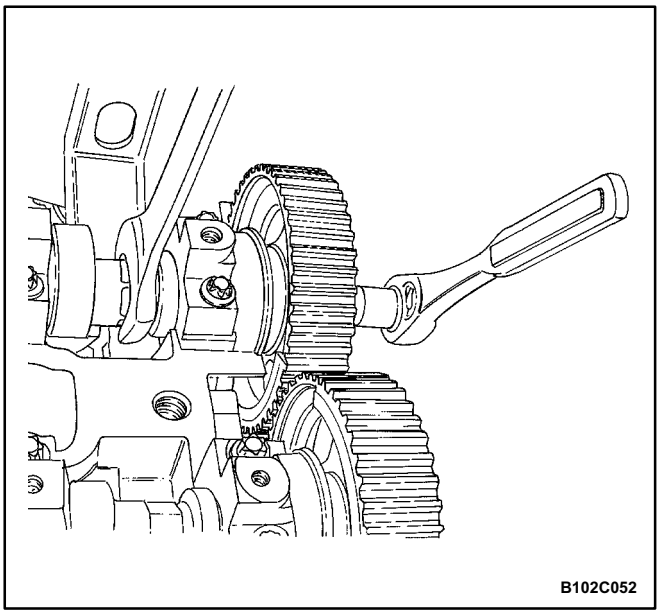
24. Disconnect the upper radiator hose at the thermo-stat housing.
25. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump.*
26. Remove the crankshaft pulley bolts.
27. Remove the crankshaft pulley.


B102C046

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

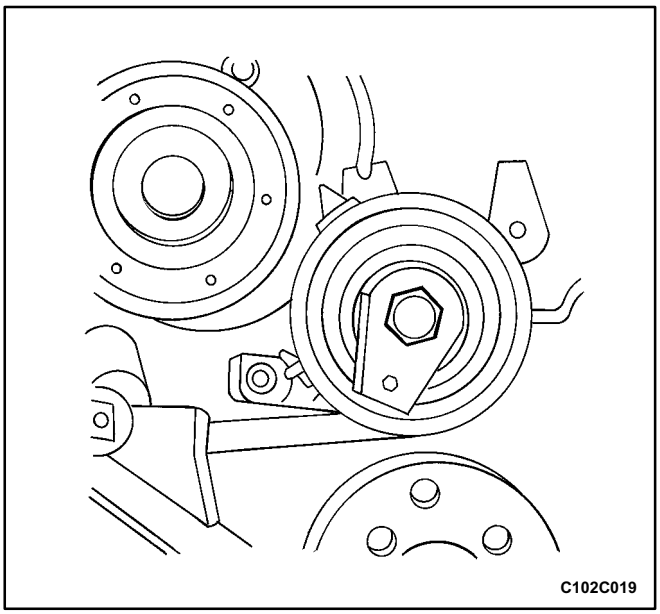

B102C048

30. Remove the timing belt. Refer to "Timing Belt" in this section.
31. Disconnect the breather tube at the valve cover.
32. Remove the spark plug cover bolts.
33. Remove the spark plug cover.
34. Disconnect the ignition wires from the spark plugs.
35. Remove the valve cover bolts.
36. Remove the valve cover washers.
37. Remove the valve cover and the valve cover gasket.

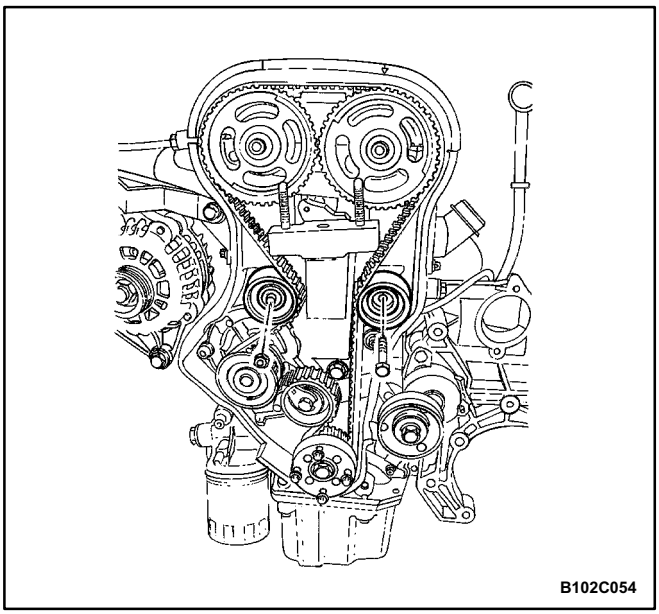

B102C052

Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

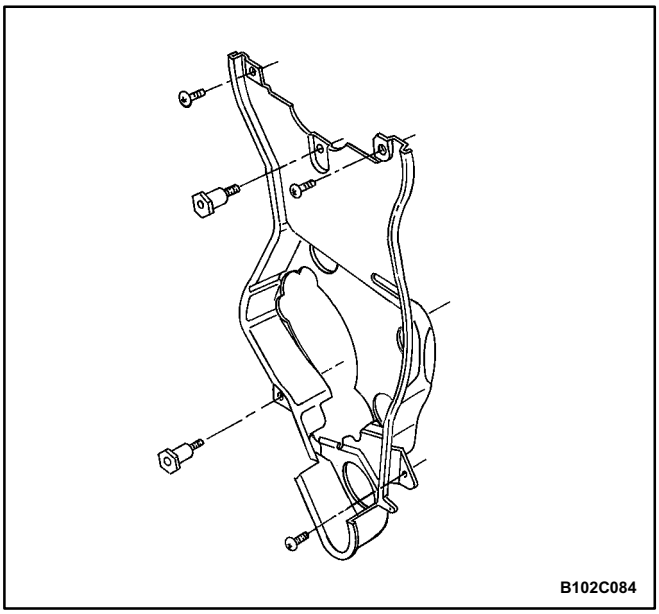
38. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
39. Remove the intake camshaft gear.
40. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
41. Remove the exhaust camshaft gear.


C102C019

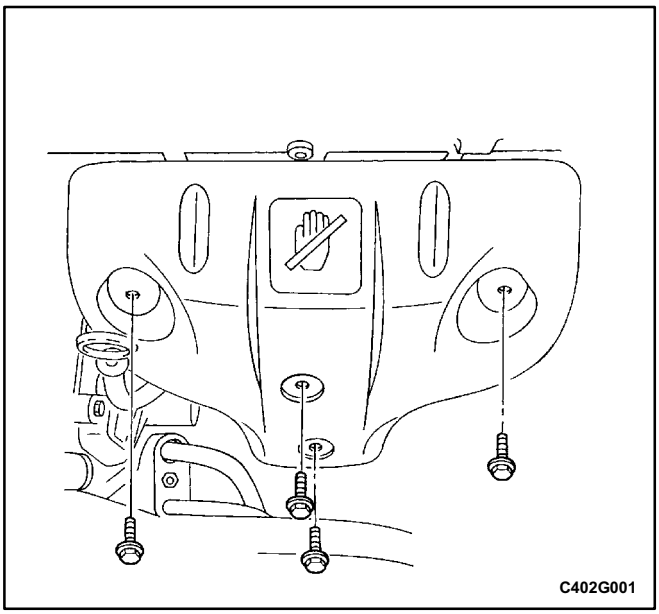
42. Remove the timing belt automatic tensioner bolts.
43. Remove the timing belt automatic tensioner.



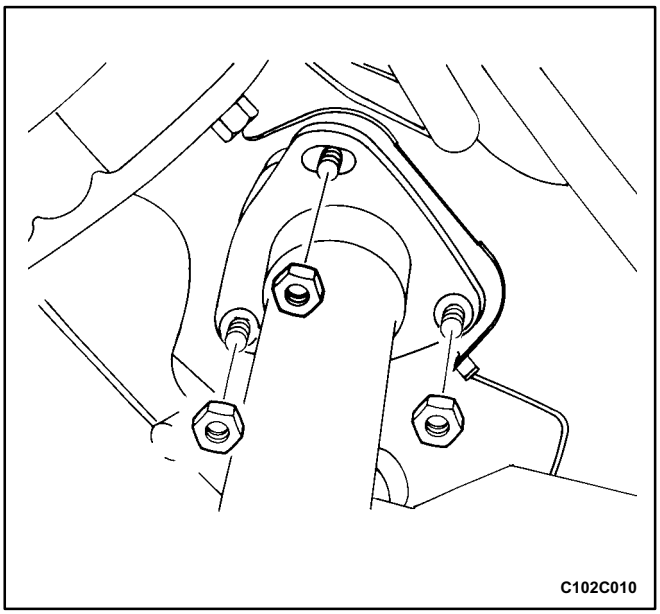
44. Remove the timing belt idler pulley nuts.
45. Remove the timing belt idler pulleys.
46. Remove the engine mount bolts.
47. Remove the engine mount.



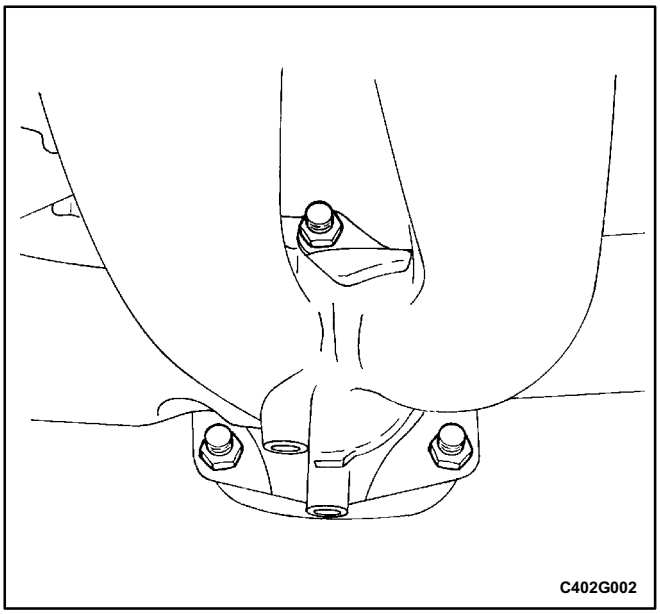
48. Remove the rear timing belt cover bolts.
49. Remove the rear timing belt cover.



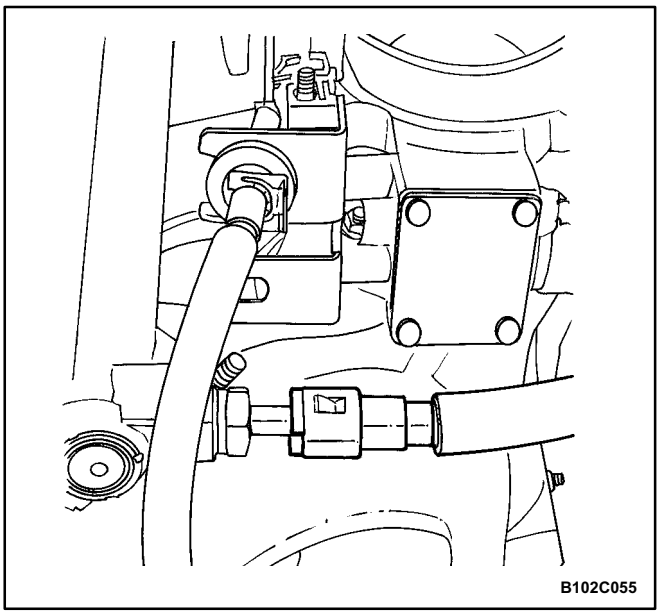
50. Remove the exhaust manifold heat shield nuts and the heat shield.



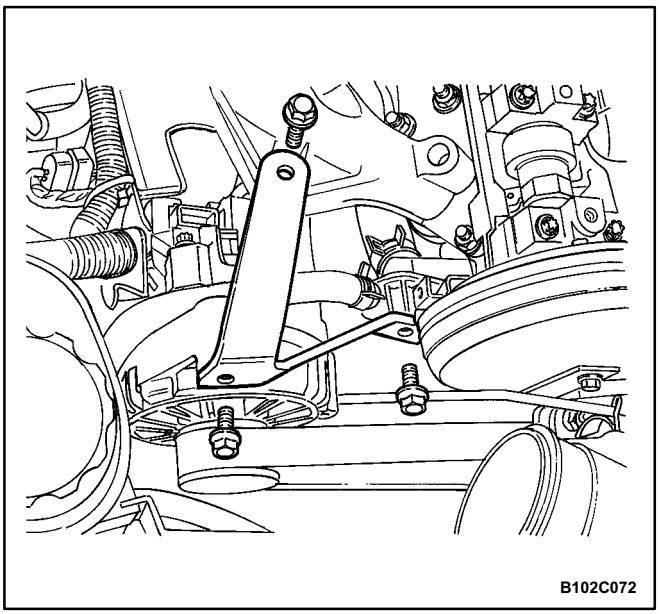
51. Remove the exhaust flex pipe retaining nuts from the exhaust manifold studs (2.0L DOHC).



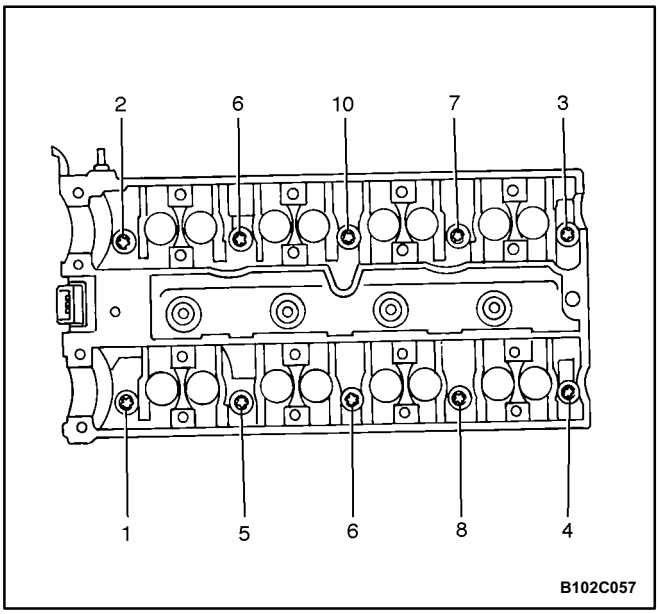
52. Remove the auxiliary catalytic converter upper flange nuts (2.2L DOHC).
53. Disconnect the vacuum hoses, as needed.



54. Disconnect the fuel return line at the fuel pressure regulator.
55. Disconnect the fuel feed line at the fuel rail.
56. Disconnect the coolant hose at the rear cylinder head and ignition coil EGR bracket.
57. Disconnect the surge tank coolant hose at the throttle body.
58. Remove the fuel rail assembly. Refer to *Section 1F, Engine Controls.*


B102C072

59. Remove the alternator-to-intake manifold support bracket bolts at the cylinder head coolant bypass and the intake manifold.
60. Remove the alternator support bracket.
61. Remove the intake manifold-to-alternator strap bracket bolt and loosen the bolt on the alternator.
62. Move the strap clear of the intake manifold.
63. Remove the canister purge solenoid bracket bolt and move the bracket clear (if equipped).

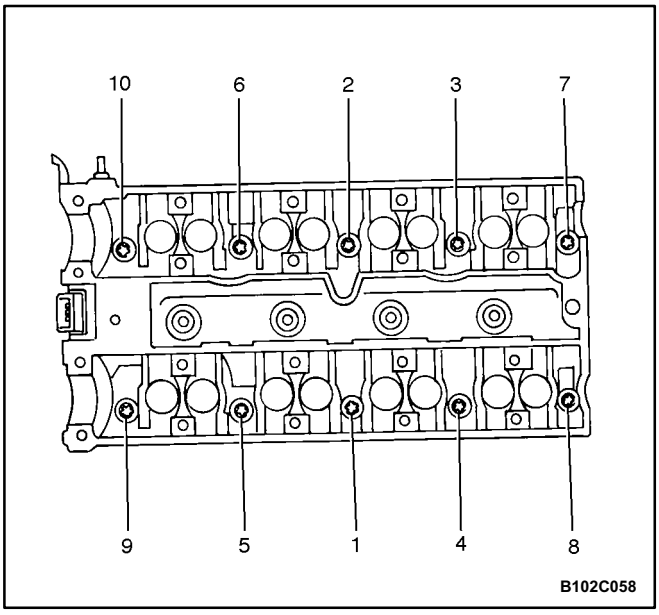


B102C057

64. Disconnect the throttle cable at the throttle body and the intake manifold.
65. Loosen all of the cylinder head bolts gradually and in the sequence shown.
66. Remove the cylinder head bolts.
67. 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.

68. Remove the cylinder head gasket.



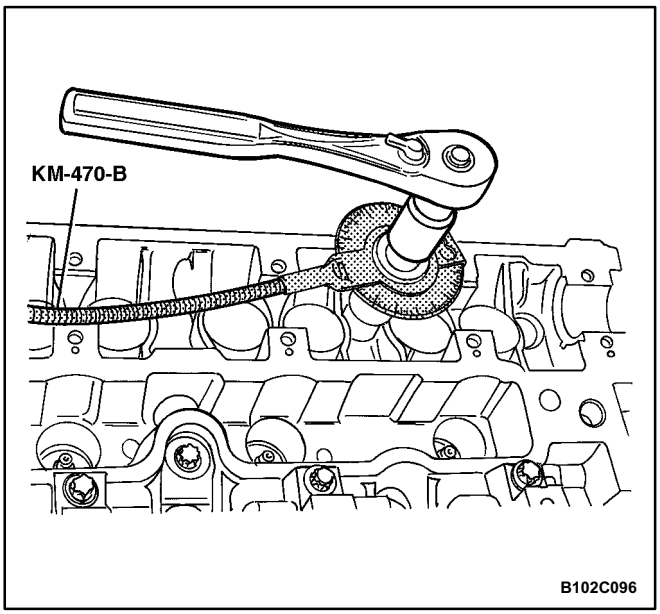
B102C058

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 "Cylin-der Head and Valve Train Components" in this sec-tion.

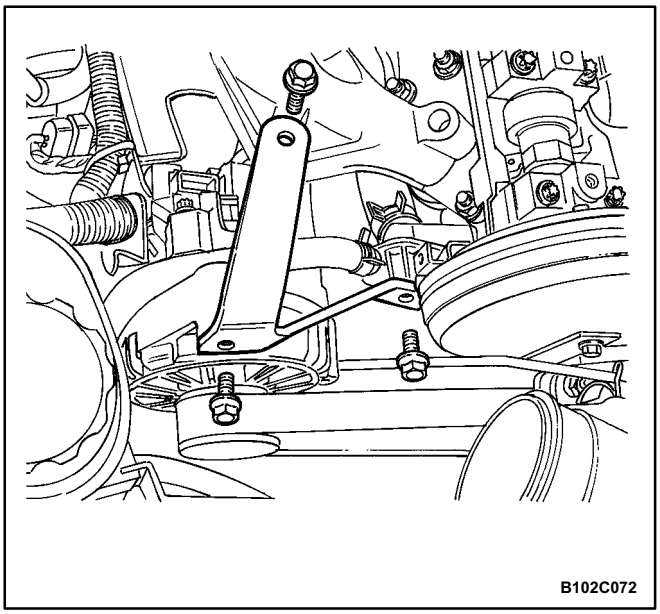
Installation Procedure

1. Install the cylinder head gasket.
2. Install the cylinder head with the intake manifold and the exhaust manifold attached.
3. Install the cylinder head bolts.
4. Tighten the cylinder head bolts gradually and in the sequence shown.



Tighten

Tighten the cylinder head bolts to 25 N•m (18 lb•ft) and turn the bolts another 3 turns of 90 degrees using the angular torque gauge KM-470-B.



5. Connect the throttle cable at the throttle body and the intake manifold.
6. Install the alternator-to-intake manifold support bracket.
7. Install the intake alternator-to-manifold support bracket bolts.

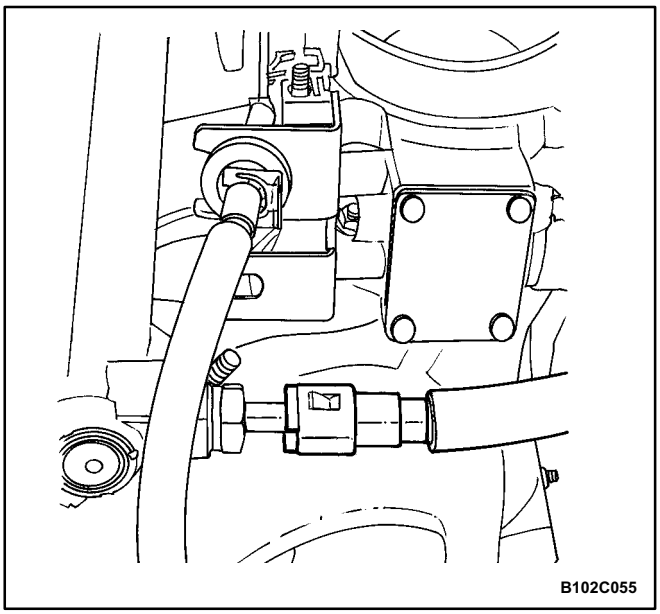
Tighten

Tighten the alternator-to-intake manifold support bracket bolts at the intake manifold to 35 N•m (26 lb•ft).

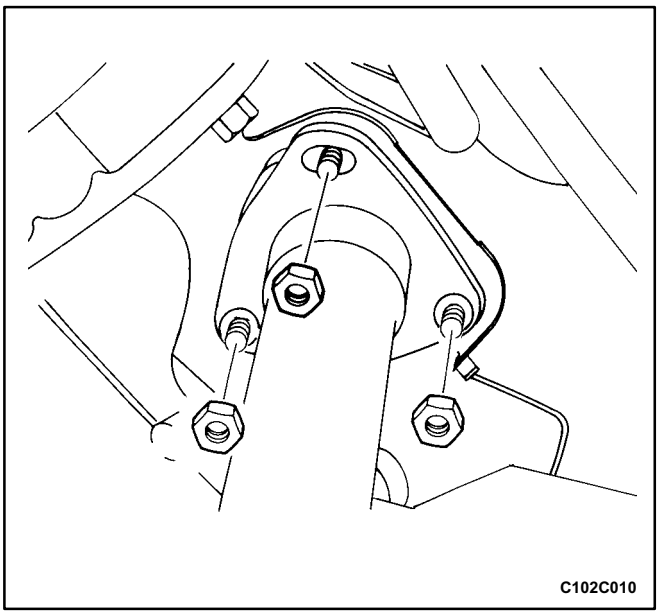
8. Install the intake manifold support bracket bolts to the alternator.

Tighten

Tighten the alternator-to-intake manifold support bracket bolt at the alternator to 20 N•m (15 lb•ft).



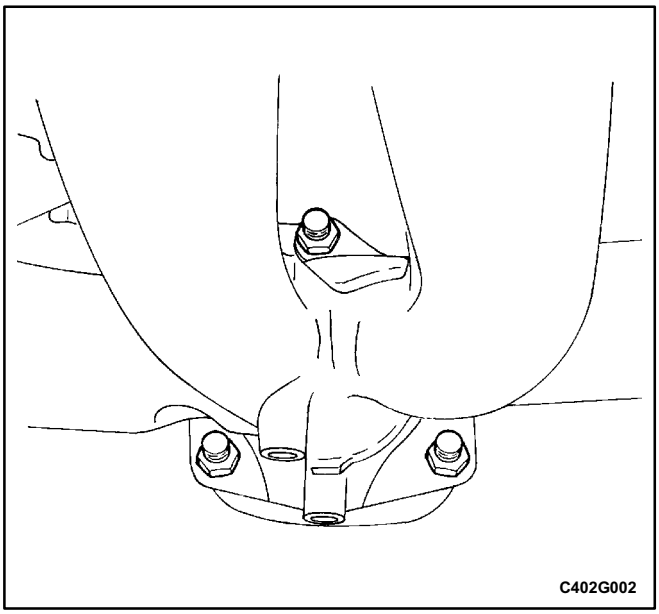
9. Connect the surge tank coolant hose at the throttle body.
10. Connect the coolant hose to the rear cylinder head and ignition coil EGR bracket.
11. Connect the fuel feed line at the fuel rail.
12. Connect the fuel return line at the fuel rail.
13. Connect all of the necessary vacuum hoses.
14. Install the fuel rail assembly. Refer to *Section 1F, Engine Controls (2.0L DOHC).*



15. Install the exhaust flex pipe retaining nuts to the ex-haust manifold studs (2.0L DOHC).

Tighten

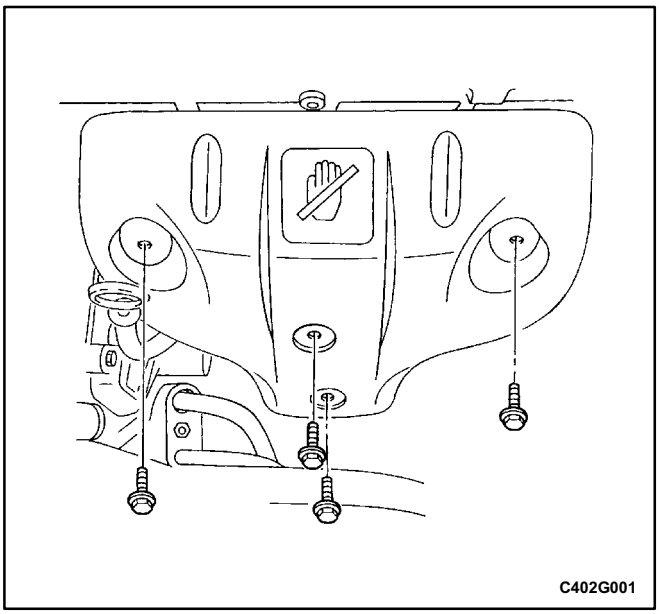
Tighten the exhaust flex pipe retaining nuts to 22 N•m (16 lb•ft).



16. Install the auxiliary catalytic converter nuts (2.2L DOHC).

Tighten

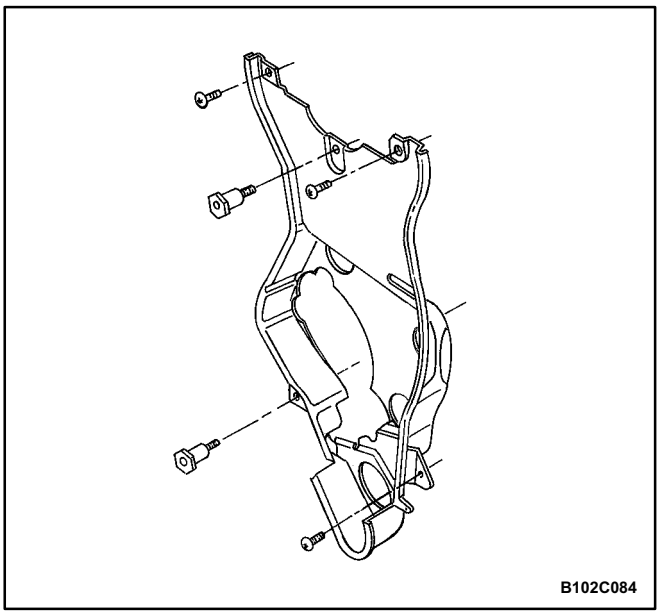
Tighten the auxiliary catalytic converter-to-exhaust manifold nuts to 40 N•m (30 lb•ft).



17. Install the exhaust manifold heat shield bolts.

Tighten

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


B102C084

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

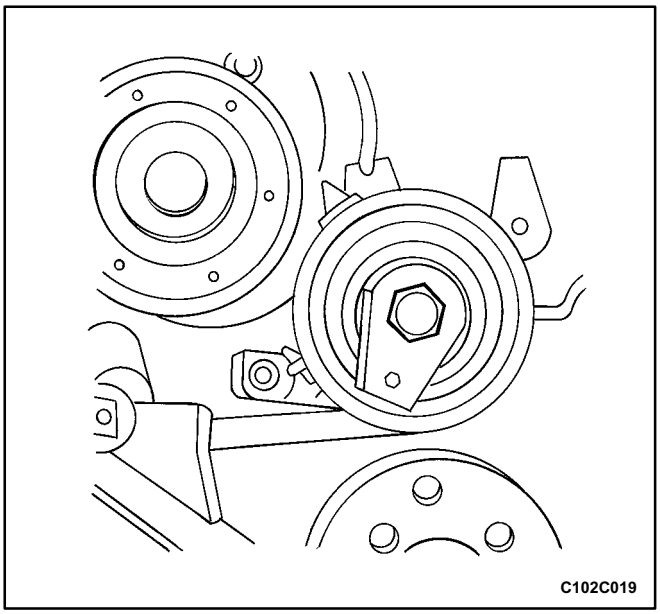
Tighten

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

20. Install the engine mount bolts.

Tighten

Tighten the engine mount bolts to 60 N•m (44 lb•ft).


C102C019

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

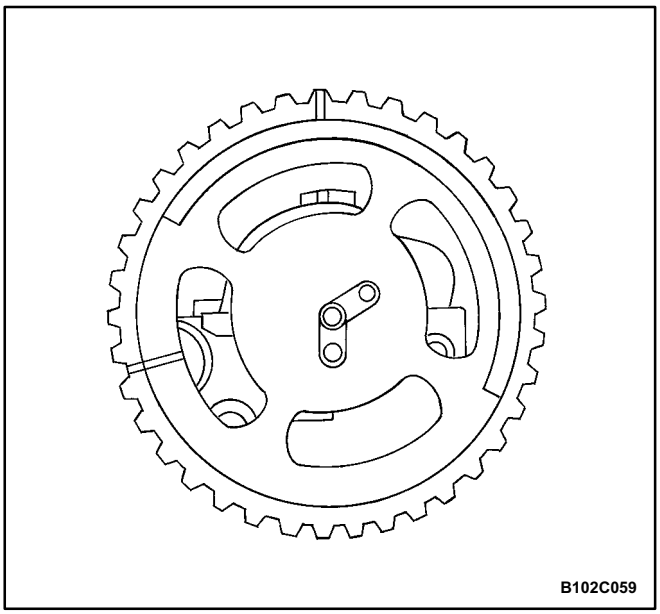
Tighten

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

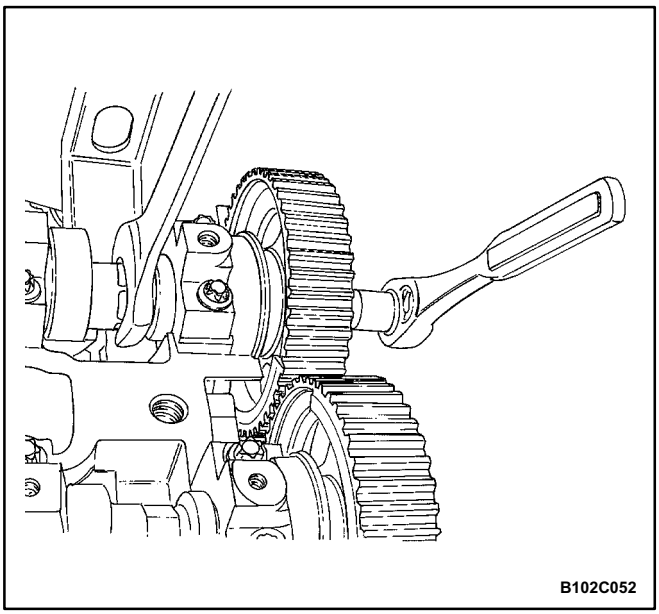
23. Install the timing belt idler pulleys.
24. Install the timing belt idler pulley nuts.

Tighten

Tighten the timing belt idler pulley nuts to 25 N•m (18 lb•ft).


B102C059

25. Install the camshaft gears with the timing marks at the front.
26. Insert the guide pin of the intake camshaft into the "IN" bore.
27. Insert the guide pin of the exhaust camshaft into the "EX" bore.


B102C052

28. Install the camshaft gears by counterholding on the hex of the camshaft with an open-ended wrench.
29. Install the intake camshaft gear with a new bolt to the camshaft.

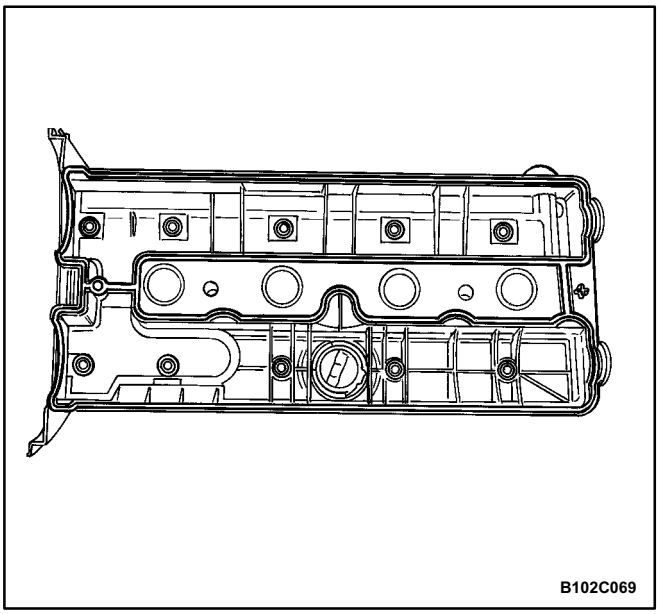
Tighten

Tighten the intake camshaft gear bolt to 50 N•m (37 lb•ft), turn the bolt another 60 degrees and 15 de-grees using the angular torque gauge.

30. While holding the exhaust camshaft firmly in place, install the exhaust camshaft gear bolt.

Tighten

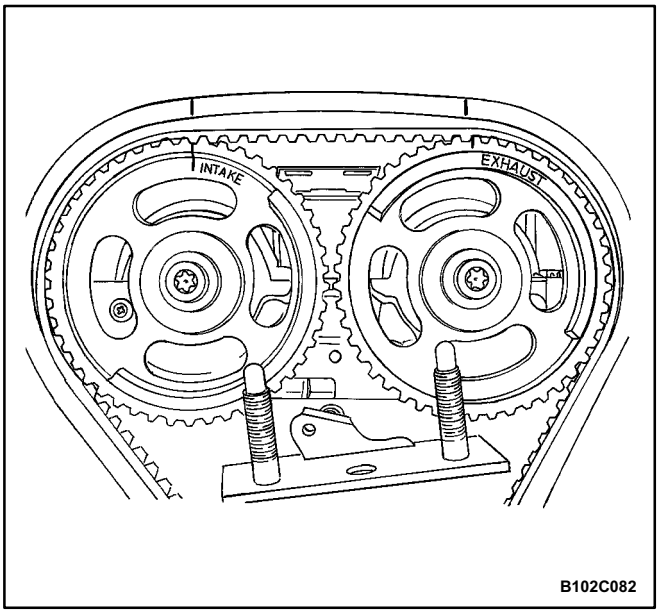
Tighten the exhaust camshaft gear bolt to 50 N•m (37 lb•ft), turn the bolt another 60 degrees and 15 de-grees using the angular torque gauge.


B102C069

31. Apply a small amount of gasket sealant to the cor-ners of the front camshaft caps and to the top of the rear valve cover-to-cylinder head seal.
32. Install the valve cover and the valve cover gasket.
33. Install the valve cover washers.
34. Install the valve cover bolts.

Tighten

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



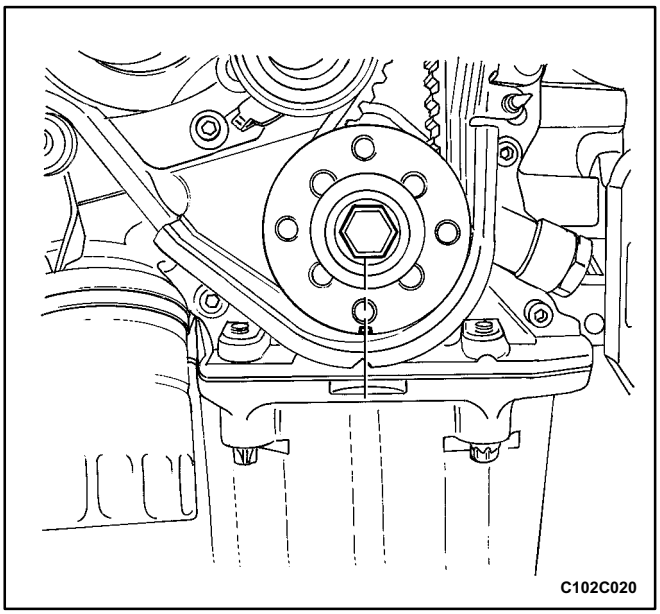
B102C082

35. Connect the ignition wires to the spark plugs.
36. Install the spark plug cover.
37. Install the spark plug cover bolts.

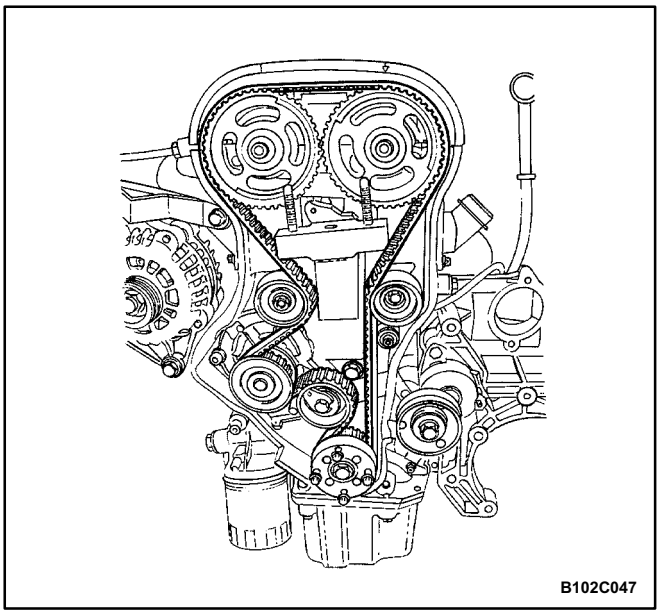
Tighten

Tighten the spark plug cover bolts to 3 N•m (27 lb•in).

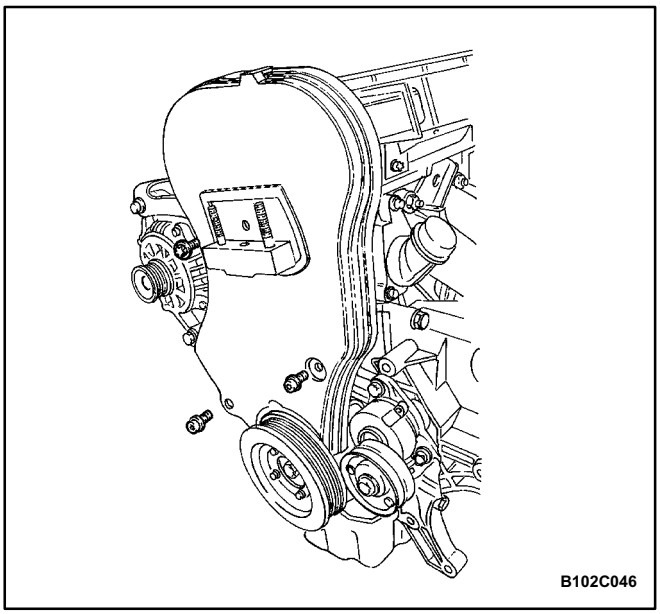
38. Connect the breather tube to the valve cover.
39. Align the timing marks on the camshaft gears to the notches on the valve cover, using the intake gear mark for the intake gear and the exhaust gear mark for the exhaust gear.


C102C020

40. Align the mark on the crankshaft gear with the notch at the bottom of the rear timing belt cover.


B102C047

41. Install the timing belt. Refer to ``Timing Belt'' in this section.
42. Check and adjust the timing belt tension. Refer to "Timing Belt Check and Adjust" in this section.


B102C046

43. Install the front timing belt cover.
44. Install the front timing belt cover bolts.

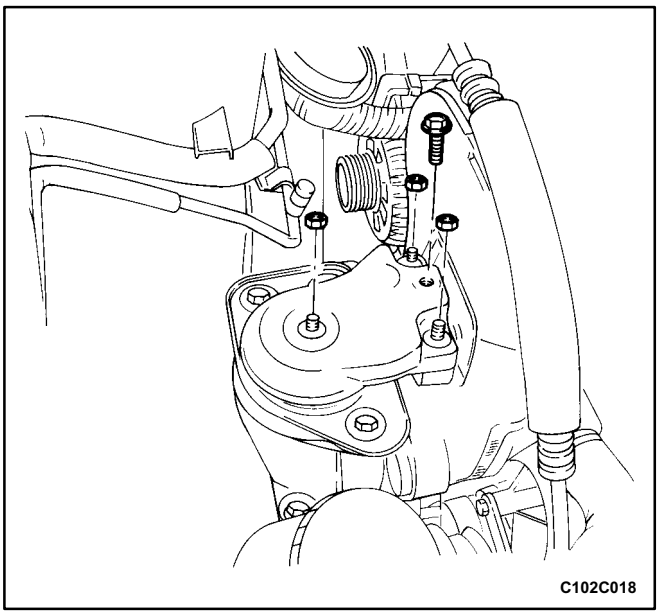
Tighten

Tighten the upper and lower front timing belt cover bolts to 8 N•m (71 lb•in).

45. Install the crankshaft pulley.
46. Install the crankshaft pulley bolts.

Tighten

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

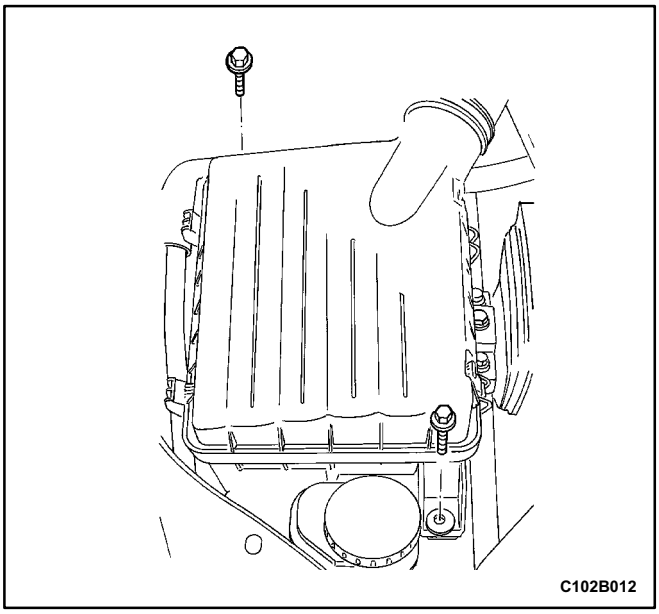

C102C018

47. Install the right engine mount bracket and retaining bolts and nut.

Tighten

Tighten the right engine mount bracket retaining bolts and nut to 60 N•m (44 lb•ft).

48. Remove the engine assembly lift support J28467B.
49. Install the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump.*
50. Connect the upper radiator hose to the thermostat housing.
51. Install the right front wheel well splash shield. Refer to *Section 9R, Body Front End.*
52. Install the right front wheel. Refer to *Section 2E, Tires and Wheels.*


C102B012

53. Install the air filter housing.
54. Install the air filter housing bolts.

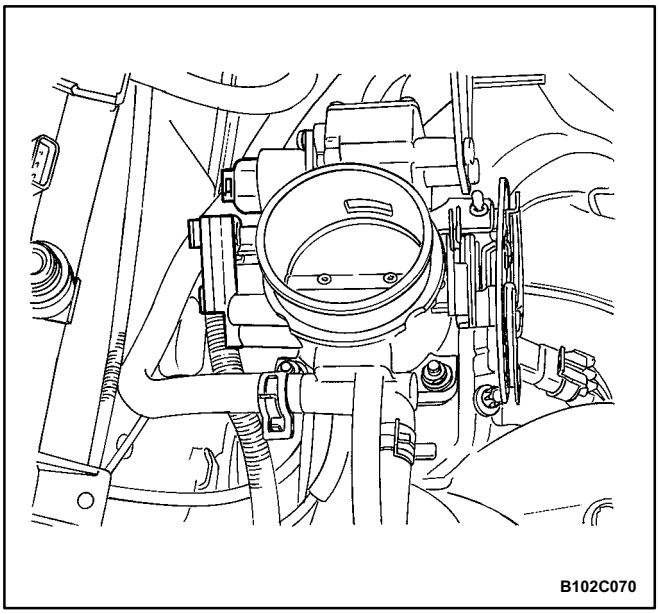
Tighten

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

55. Connect the air intake tube to the throttle body.
56. Connect the breather tube to the valve cover.
57. Connect the manifold air temperature sensor con-nector.
58. Install the resonator and the retaining bolts.

Tighten

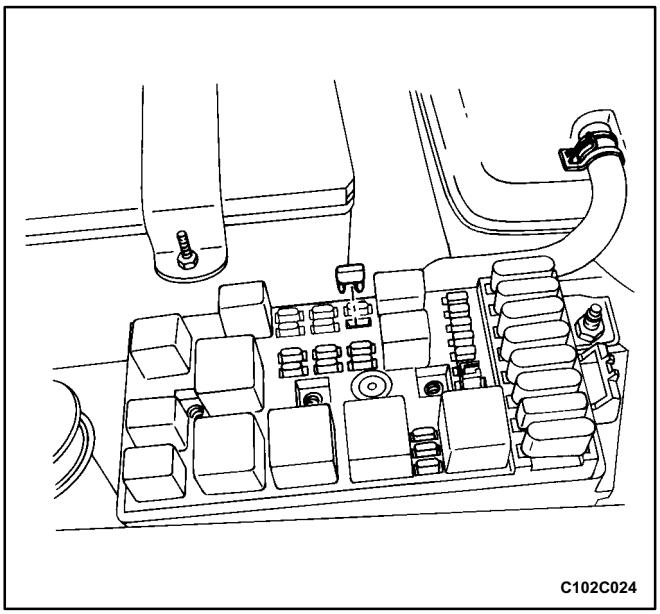
Tighten the resonator retaining bolts to 8 N•m (71 lb•in).


B102C070

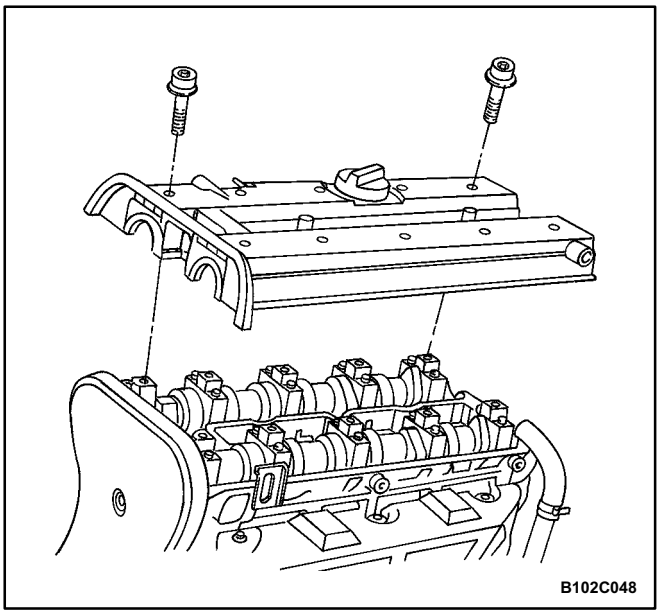
59. Connect camshaft position (CMP) sensor connec-tor.
60. Connect the coolant temperature sensor connector.
61. Connect the engine coolant temperature sensor connector.
62. Connect the idle air control valve connector.
63. Connect the throttle position sensor connector.
64. Install the canister purge solenoid bracket bolt.

Tighten

Tighten the canister purge solenoid bracket bolt to 5 N•m (44 lb•in).


C102C024

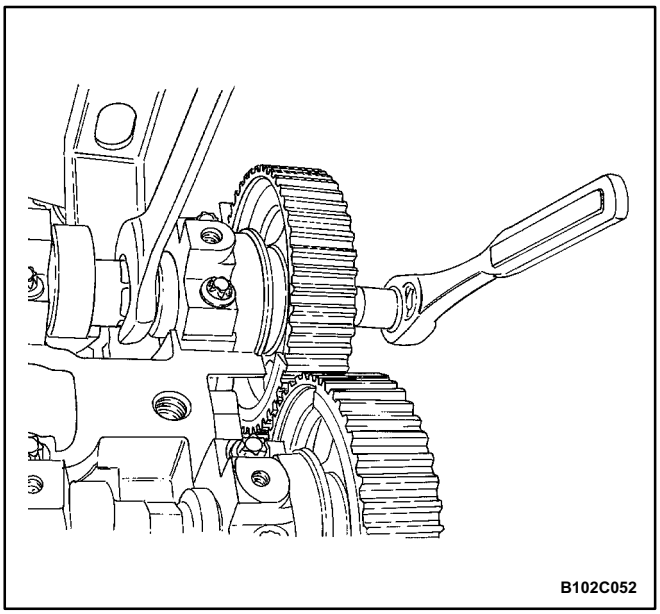
65. Connect the DIS ignition coil connector.
66. Connect the oxygen sensor connector.
67. Connect the ECM ground terminal.
68. Install the fuel pump fuse.
69. Connect the negative battery ground cable.
70. Refill the engine cooling system. Refer to *Section 1D, Engine Cooling.*


B102C048

CAMSHAFTS

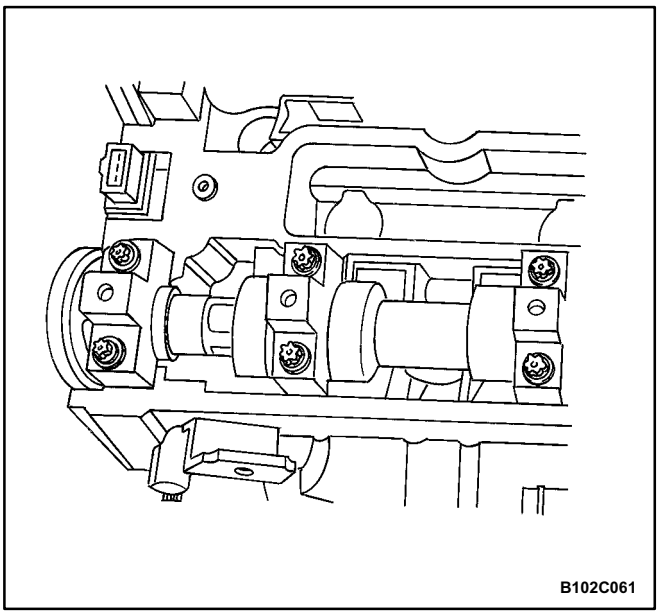
Removal Procedure

1. Remove the timing belt. Refer to "Timing Belt" in this section.
2. Disconnect the breather tube at the valve cover.
3. Disconnect the crankcase ventilation tube at the valve cover.
4. Remove the spark plug cover bolts.
5. Remove the spark plug cover.
6. Disconnect the ignition wires from the spark plugs.
7. Disconnect the camshaft position (CMP) sensor connector (2.2L DOHC).
8. Remove the valve cover bolts.
9. Remove the valve cover washers.
10. Remove the valve cover and the valve cover gasket.


B102C052

Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

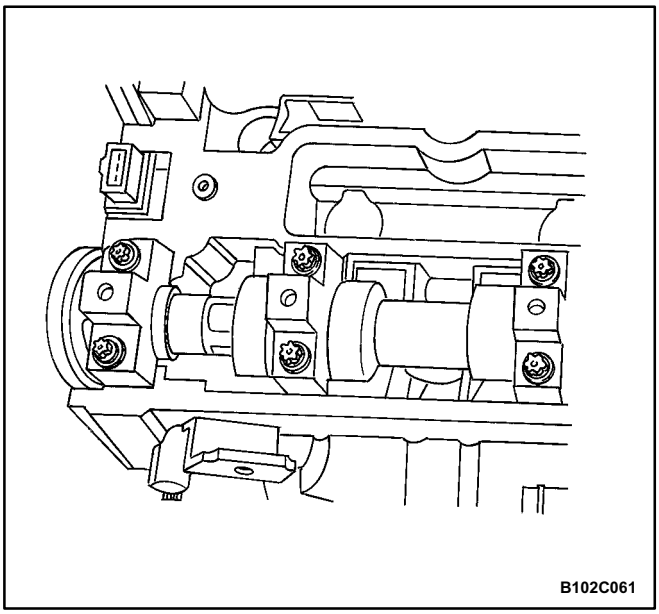
11. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
12. Remove the intake camshaft gear.
13. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
14. Remove the exhaust camshaft gear.



15. Loosen the camshaft bearing cap bolts in stages of one-half to one turn.
16. Remove the camshaft bearing cap bolts from the cylinder head.
17. Remove the camshafts.
18. Remove the seal ring from the camshafts.

Important: The camshaft must detach evenly from the bearing seats in the front guide bearing.

19. Check the camshaft and bearing seats for wear and replace them if necessary.



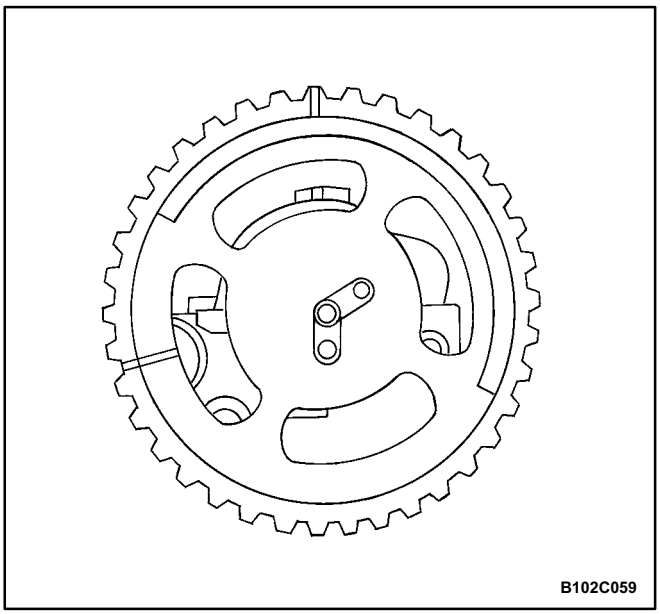
Installation Procedure

Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

1. Lubricate the camshaft journals and the camshaft caps with engine oil.
2. Install the intake camshaft.
3. Install the intake camshaft caps in their original posi-tions.
4. Install the intake camshaft cap bolts.
5. Install the exhaust camshaft.
6. Install the exhaust camshaft caps in their original positions.
7. Install the exhaust camshaft cap bolts.
8. Tighten the camshaft cap bolts gradually and in the sequence shown for each camshaft cap.

Tighten

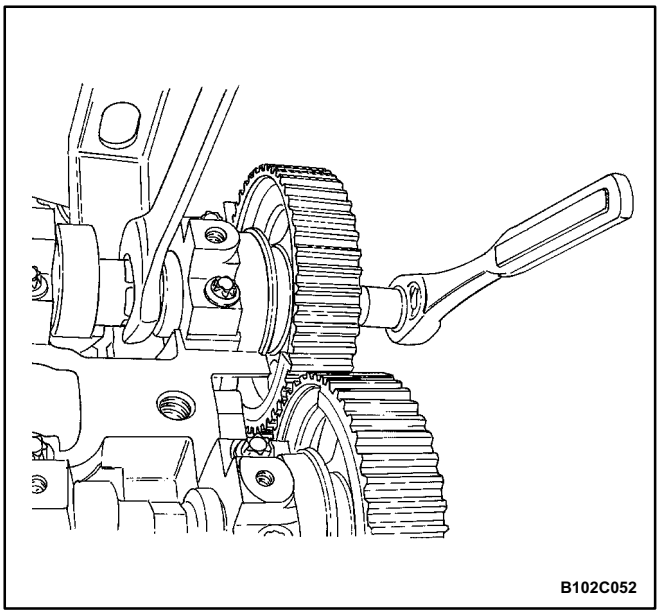
Tighten the camshaft bearing cap bolts to 8 N•m (71 lb•in).


B102C059

9. Measure the intake camshaft end play and the ex-haust camshaft end play. Refer to "Engine Specifi-cations" in this section.
10. Install the intake camshaft gear.
11. While holding the intake camshaft firmly in place, install the intake camshaft gear bolt.

Tighten

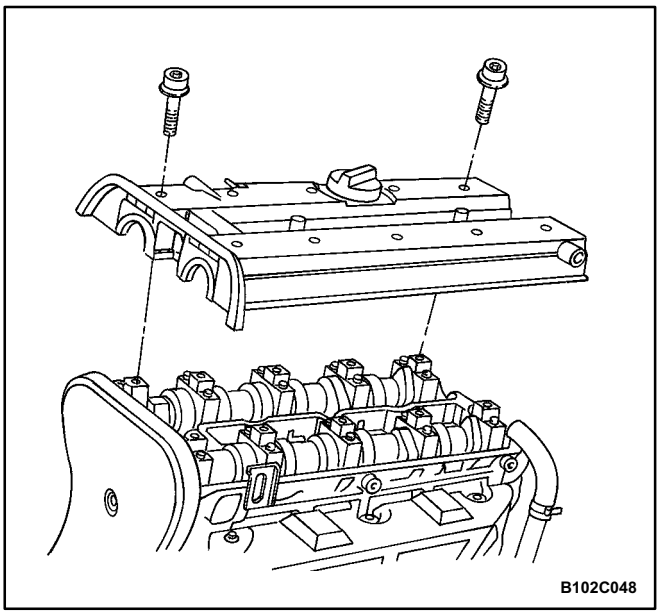
Tighten the intake camshaft gear bolt to 50 N•m (37 lb•ft), turn the bolt another 60 degrees and 15 degrees using the angular torque gauge.


B102C052

12. Install the exhaust camshaft gear.
13. While holding the exhaust camshaft firmly in place, install the exhaust camshaft gear bolt.

Tighten

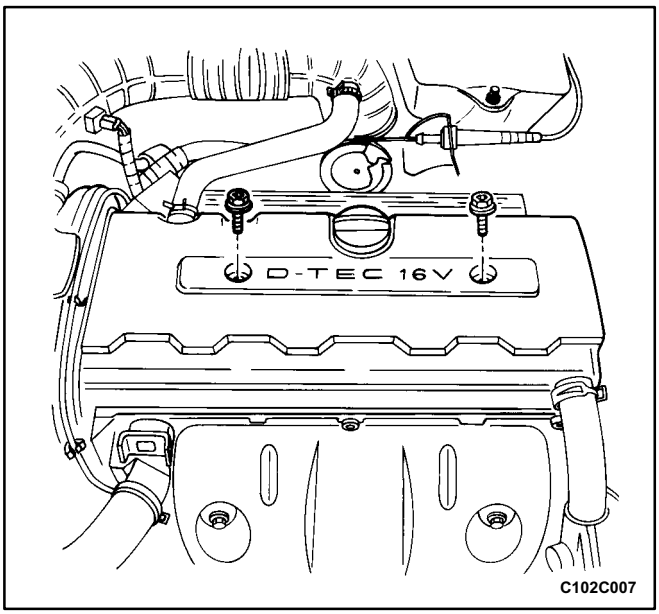
Tighten the exhaust camshaft gear bolt to 50 N•m (37 lb•ft), turn the bolt another 60 degrees and 15 degrees using the angular torque gauge.


B102C048

14. Install the valve cover and the valve cover gasket.
15. Install the valve cover washers.
16. Install the valve cover bolts.

Tighten

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

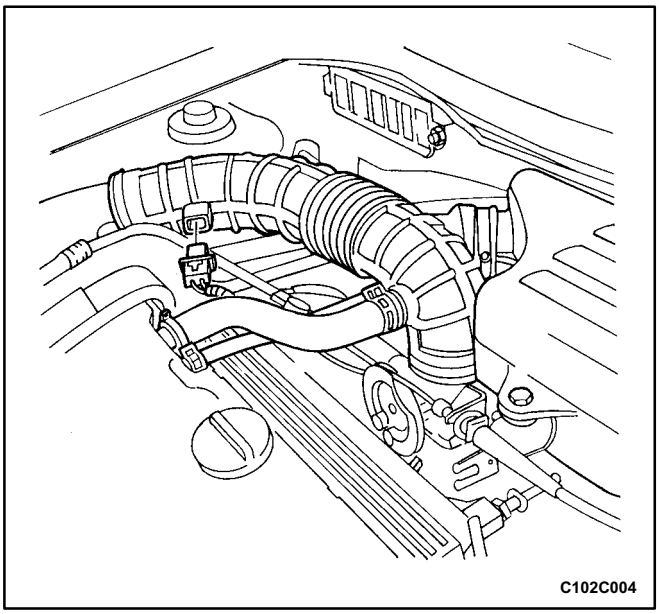


17. Connect the ignition wires to the spark plugs.
18. Connect the camshaft position (CMP) sensor connector (2.2L DOHC).
19. Install the spark plug cover.
20. Install the spark plug cover bolts.

Tighten

Tighten the spark plug cover bolts to 3 N•m (27 lb•in).

21. Connect the breather tube to the valve cover.
22. Connect the crankcase ventilation tube to the valve cover.
23. Install the timing belt. Refer to "Timing Belt" in this section.

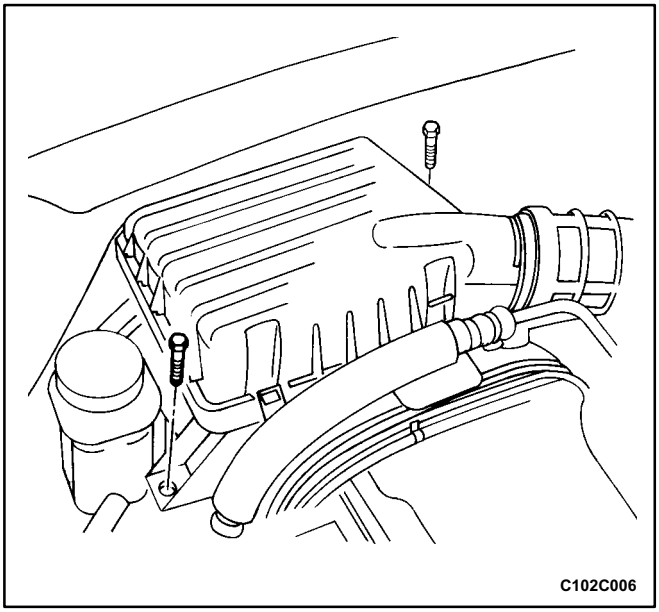


TIMING BELT CHECK AND ADJUST

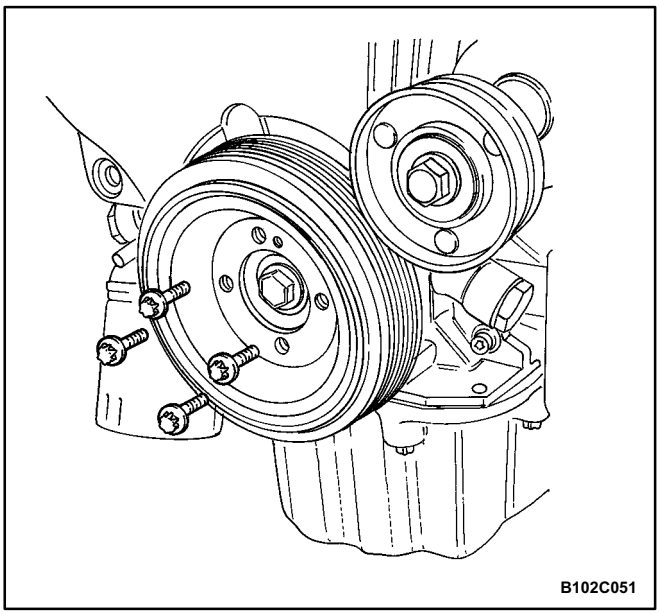
(Left-Hand Drive Shown, Right-Hand Drive Similar)

Adjustment Procedure

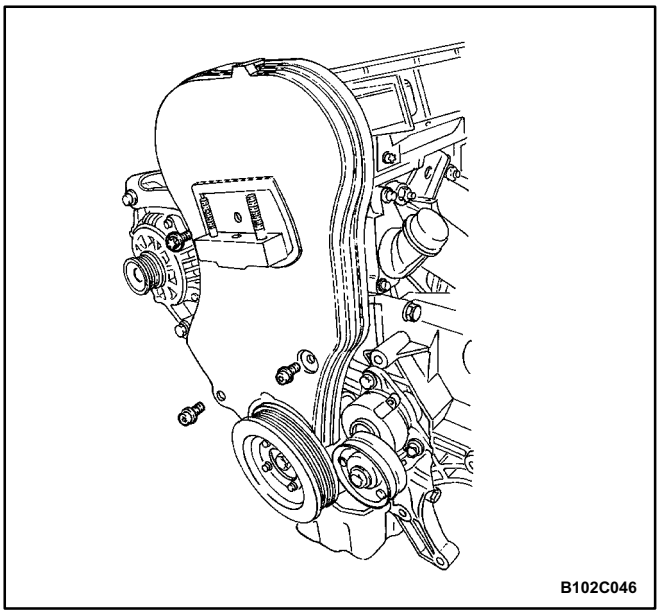
1. Disconnect the negative battery cable.
2. Disconnect the manifold air temperature sensor con-nector.
3. Remove the air intake tube from the throttle body.
4. Remove the breather tube from the valve cover.



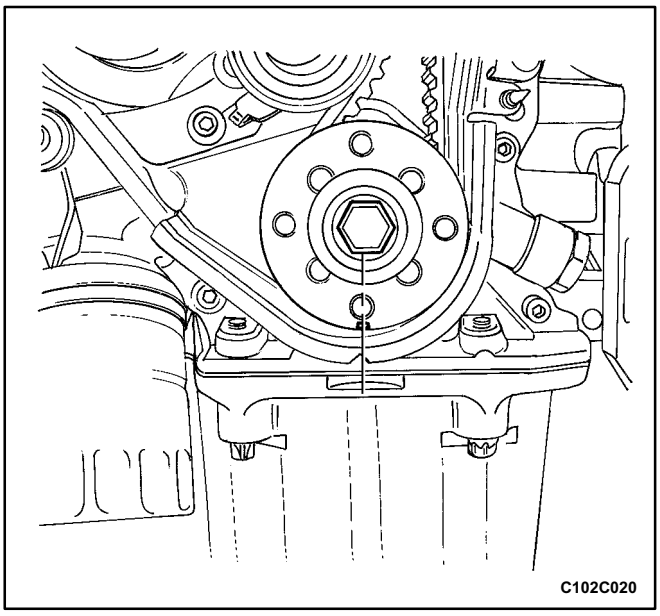
5. Remove the air filter housing bolts.
6. Remove the air filter housing.
7. Remove the right front wheel. Refer to *Section 2E, Tires and Wheels.*
8. Remove the right front wheel well splash shield. Refer to *Section 9R, Body Front End.*



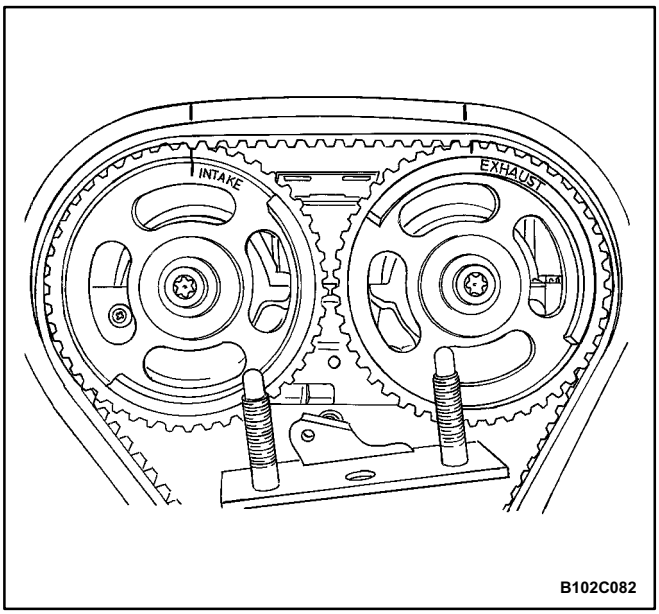
9. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump.*
10. Remove the crankshaft pulley bolts.
11. Remove the crankshaft pulley.
12. Remove the right engine mount bracket. Refer to "Engine Mount" in this section.



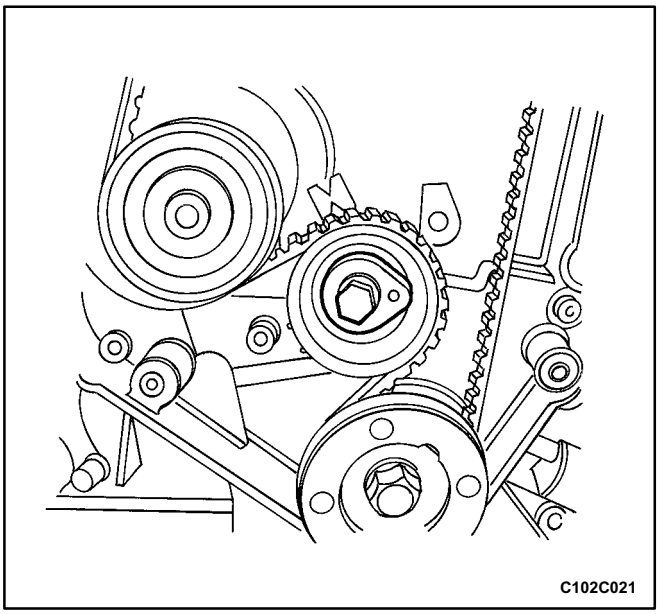
13. Remove the front timing belt cover bolts.
14. Remove the front timing belt cover.



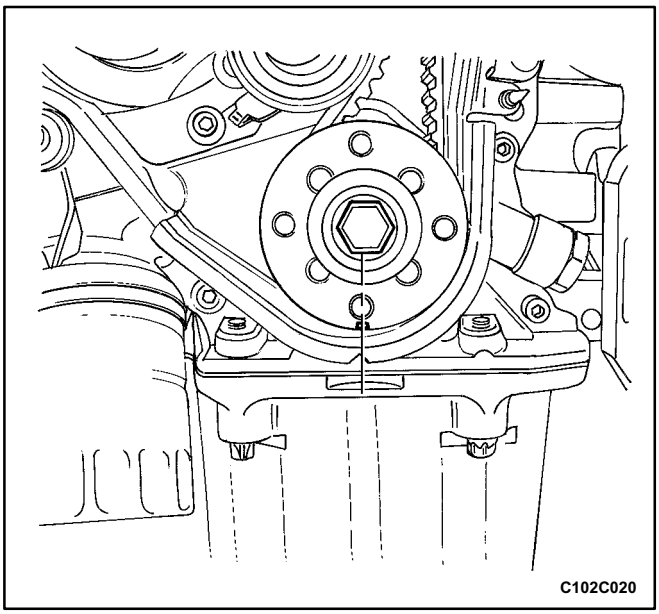
15. Rotate the crankshaft at least one full turn clockwise using the crankshaft gear bolt.
16. Align the mark on the crankshaft gear with the notch at the bottom of the rear timing belt cover.



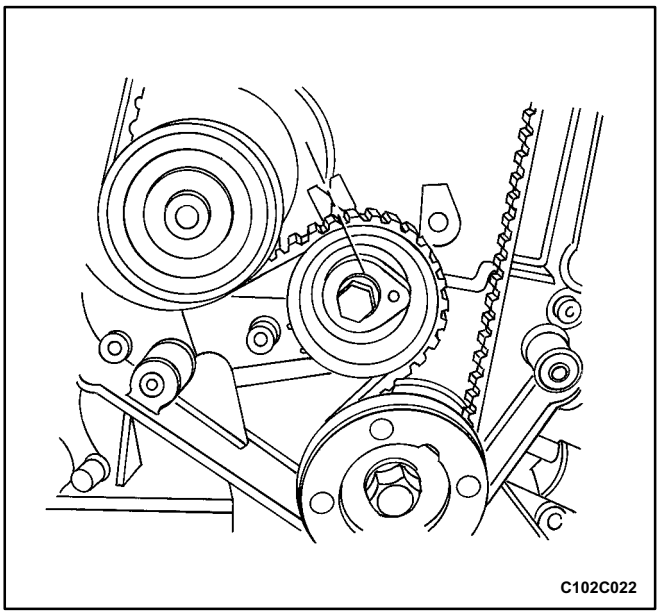
17. Align the camshaft gear timing marks. Use the ex-haust gear mark for the exhaust gear and the intake gear mark for the intake gear, since the gears are interchangeable.



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



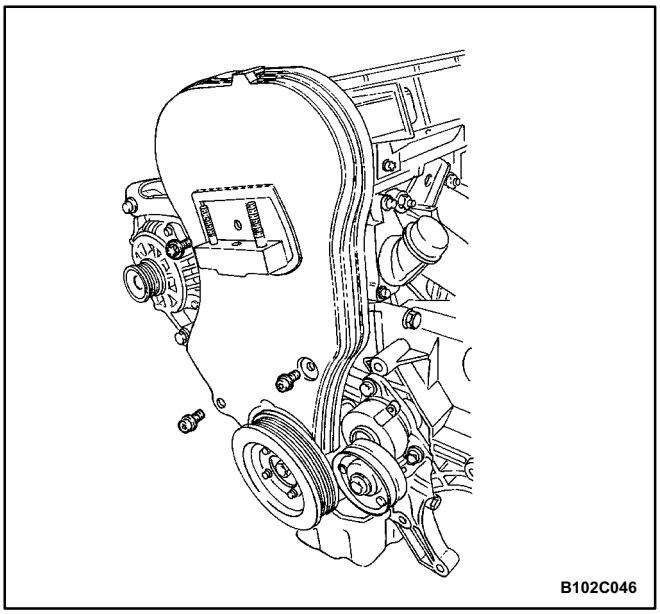
20. Tighten the automatic tensioner bolt.
21. Rotate the crankshaft two full turns clockwise using the crankshaft gear bolt.
22. Check the automatic tensioner pointer.


C102C022

23. When the adjust arm pointer of the timing belt auto-matic tensioner is aligned with the notch on the tim-ing belt automatic tensioner bracket, the belt is tensioned correctly.

Tighten

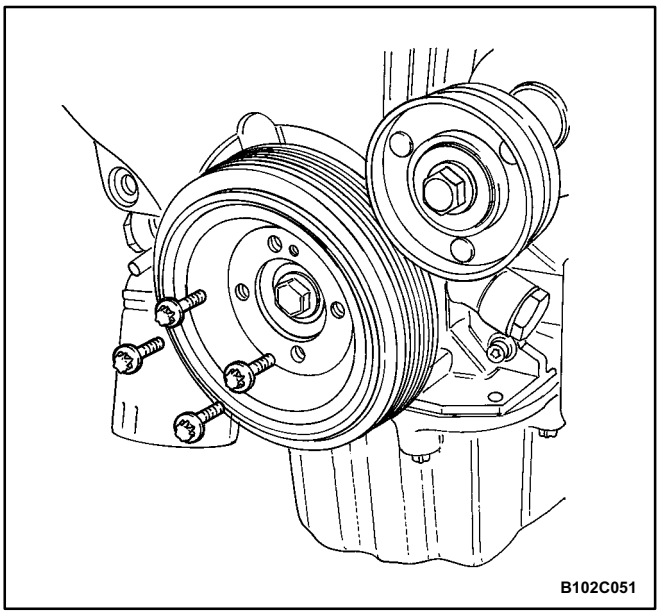
Tighten the automatic tensioner bolt to 25 N•m (18 lb•ft).


B102C046

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).

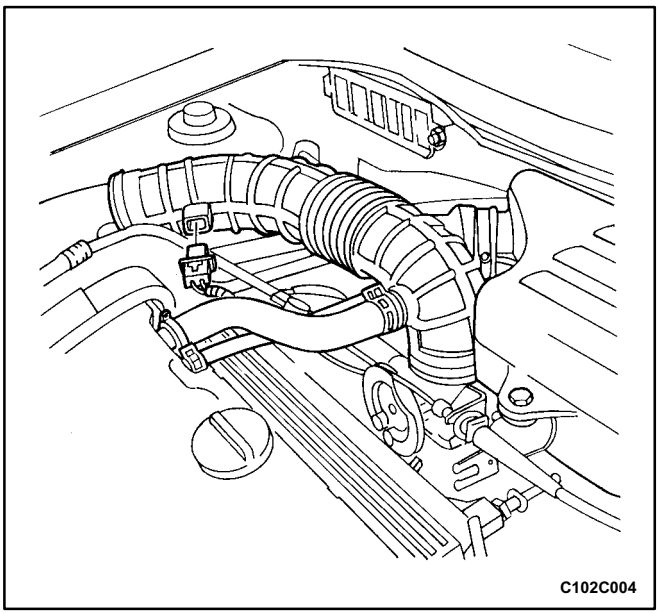

B102C051

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 engine mount bracket. Refer to "En-gine Mount" in this section.
29. Install the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump.*

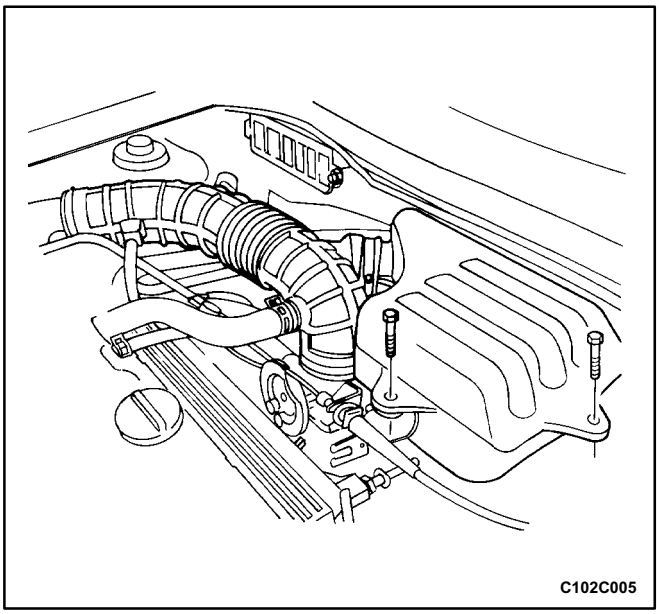

C102C004

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, Tires and Wheels*.
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 to the throttle body.
35. Connect the breather tube to the valve cover.
36. Connect the manifold air temperature sensor con-nector.
37. Connect the negative battery cable.

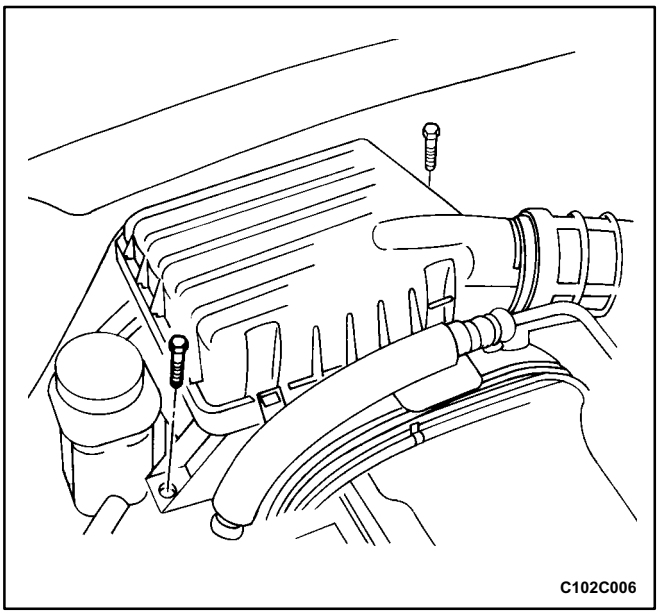

C102C005

TIMING BELT

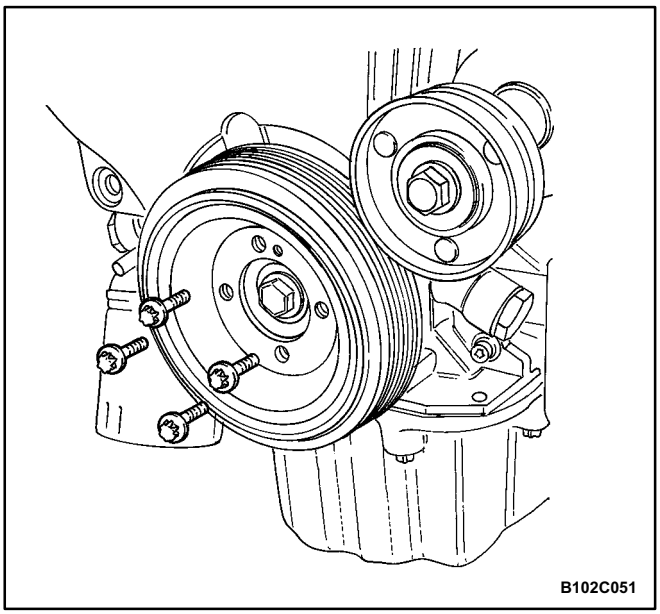
(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal Procedure

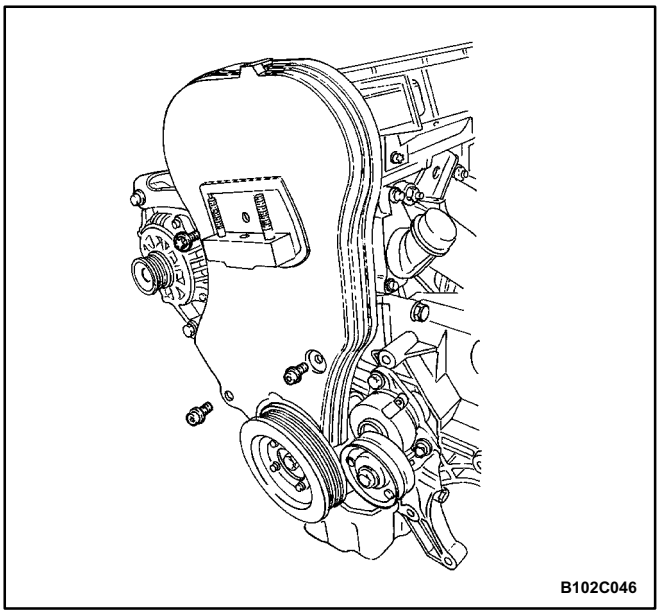
1. Disconnect the negative battery cable.
2. Disconnect the manifold air temperature (MAT) sen-sor connector.
3. Disconnect the air intake tube from the throttle body.
4. Remove the resonator retaining bolts and the reso-nator from the throttle body.
5. Disconnect the breather tube from the valve cover.


C102C006

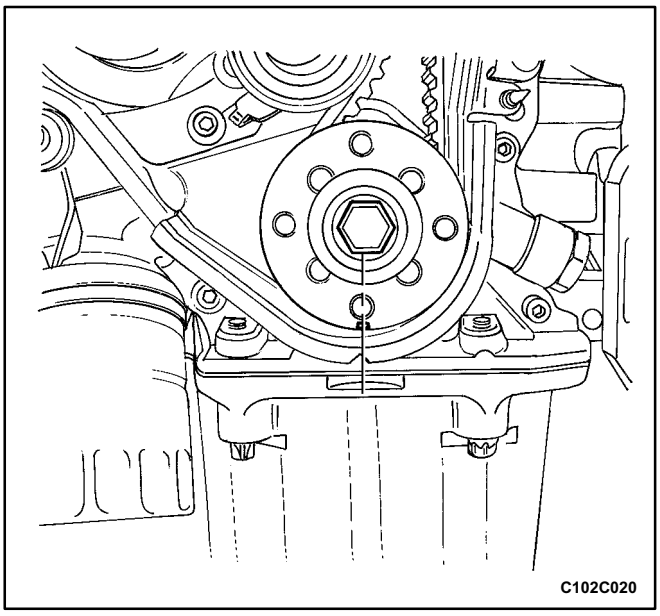
6. Remove the air filter housing bolts.
7. Remove the air filter housing.
8. Remove the right front wheel. Refer to *Section 2E, Tires and Wheels*.
9. Remove the right front wheel well splash shield. Refer to *Section 9R, Body Front End.*


B102C051

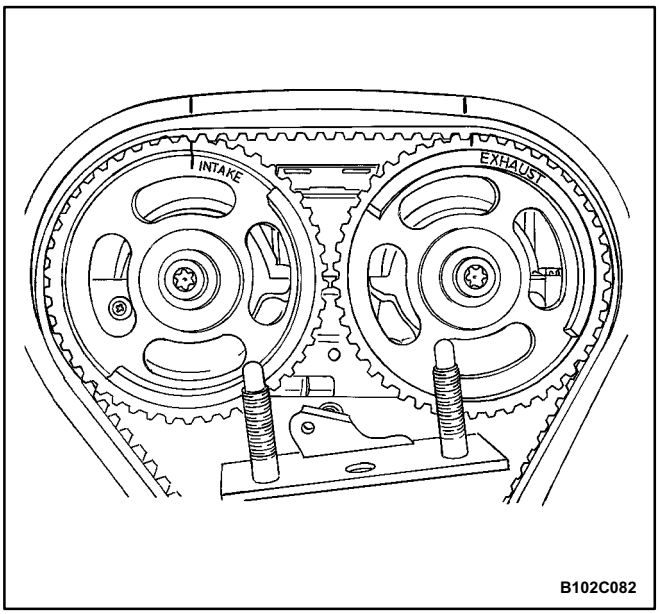
10. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.
11. Remove the crankshaft pulley bolts.
12. Remove the crankshaft pulley.
13. Remove the right engine mount bracket. Refer to "Engine Mount" in this section.


B102C046

14. Remove the power steering hose clamp bolt, and position the hose clear of the repair area.
15. Remove the front timing belt cover bolts.
16. Remove the front timing belt cover.


C102C020

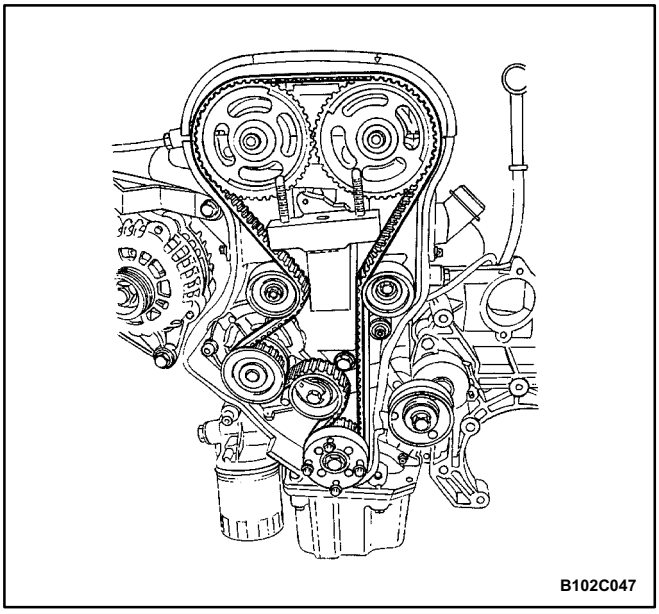
17. Using the crankshaft gear bolt, rotate the crankshaft clockwise until the timing mark on the crankshaft gear is aligned with the notch at the bottom of the rear timing belt cover.



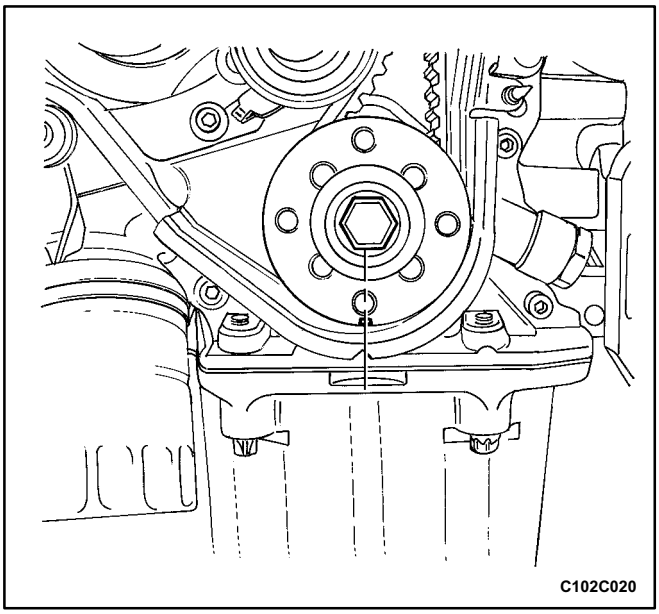
Notice: The camshaft gears must align with the notch on the valve cover or damage to the engine could result.

18. Align the camshaft gears with the notch on the valve cover.

Important: Use the intake gear mark for the intake camshaft gear and the exhaust gear mark for the ex-haust camshaft gear since both gears are interchange-able.

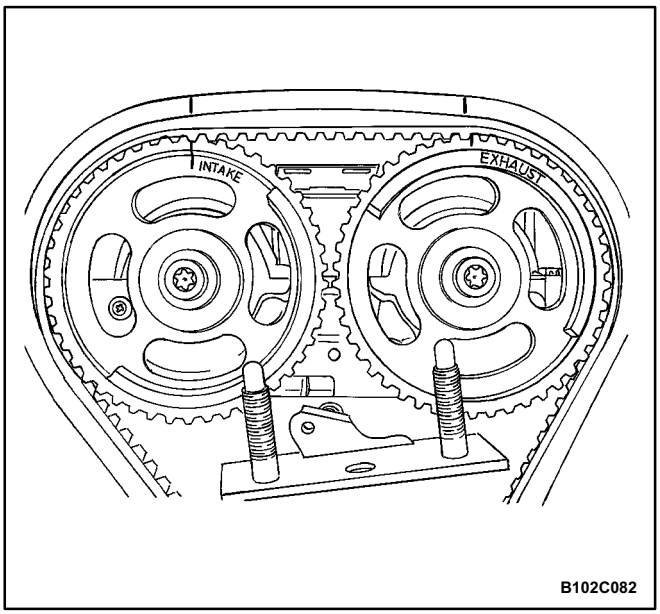


19. Loosen the automatic tensioner bolt. Turn the hex-key tab to relieve belt tension.
20. Remove the timing belt.

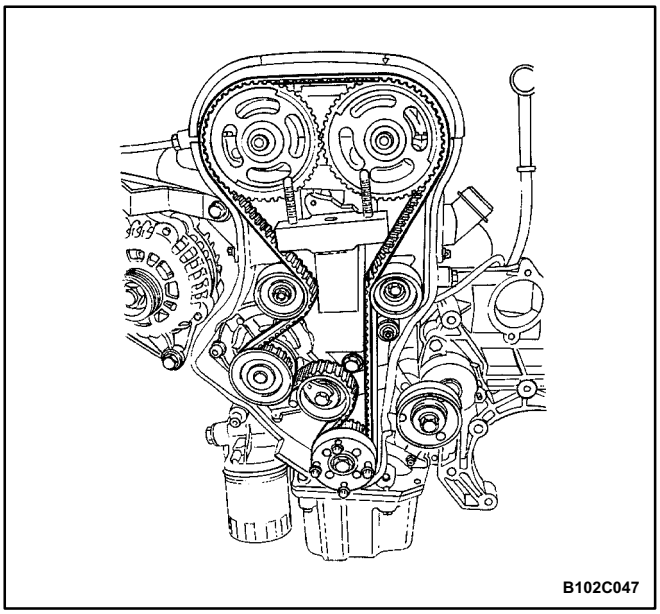


Installation Procedure

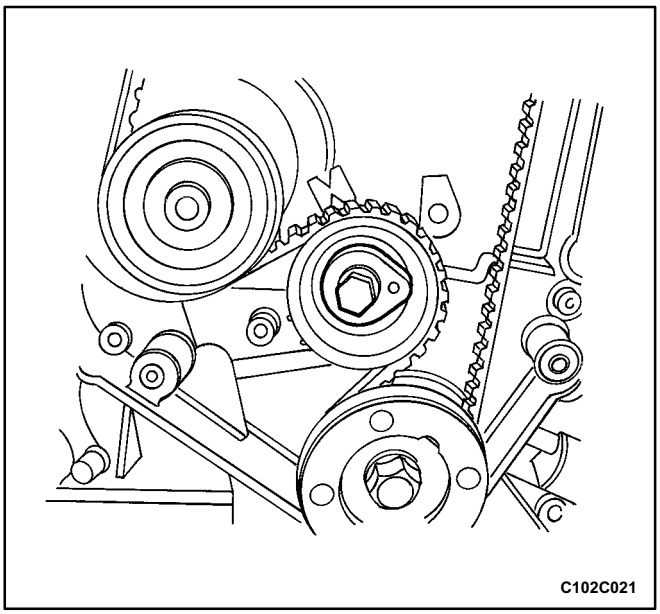
1. Align the timing mark on the crankshaft gear with the notch on the bottom of the rear timing belt cover.



2. Align the timing marks on the camshaft gears, using the intake gear mark for the intake gear and the ex-haust gear mark for the exhaust gear.



3. Install the timing belt.

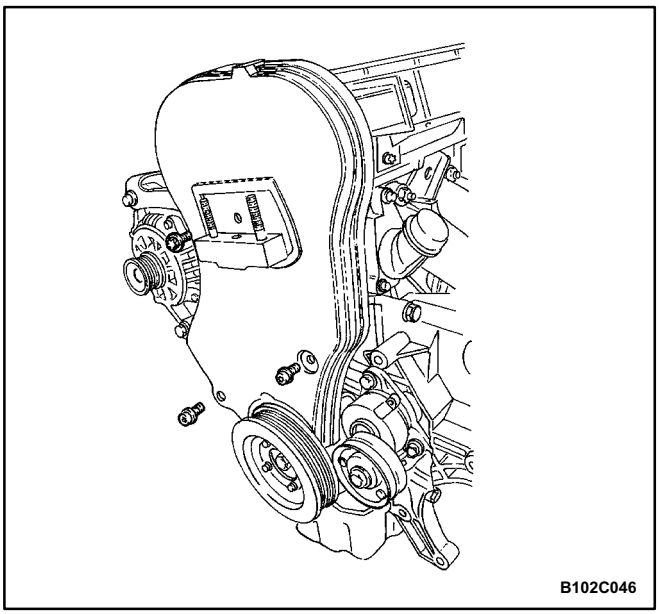


4. Turn the hex-key tab in a counterclockwise direction to tension the belt. Turn until the pointer aligns with the notch.
5. Install the automatic tensioner bolt.

Tighten

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

6. Rotate the crankshaft two full turns clockwise using the crankshaft gear bolt.
7. Recheck the automatic tensioner pointer.


B102C046

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

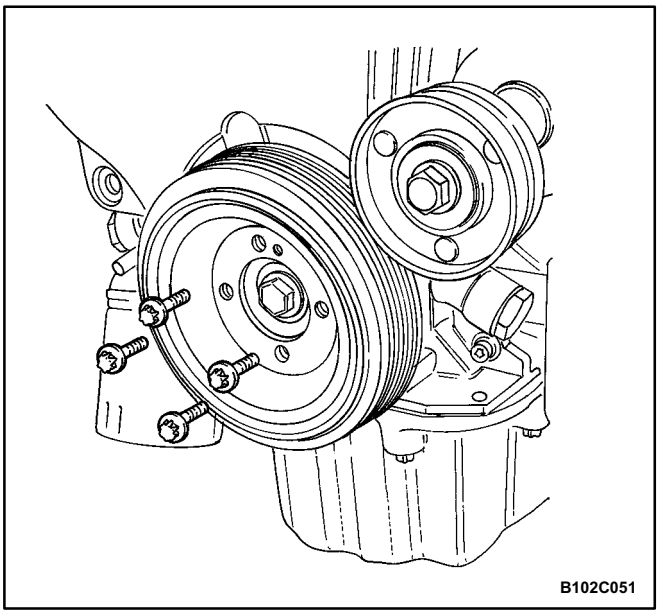
Tighten

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

10. Install the right engine mount bracket. Refer to "En-gine Mounts" in this section.
11. Position the power steering hose in place and install the clamp bolt.

Tighten

Tighten the power steering hose clamp bolt to 8 N•m (71 lb•in).


B102C051

12. Install the crankshaft pulley.
13. Install the crankshaft pulley bolts.

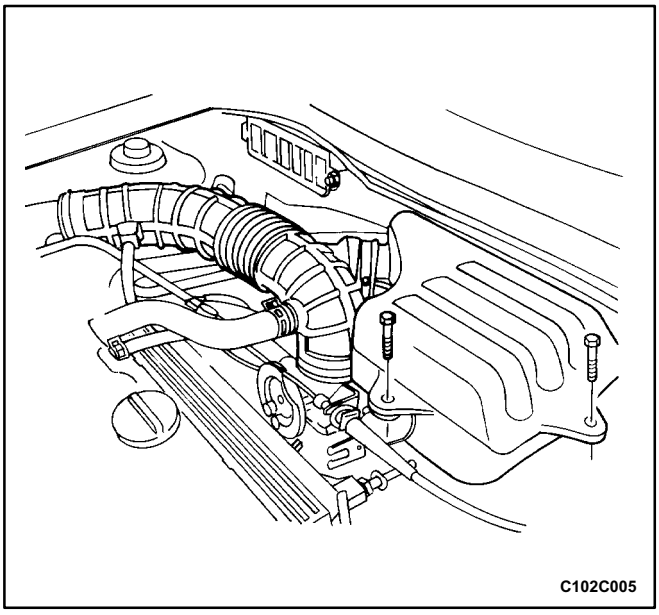
Tighten

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

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).

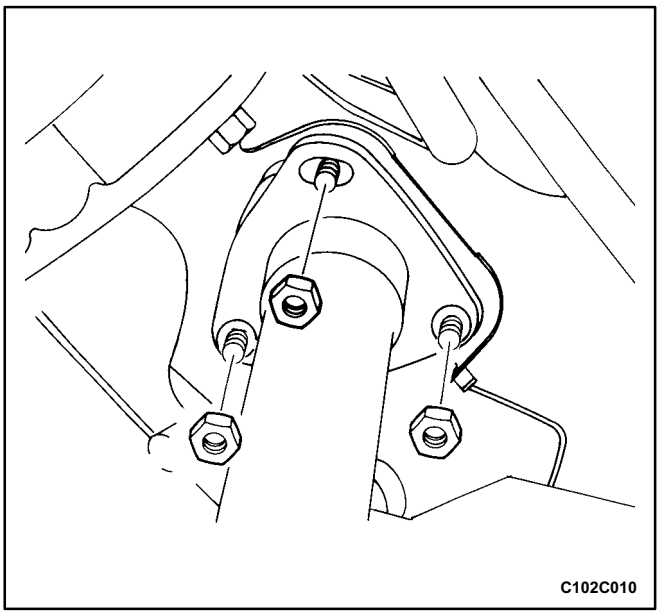

C102C005

19. Install the resonator and the retaining bolts.

Tighten

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

20. Connect the air intake tube to the throttle body.
21. Connect the breather tube to the valve cover.
22. Connect the manifold air temperature sensor con-nector.
23. Connect the negative battery cable.



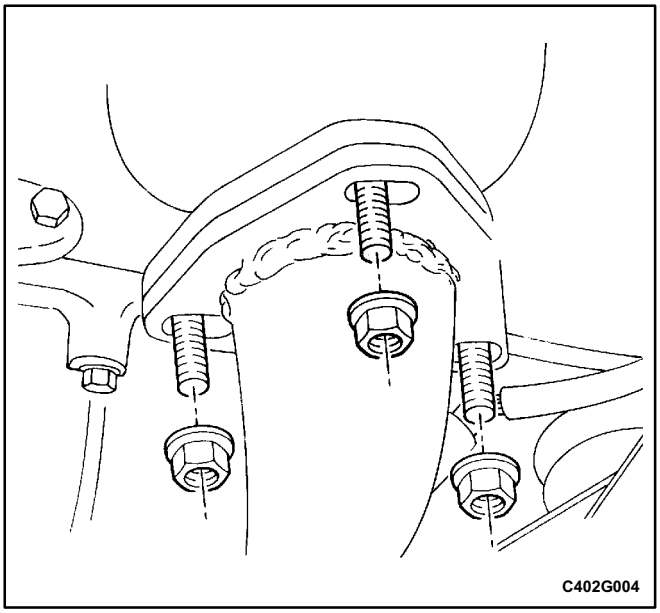
OIL PAN

Removal Procedure

1. Disconnect the negative battery cable.

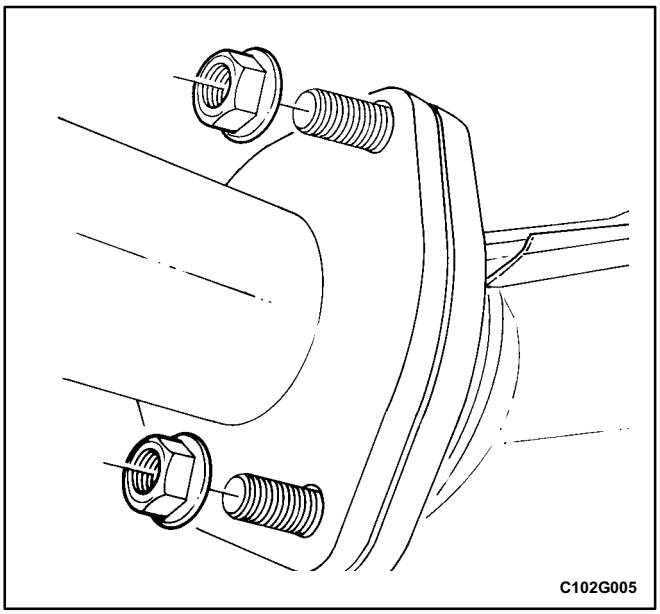
(2.0L DOHC)

2. Remove the exhaust flex pipe retaining nuts from the exhaust manifold and the support bracket.
3. Remove the exhaust flex pipe retaining nuts from the catalytic converter.
4. Remove the exhaust flex pipe.

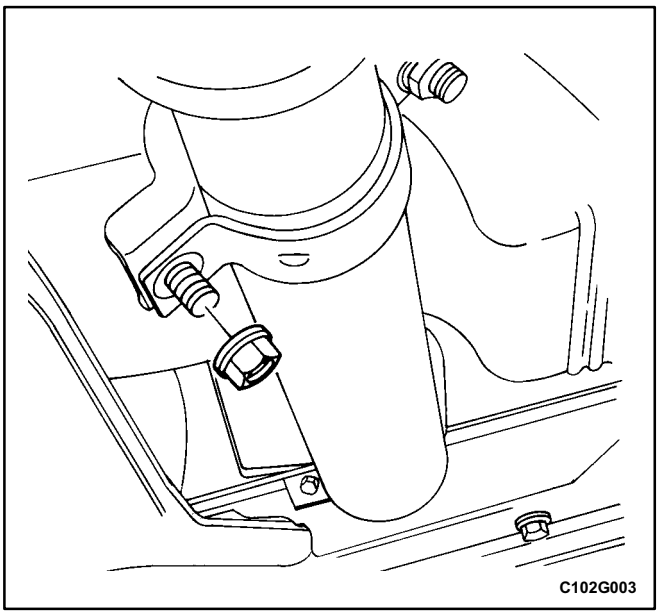


(2.2L DOHC)

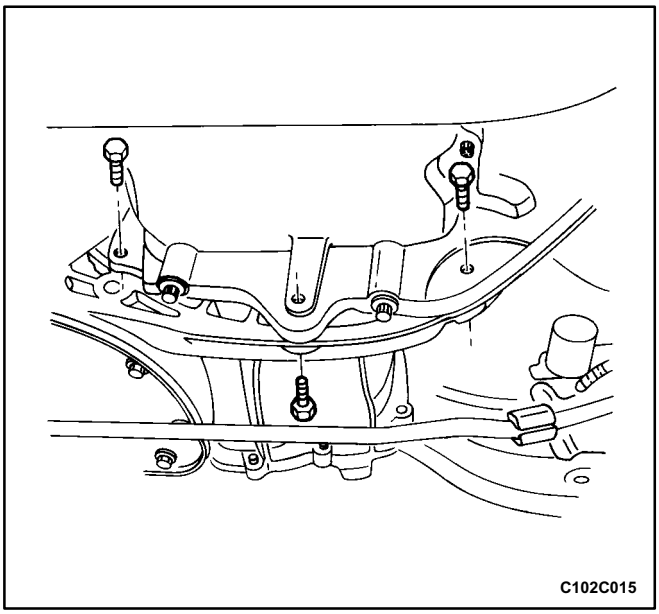
5. Disconnect the post converter heated oxygen sen-sor connector.
6. Remove the auxiliary catalytic converter lower flange nuts.



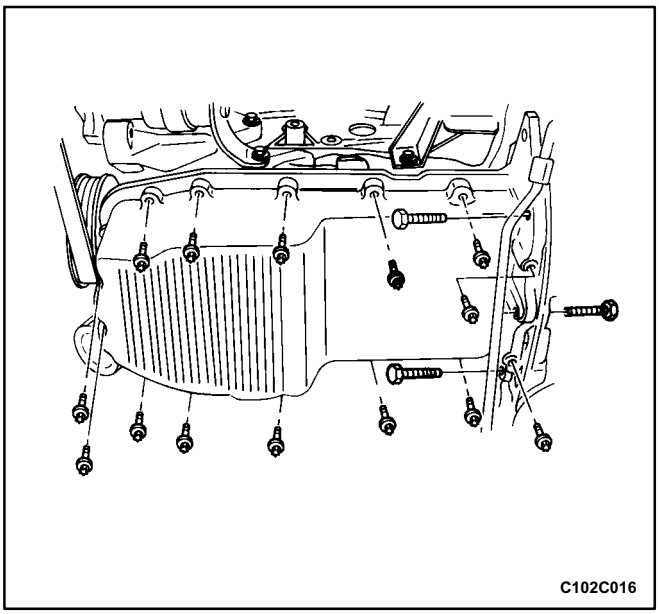
7. Remove the nuts that secure the front muffler pipe to the main catalytic converter.
8. Remove the rubber hangers that attach the connect-ing pipe to the vehicle.



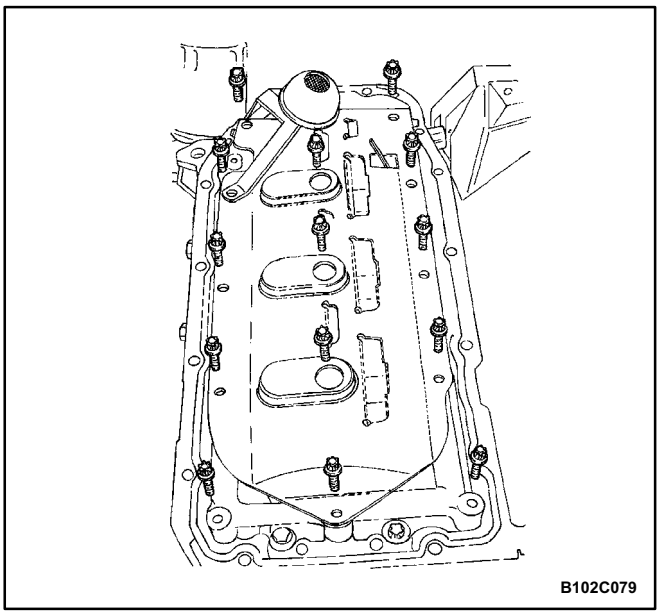
9. Remove the connecting pipe mounting bracket nuts and the bracket.
10. Remove the main catalytic converter and the con-necting pipe.



11. Drain the engine oil from the engine crankcase.
12. Remove the oil pan flange-to-transaxle retaining bolts.

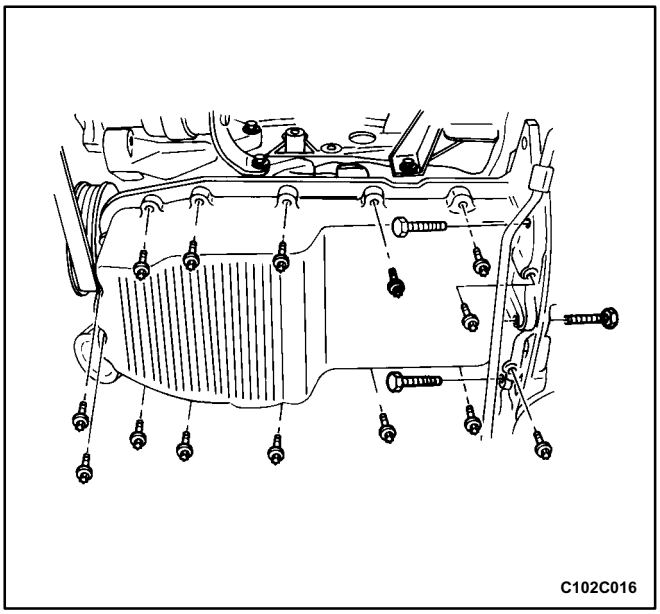


13. Remove the oil pan retaining bolts.
14. Remove the oil pan from the engine block.
15. Remove the oil pan gasket from the oil pan.


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 attaching bolt holes in the engine block.
5. Clean the oil pan splash shield.

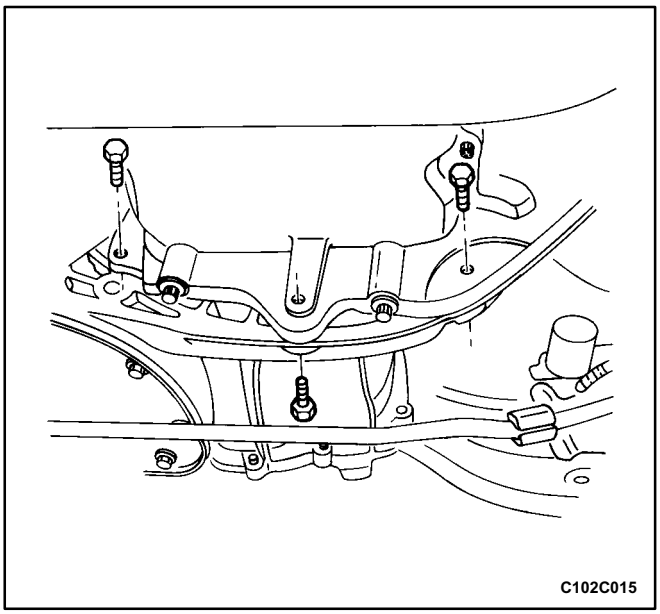

C102C016

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

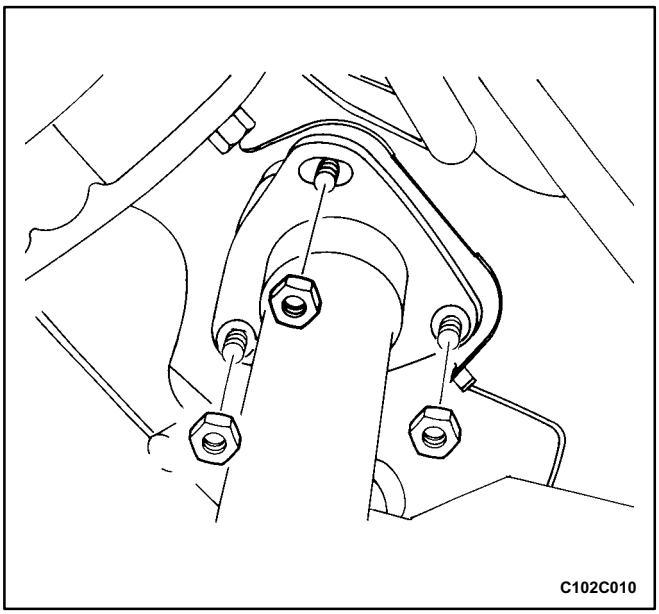
Tighten the oil pan retaining bolts to 10 N•m (89 lb•in).


C102C015

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).



(2.0L DOHC)

6. Install the exhaust flex pipe.
7. Install the exhaust flex pipe retaining nuts to the ex-haust manifold and the support bracket.

Tighten

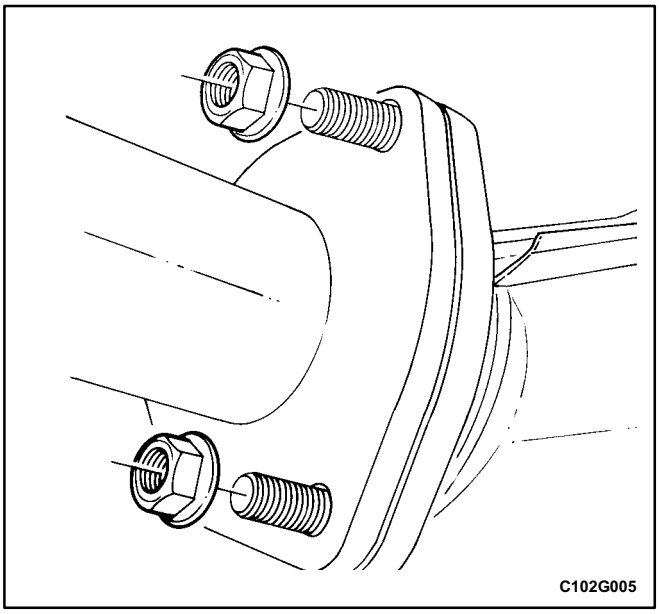
Tighten the exhaust flex pipe retaining nuts to the exhaust manifold to 22 N•m (16 lb•ft).

Tighten the exhaust pipe support bracket bolts to 30 N•m (22 lb•ft).

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

Tighten

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

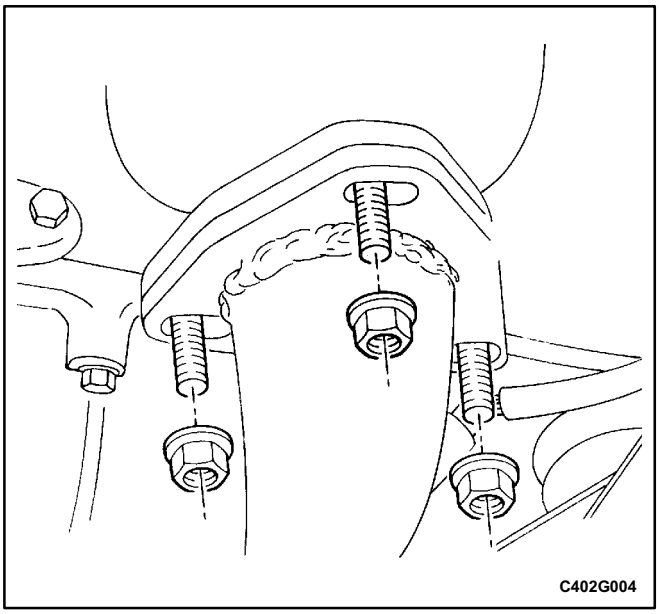


(2.2L DOHC)

9. Insert the main catalytic converter bolts into the front muffler flange.
10. Install the rubber hangers that attach the connecting pipe to the vehicle.
11. Install the nuts to secure the front muffler pipe to the main catalytic converter.

Tighten

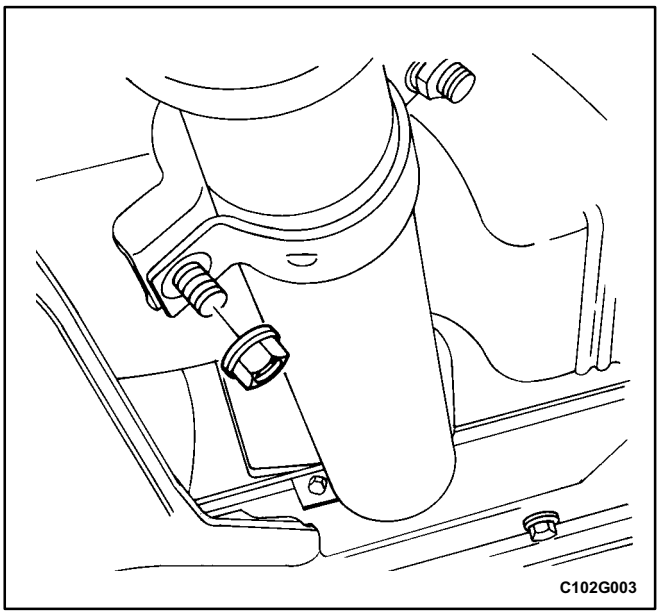
Tighten the front muffler pipe-to-main catalytic con-verter nuts to 30 N•m (22 lb•ft).



12. Install the auxiliary catalytic converter lower flange bolts.

Tighten

Tighten the auxiliary catalytic converter-to-connec-ting pipe nuts to 40 N•m (30 lb•ft).

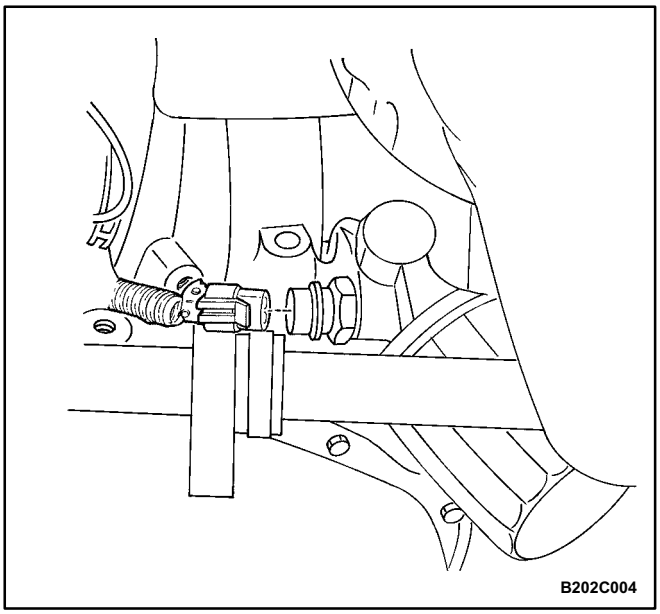


13. Install the connecting pipe mounting bracket and nuts.

Tighten

Tighten the connecting pipe mounting bracket nuts to 30 N•m (22 lb•ft).

14. Connect the post-converter heated oxygen sensor connector.
15. Connect the negative battery cable.
16. Refill the engine crankcase with engine oil.
17. Connect the negative battery cable.
18. Refill the engine crankcase with engine oil.



OIL PUMP

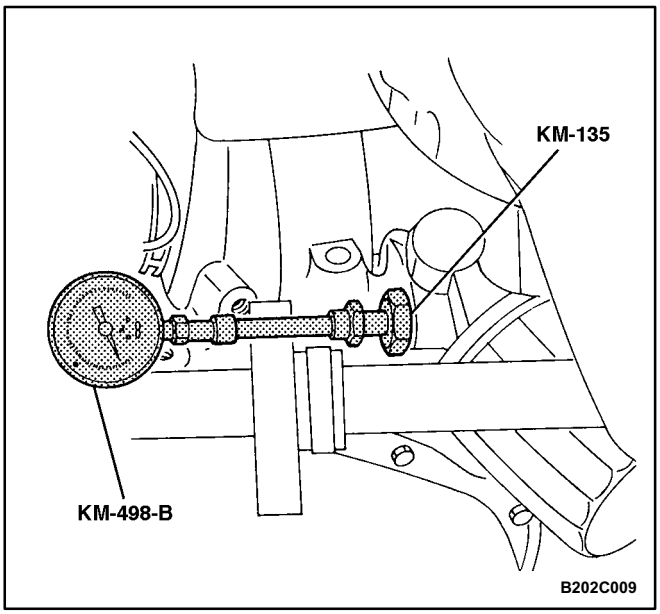
Tools Required

KM-498-B Pressure Gauge

KM-135 Adapter

Engine Oil Pressure Inspection Procedure

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

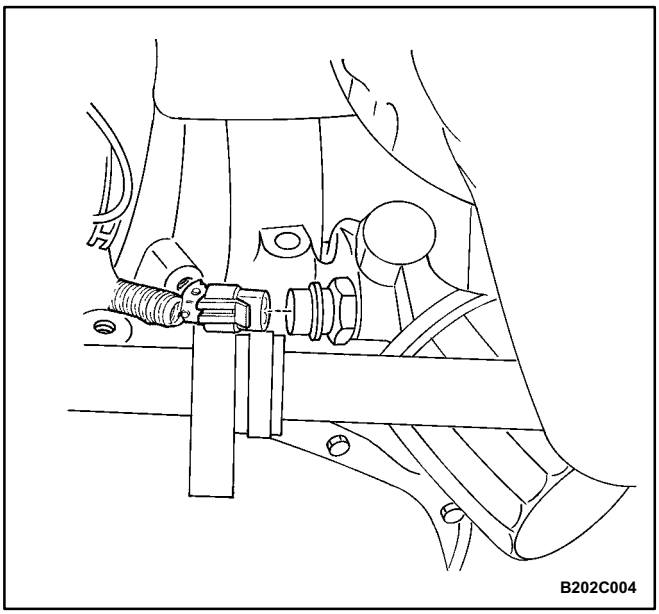


3. Install the adapter KM-135 in place of the oil pres-sure switch.
4. Connect the pressure gauge KM-498-B to the adapter.
5. Start the engine and check the oil pressure at idle speed and engine temperature of 80°C (176°F). The minimum oil pressure should be 30 kPa (0.3 bar).
6. Stop the engine and remove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

Tighten

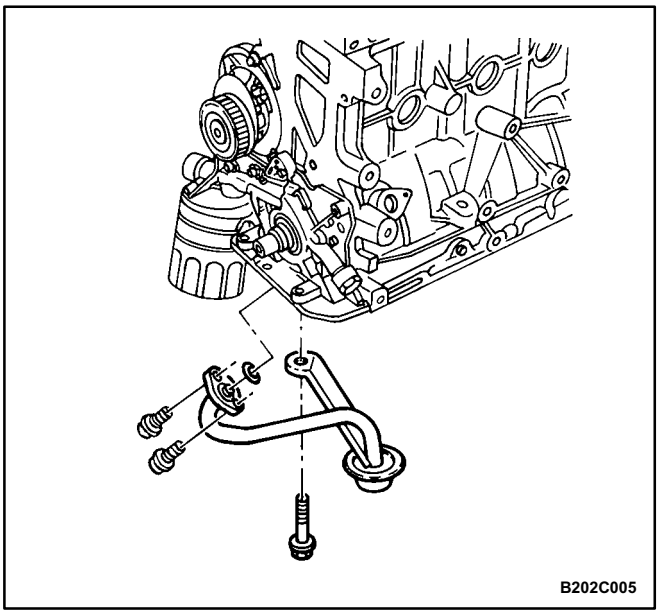
Tighten the oil pressure switch to 40 N•m (30 lb•ft).

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

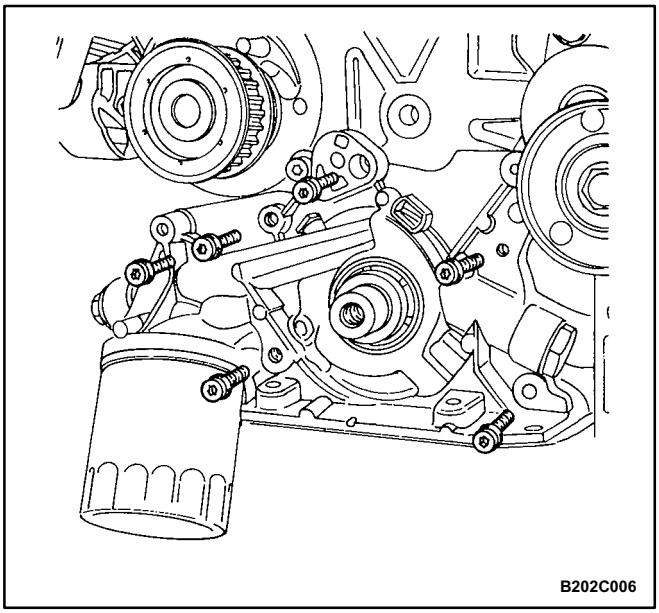


Removal Procedure

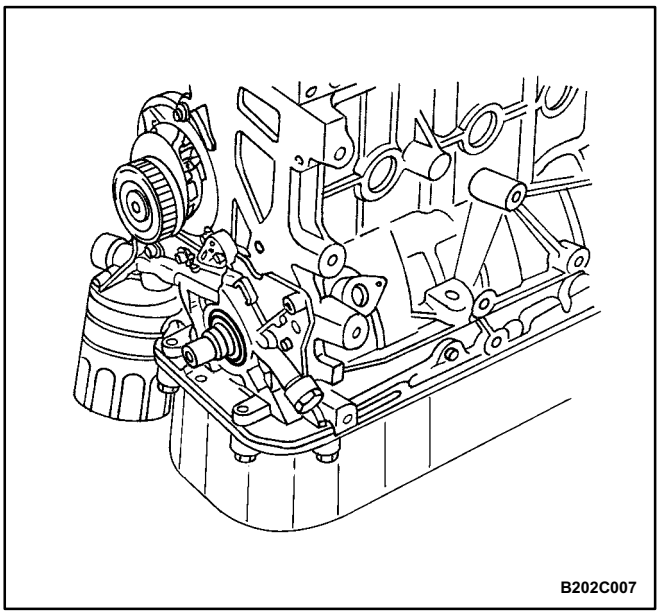
1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to "Timing Belt" in this section.
3. Remove the rear timing belt cover. Refer to "Rear Timing Belt Cover" in this section.
4. Disconnect the oil pressure switch connector.



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

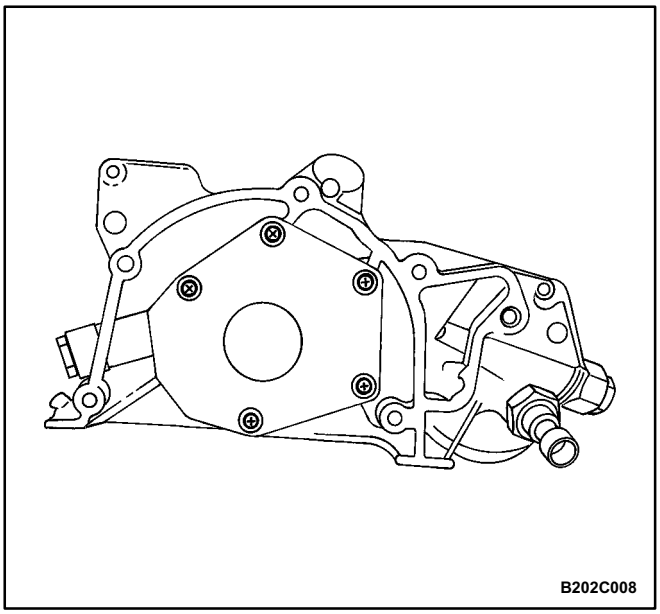


8. Remove the oil pump retaining bolts.
9. Carefully separate the oil pump and the gasket from the engine block.
10. Remove the oil pump.

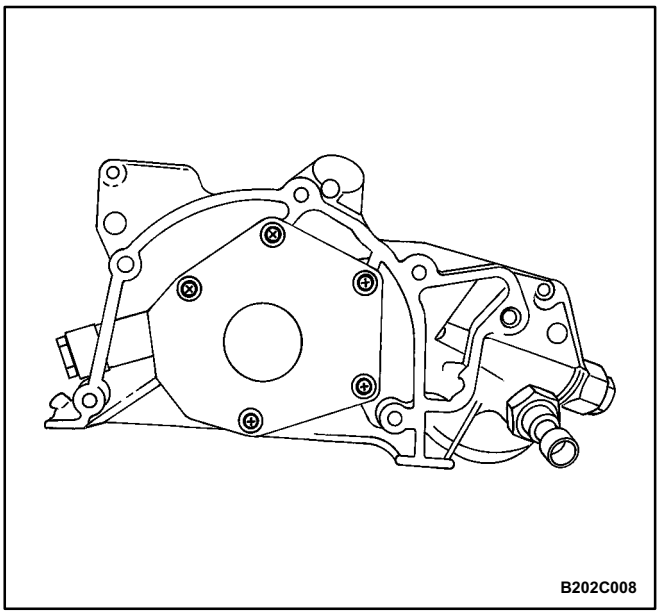

B202C007

Inspection Procedure

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


B202C008

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


B202C008

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

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.

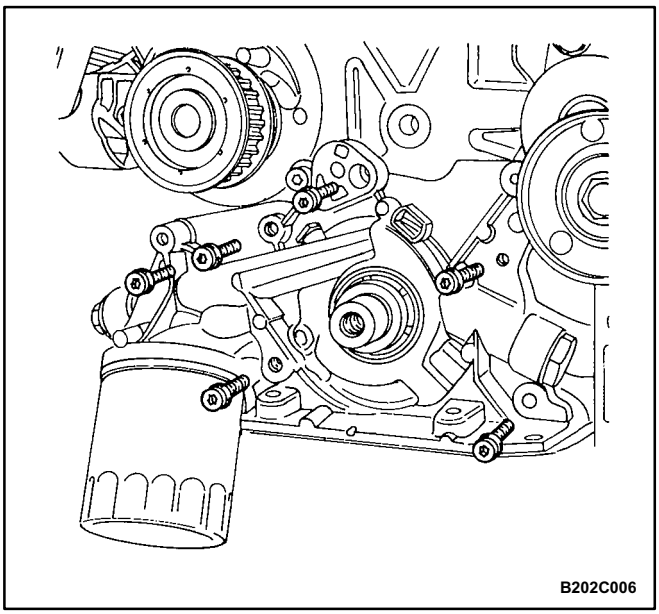
Tighten

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

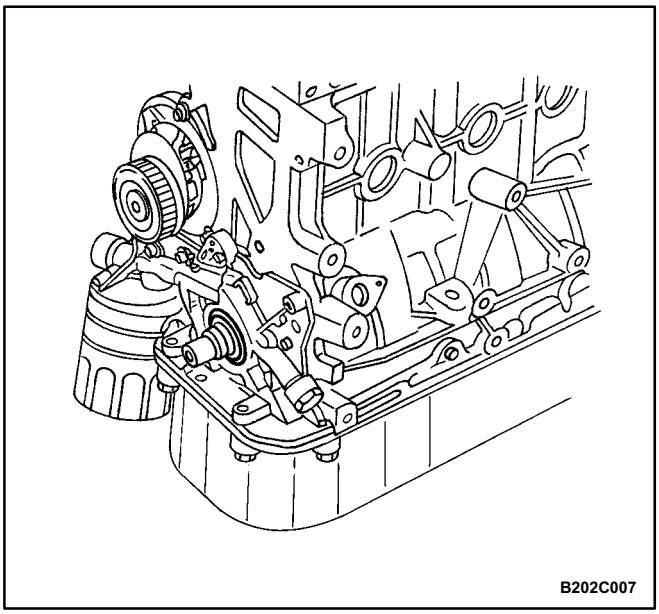

B202C006

Installation Procedure

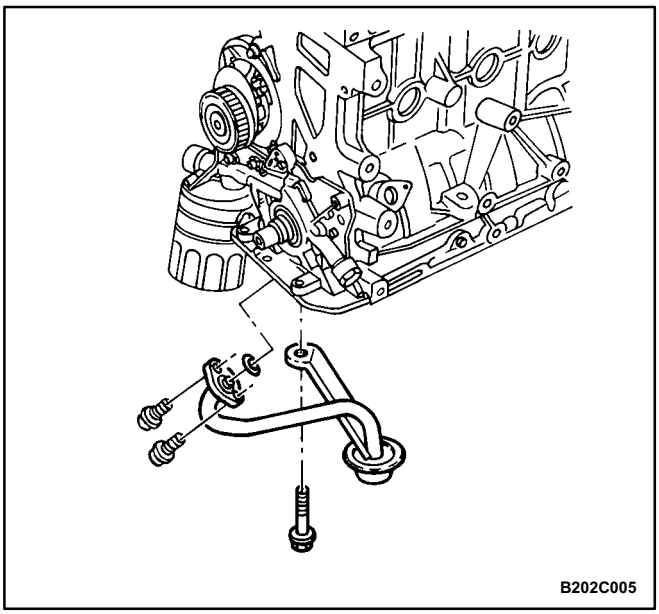
1. Apply Loctite® 242 to the oil pump bolts and RTV sealant to the new oil pump gasket.
2. Install the gasket to the oil pump, and install the oil pump to the engine block with the bolts.

Tighten

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


B202C007

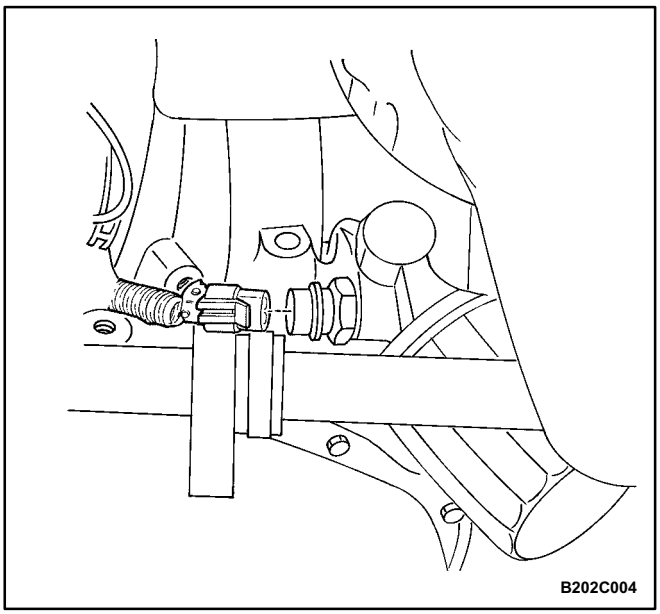
3. Install a new oil pump-to-crankshaft shaft seal. Coat the lip of the seal with a thin coat of grease.


B202C005

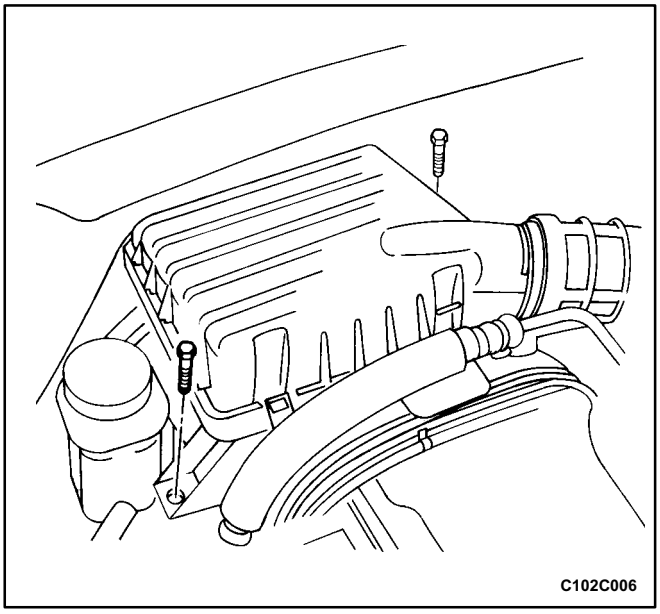
4. Coat the threads of the oil pump pickup tube and support bracket bolts with Loctite® 242.
5. Install the oil pump pickup tube and the bolts.

Tighten

Tighten the oil pump pickup tube bolt to 8 N•m (71 lb•in) and oil pump pickup tube support bracket bolts to 10 N•m (89 lb•in).


B202C004

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.


C102C006

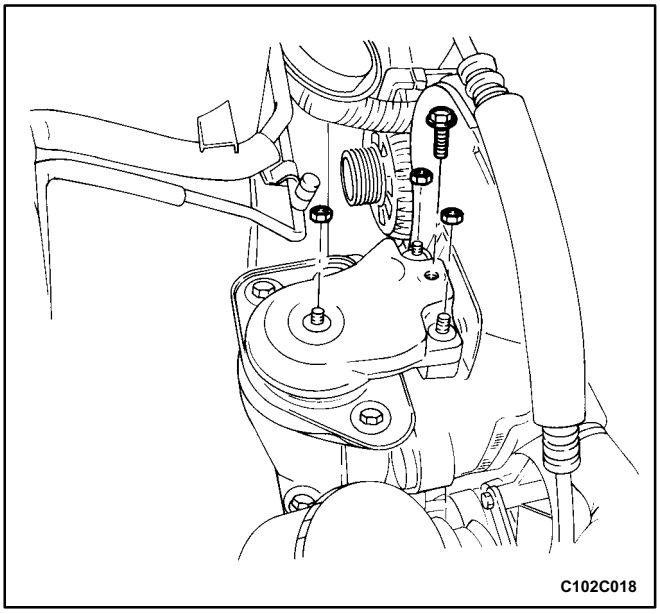
ENGINE MOUNT, RIGHT SIDE

Tools Required

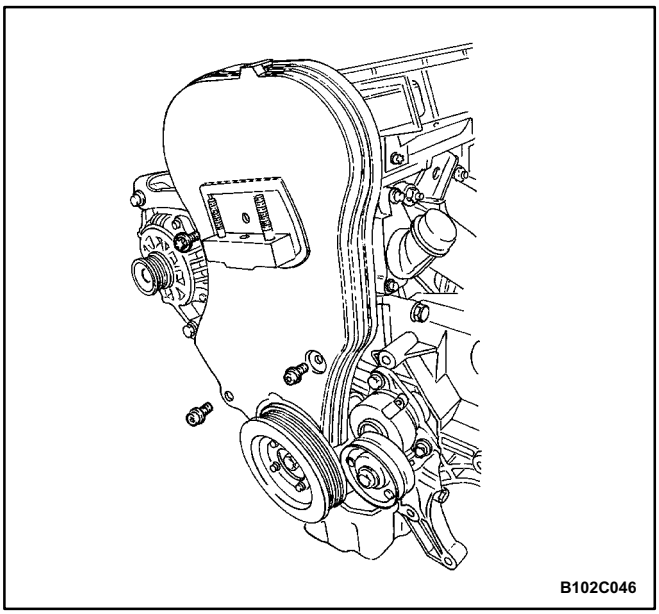
J28467B Engine Assembly Lift Support

Removal Procedure

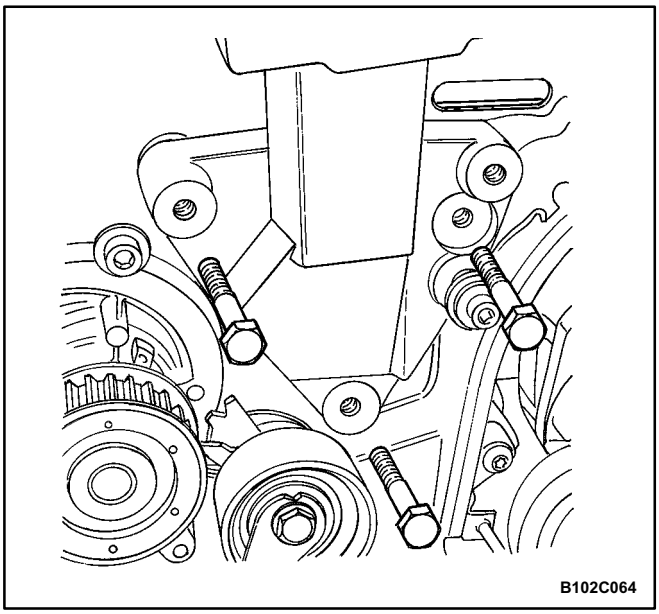
1. Disconnect the negative battery cable.
2. Support the engine assembly using the engine as-sembly lift support J28467B.
3. Remove the right front wheel well splash shield. Refer to *Section 9R, Body Front End.*
4. Remove the air filter housing assembly bolts.
5. Remove the air filter housing assembly.


C102C018

6. Remove the engine mount bracket retaining bolts.
7. Remove the engine mount bracket.
8. Remove the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.


B102C046

9. Remove the front timing belt cover bolts and the front timing belt cover.
10. Align the crankshaft pulley timing mark with the pointer, and the camshaft gears with the timing marks on the rear cover, by turning the crankshaft gear bolt.
11. Loosen the timing belt automatic tensioner bolt.
12. Turn the hex-key tab to relieve belt tension.
13. Remove the timing belt idler pulley nuts.
14. Remove the timing belt idler pulley.
15. Remove the engine mount retaining bolts.
16. Remove the engine mount.

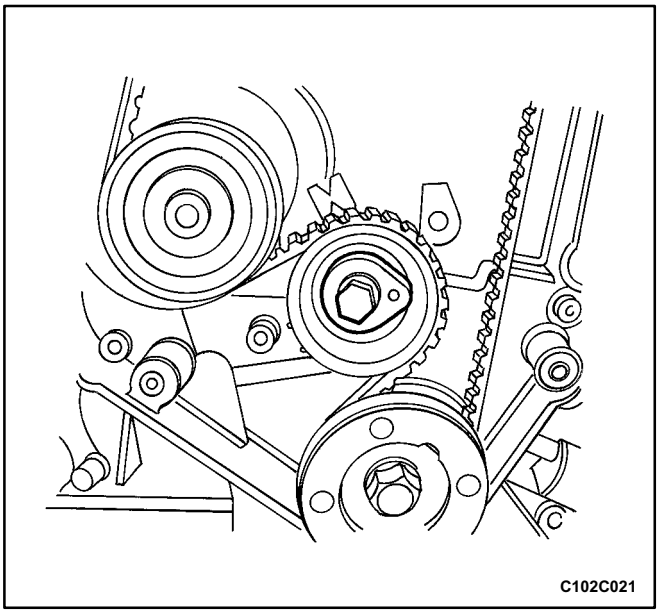

B102C064

Installation Procedure

1. Install the engine mount.
2. Install the engine mount retaining bolts.

Tighten

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


C102C021

3. Install the timing belt idler pulleys.
4. Install the timing belt idler pulley nuts.

Tighten

Tighten the timing belt idler pulley nuts to 25 N•m (18 lb•ft).

5. Tension the timing belt by turning the timing belt auto-matic tensioner hex-key tab counterclockwise until the pointer is aligned to the indicator.

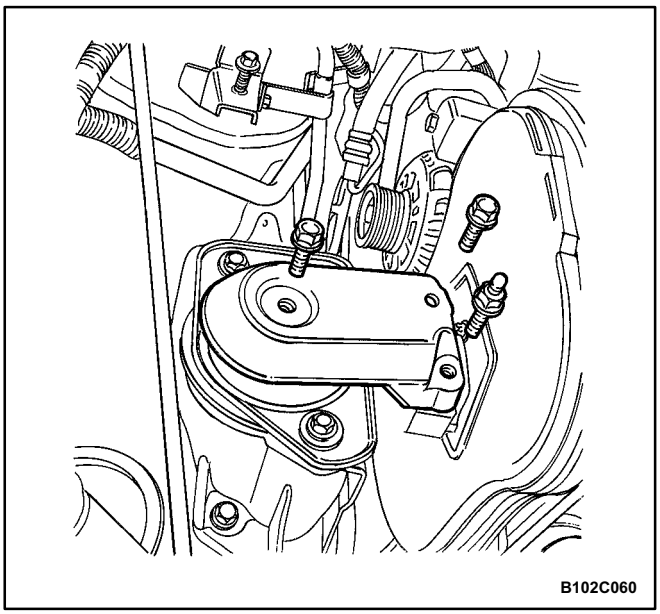
Tighten

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

6. Install the front timing belt cover.
7. Install the front timing belt cover bolts.

Tighten

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


B102C060

8. Install the engine mount bracket and retaining bolts.

Tighten

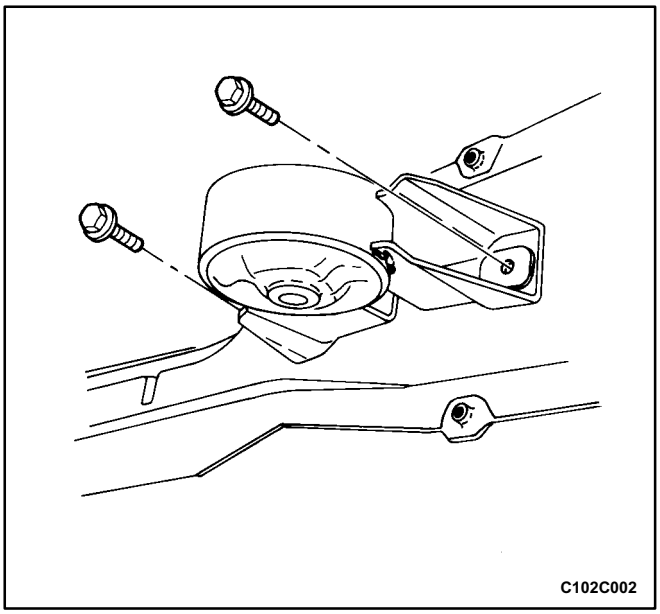
Tighten the engine mount bracket retaining bolts to 60 N•m (44 lb•ft).

9. Remove engine assembly lift support J-28467-B.
10. Install the serpentine accessory drive belt. Refer to *Section 6B, Power Steering Pump*.
11. Install the right front wheel well splash shield. Refer to *Section 9R, Body Front End.*
12. Install the air filter housing assembly with the bolts.

Tighten

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

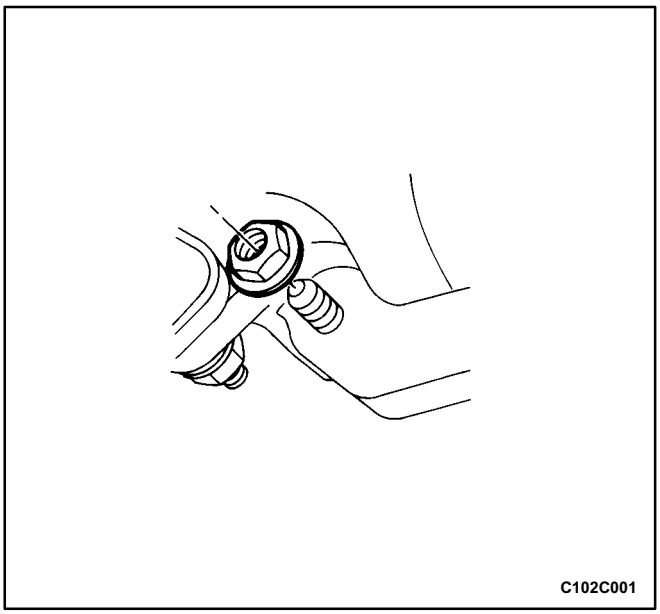
13. Connect the negative battery cable.


C102C002

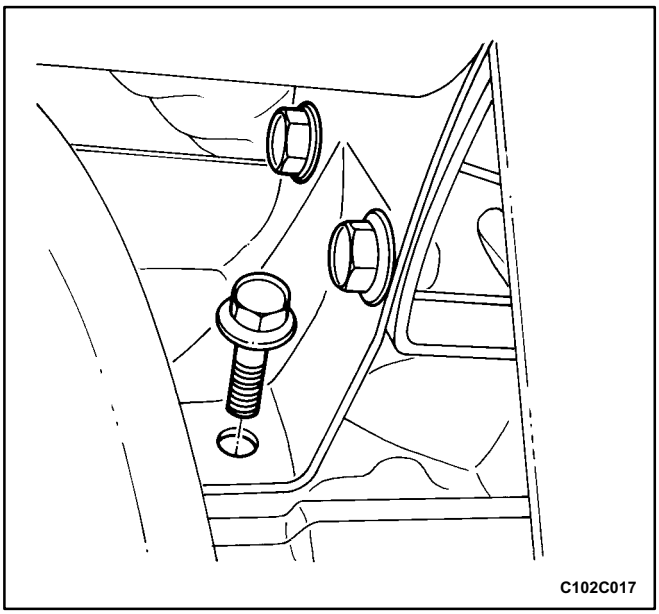
ENGINE MOUNT, FORWARD

Removal Procedure

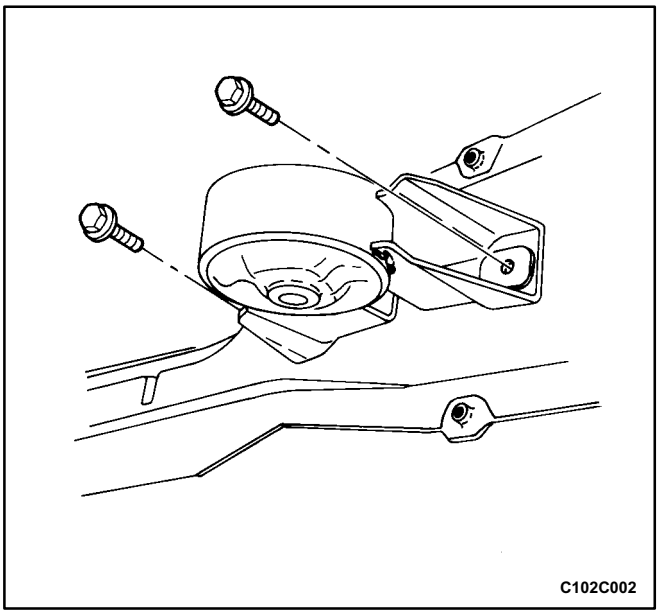
1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Remove the center member. Refer to *Section 9N, Frame and Underbody.*
4. Remove the bolts securing the engine mount to cen-ter member.
5. Remove the engine mount.


C102C001

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



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

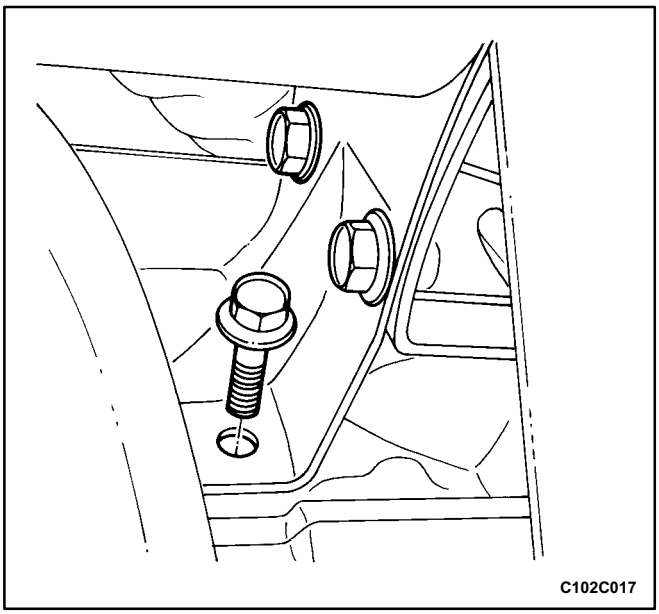


Installation Procedure

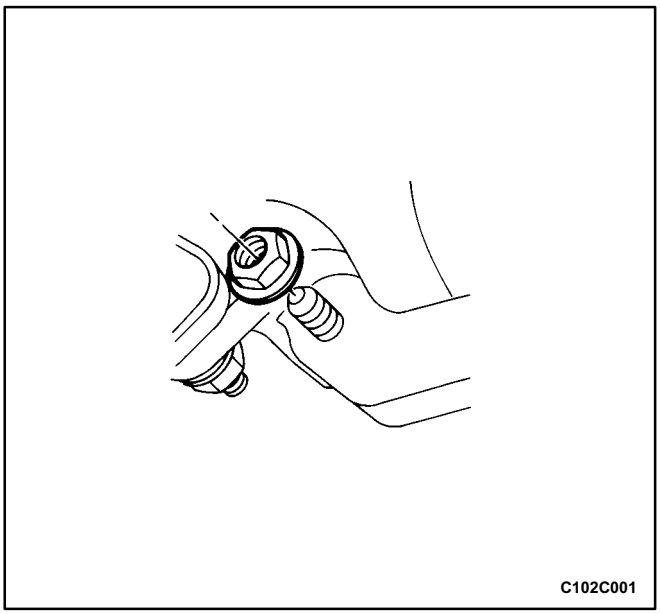
1. Install the engine mount and bolts to the center member.

Tighten

Tighten the engine mount bolts to 60 N•m (44 lb•ft).



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

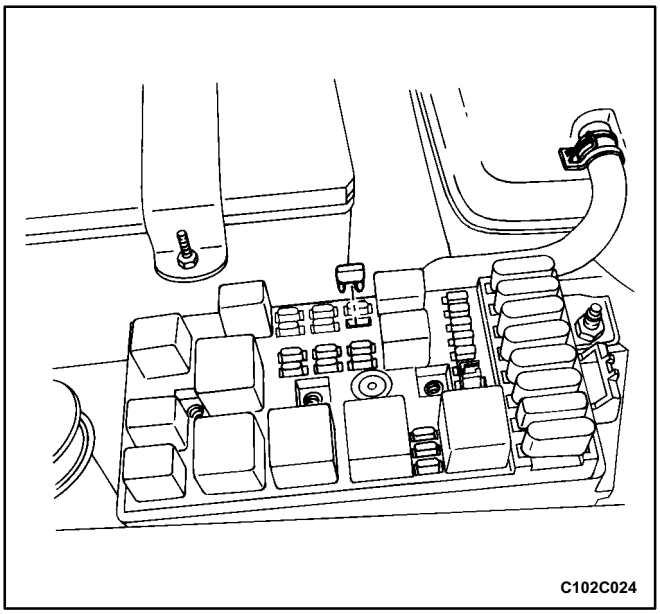

C102C001

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

Tighten

Tighten the engine mount bracket-to-engine block bolts and 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.

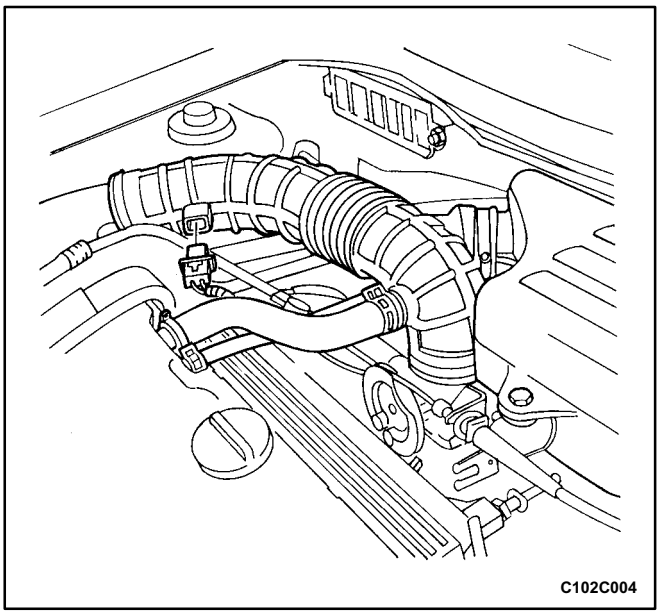

C102C024

INTAKE MANIFOLD

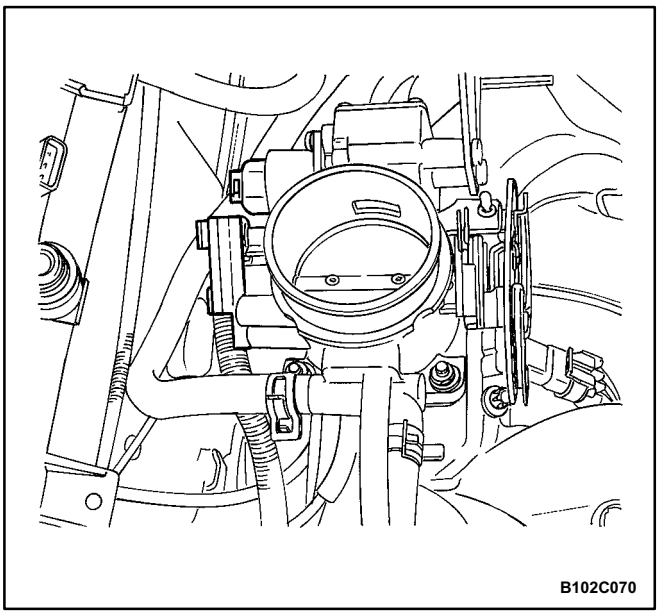
(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal Procedure

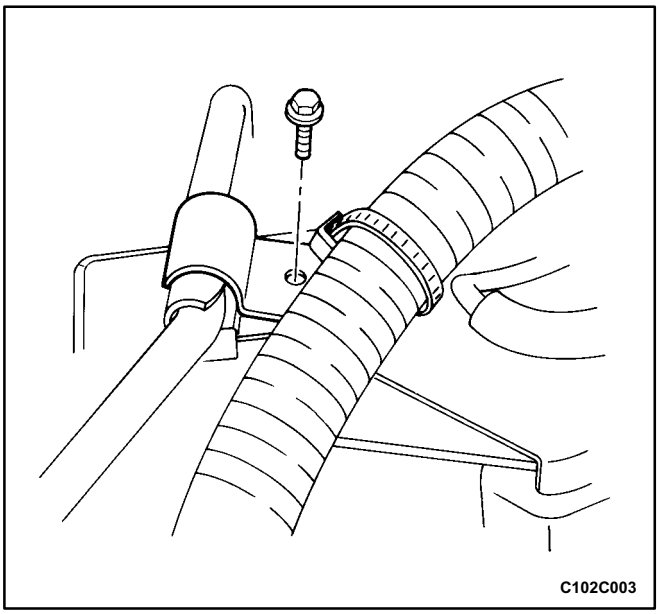
1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine for 10 seconds to rid the fuel system of fuel pressure.
3. Disconnect the negative battery cable.
4. Disconnect the canister purge solenoid from the in-take manifold and loosen the bracket bolt.
5. Drain the engine coolant. Refer to *Section 1D, Engine Cooling.*


C102C004

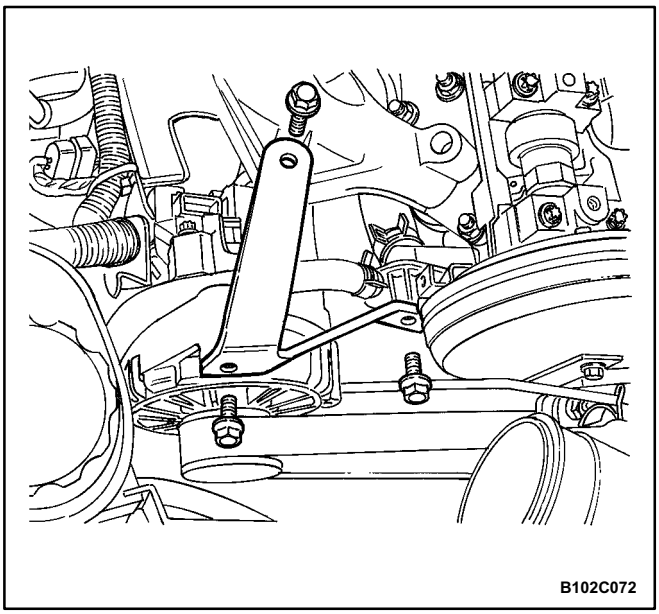
6. Disconnect the manifold air temperature sensor con-nector.
7. Disconnect the air intake tube from the throttle body.


B102C070

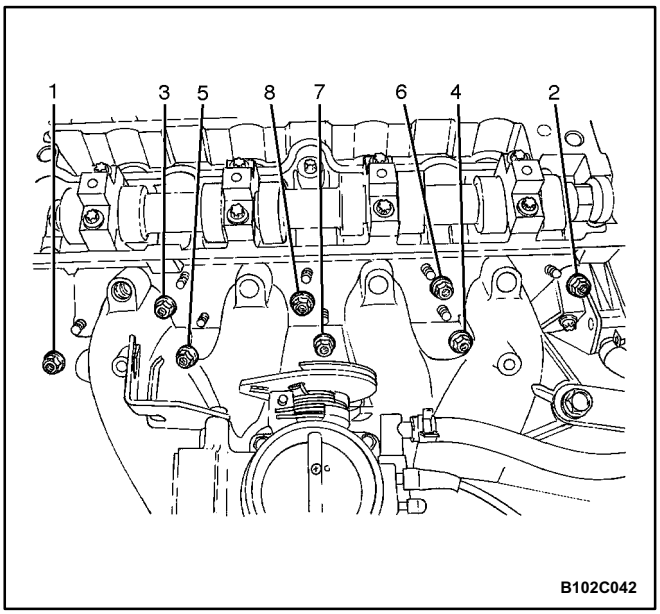
8. Disconnect the idle air control valve connector.
9. Disconnect the throttle position sensor connector.
10. Disconnect the manifold absolute pressure (MAP) sensor connector.
11. Disconnect the coolant hoses at the throttle body.


C102C003

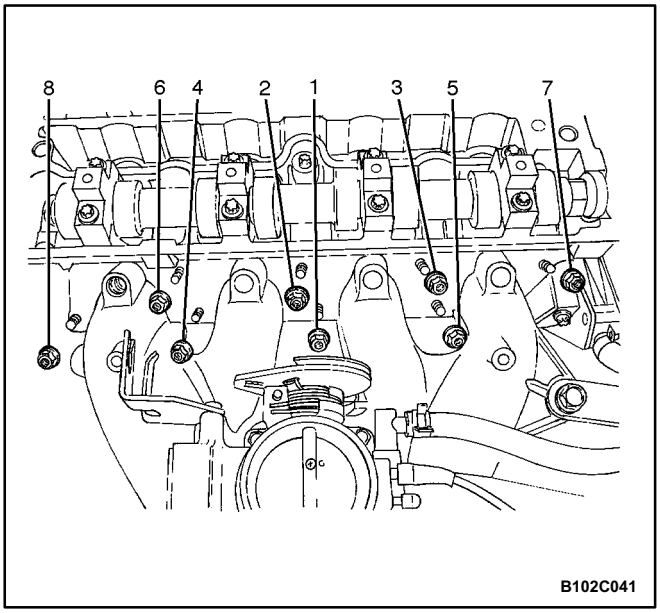
12. Disconnect all of the necessary vacuum hoses, in-cluding the vacuum hose at the fuel pressure regu-lator and the brake booster vacuum hose at the intake manifold.
13. Disconnect the throttle cable from the throttle body and the intake manifold.
14. Remove the throttle cable bracket bolts from the in-take manifold.
15. Remove the throttle cable bracket.
16. Remove the alternator-to-intake manifold strap bracket bolts and strap.
17. Remove the power steering hose clamp bolt, and position the hose clear of the repair area.


B102C072

18. Remove the fuel rail and injector cover as an as-sembly. Refer to *Section 1F, Engine Controls (2.0L DOHC).*
19. Remove the alternator-to-intake manifold support bracket bolts.
20. Remove the alternator-to-intake manifold support bracket.
21. Remove the intake manifold support bracket bolt at the engine block and the intake manifold.
22. Remove the intake manifold support bracket.



23. Remove the intake manifold retaining bolt and nuts in the sequence shown.
24. Remove the intake manifold.
25. Remove the intake manifold gasket.
26. 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 bolt and nuts in the sequence shown.

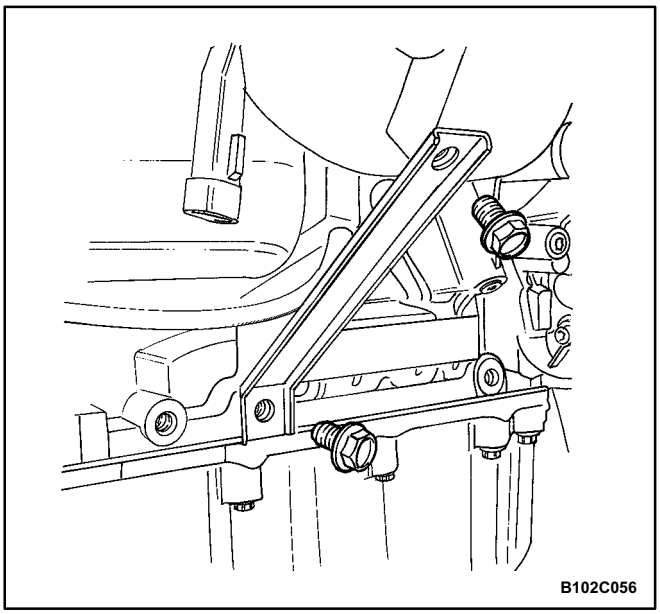
Tighten

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

4. Install the alternator-to-intake manifold strap bracket and bolts.

Tighten

Tighten the alternator-to-intake manifold strap bracket bolts to 20 N•m (15 lb•ft).



5. Install the intake manifold support bracket.
6. Install the intake manifold support bracket upper bolts to the intake manifold.

Tighten

Tighten the intake manifold support bracket upper bolts to the intake manifold to 20 N•m (15 lb•ft).

7. Install the intake manifold support bracket lower bolt to the engine block.

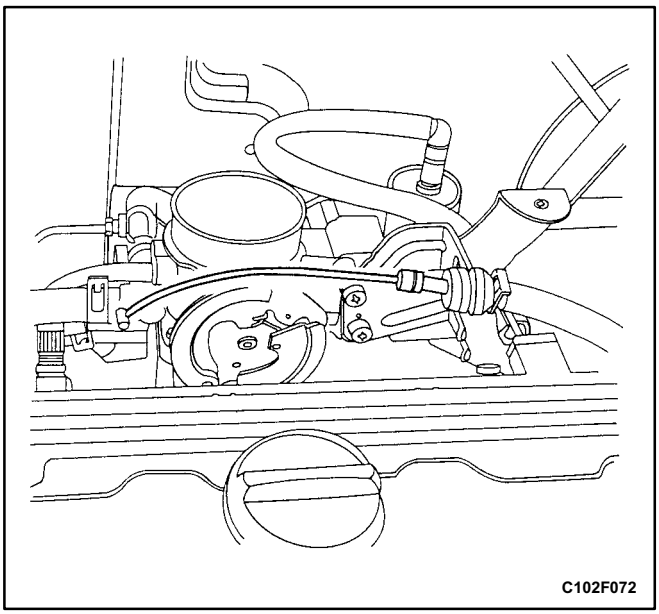
Tighten

Tighten the intake manifold support bracket lower bolt to the engine block to 20 N•m (15 lb•ft).

8. Install the alternator-to-intake manifold support bracket and bolts.

Tighten

Tighten the alternator-to-intake manifold support bracket bolts to 35 N•m (26 lb•ft).

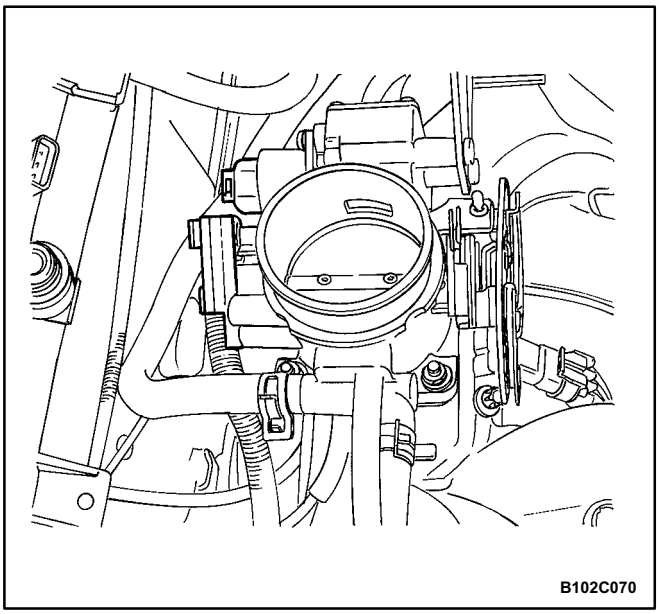

C102F072

9. Install the fuel rail and injector cover as an assembly. Refer to *Section 1F, Engine Controls (2.0L DOHC).*
10. Install the throttle cable bracket.
11. Install the throttle cable bracket bolts.

Tighten

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

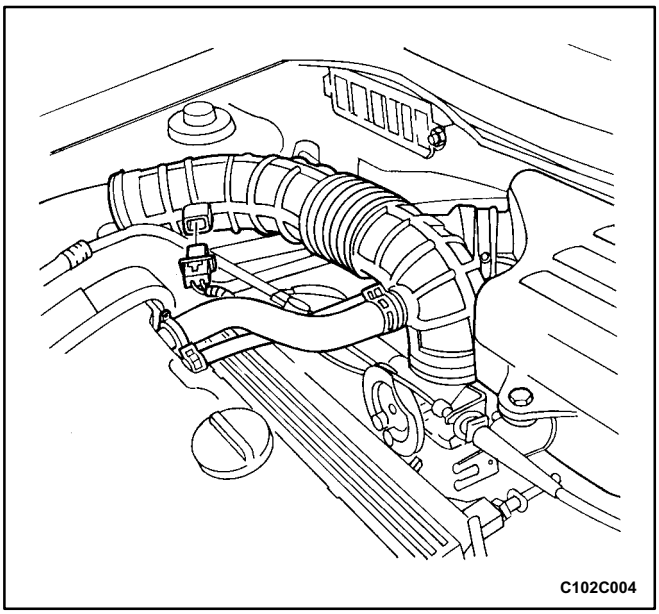
12. Connect the throttle cable to the intake manifold and the throttle body.
13. Connect all of the necessary vacuum lines that were previously disconnected.


B102C070

14. Connect the MAP sensor connector.
15. Connect the coolant hoses to the throttle body.
16. Connect the idle air control valve connector.
17. Connect the throttle position sensor connector.
18. Position the power steering hose in place and install the clamp bolt.

Tighten

Tighten the power steering hose clamp bolt to 8 N•m (71 lb•in).

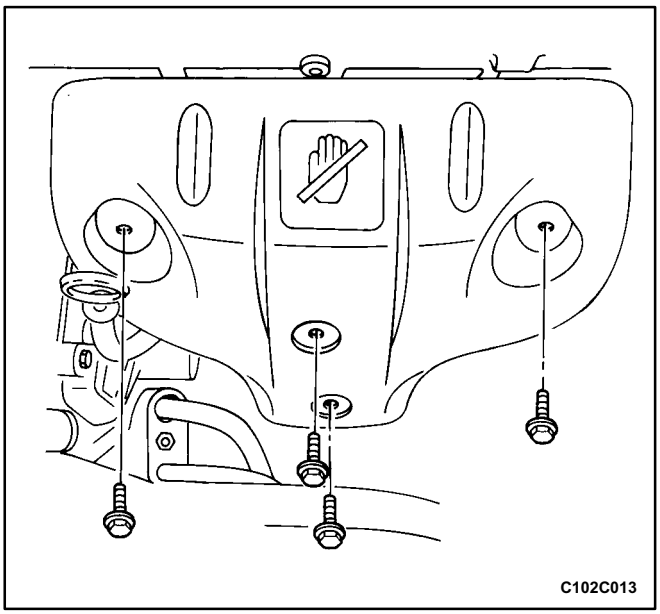

C102C004

19. Connect the air intake tube to the throttle body.
20. Connect the manifold air temperature sensor con-nector.
21. Connect the canister purge solenoid at the intake manifold and tighten the bracket bolt.

Tighten

Tighten the canister purge solenoid bracket bolt to 5 N•m (44 lb•in).

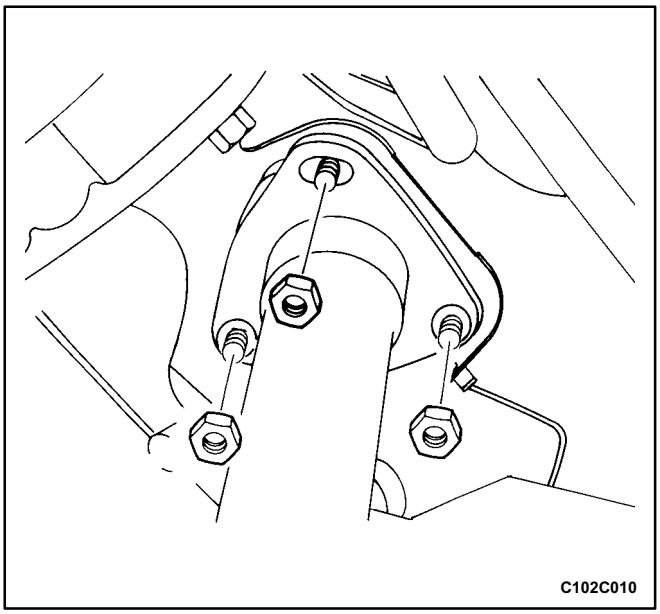
22. Install the fuel pump fuse.
23. Connect the negative battery cable.
24. Refill the engine cooling system. Refer to *Section 1D, Engine Cooling.*



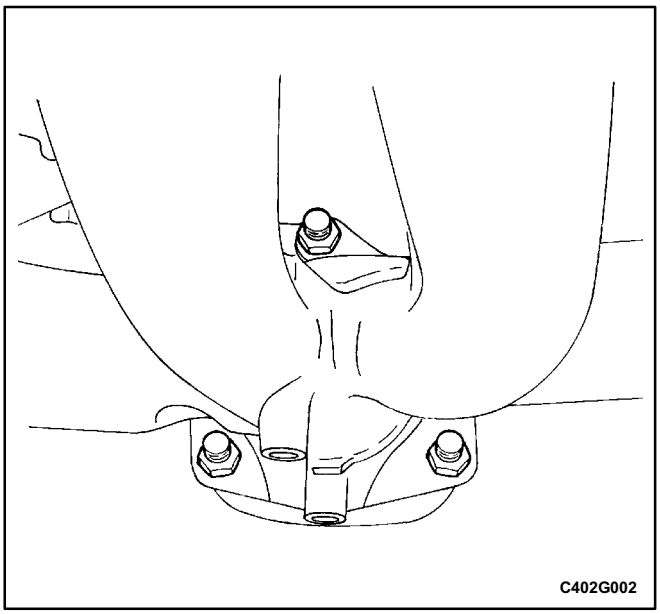
EXHAUST MANIFOLD

Removal Procedure

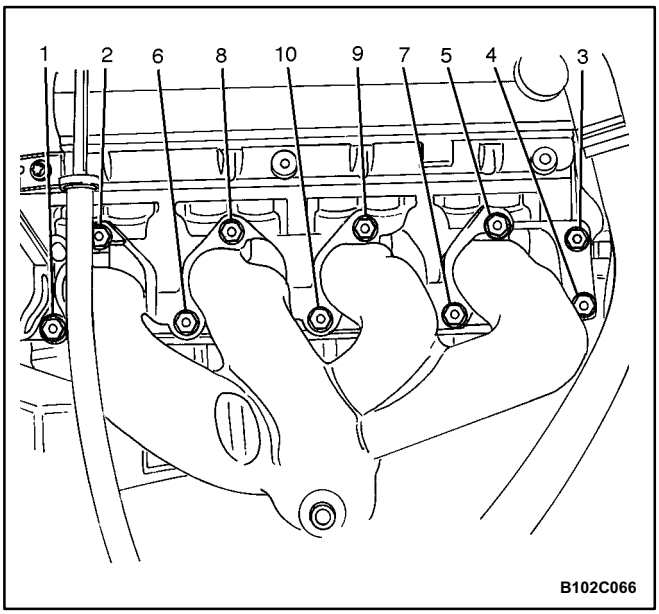
1. Disconnect the negative battery cable.
2. Disconnect the oxygen sensor connector.
3. Remove the exhaust manifold heat shield bolts.
4. Remove the exhaust manifold heat shield.



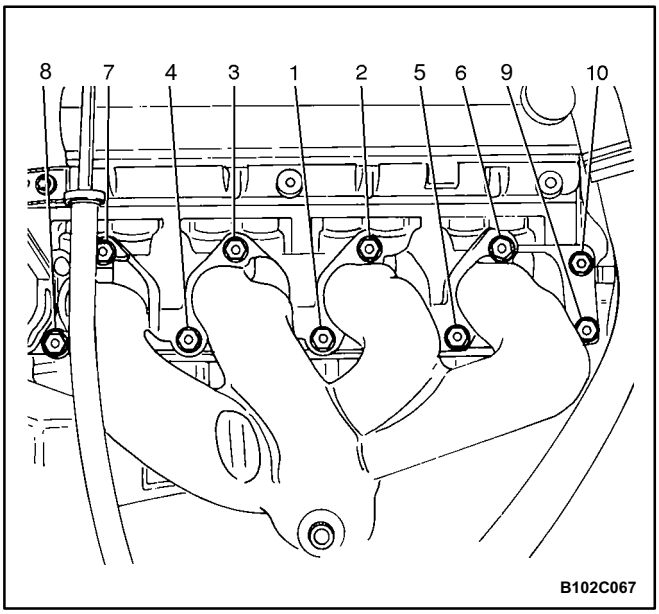
5. Remove the exhaust flex pipe retaining nuts from the exhaust manifold studs (2.0L DOHC).



6. Remove the auxiliary catalytic converter upper flange nuts (2.2L DOHC).



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

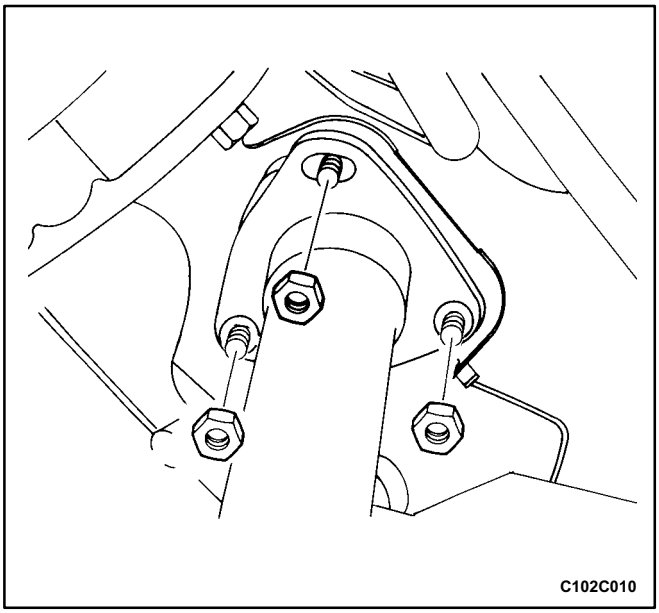


Installation Procedure

1. Install the exhaust manifold gasket.
2. Install the exhaust manifold.
3. Install the exhaust manifold retaining nuts and tighten in the sequence shown your complete passes and tighten 1.2 and 3 bolts one more time.

Tighten

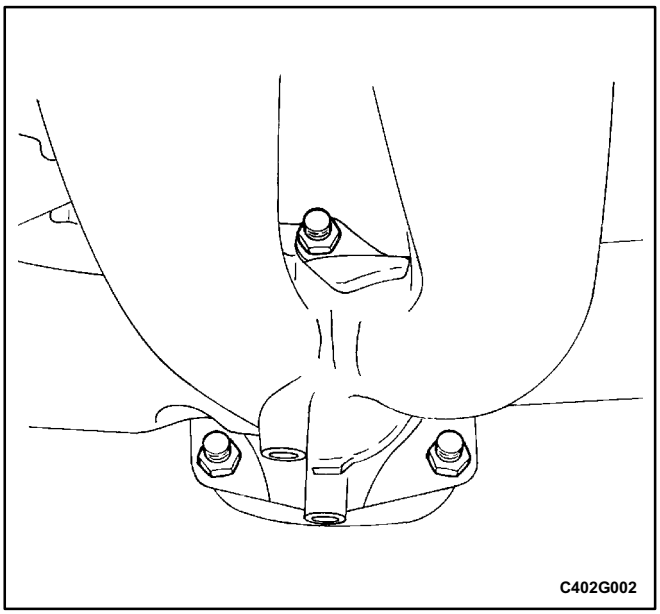
Tighten the exhaust manifold retaining nuts 15 N•m (11 lb•ft).



4. Install the exhaust flex pipe retaining nuts to the ex-haust manifold (2.0L DOHC).

Tighten

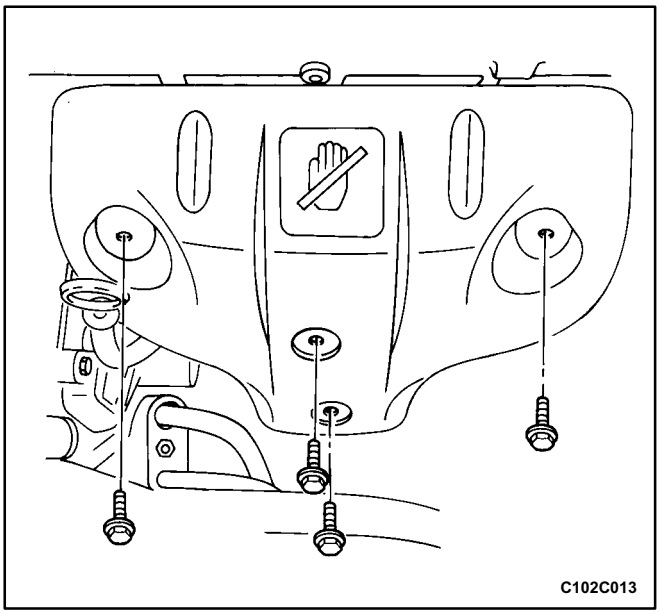
Tighten the exhaust flex pipe-to-exhaust manifold retaining nuts to 22 N•m (16 lb•ft).


C402G002

5. Install the auxiliary catalytic converter upper flange nuts (2.2L DOHC).

Tighten

Tighten the auxiliary catalytic converter-to-exhaust manifold nuts to 40 N•m (30 lb•ft).

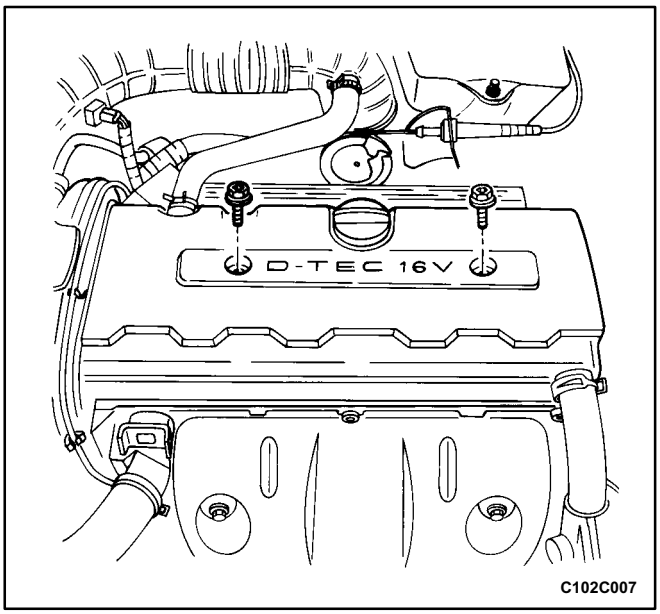

C102C013

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

Tighten

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

8. Connect the oxygen sensor connector.
9. Connect the negative battery.

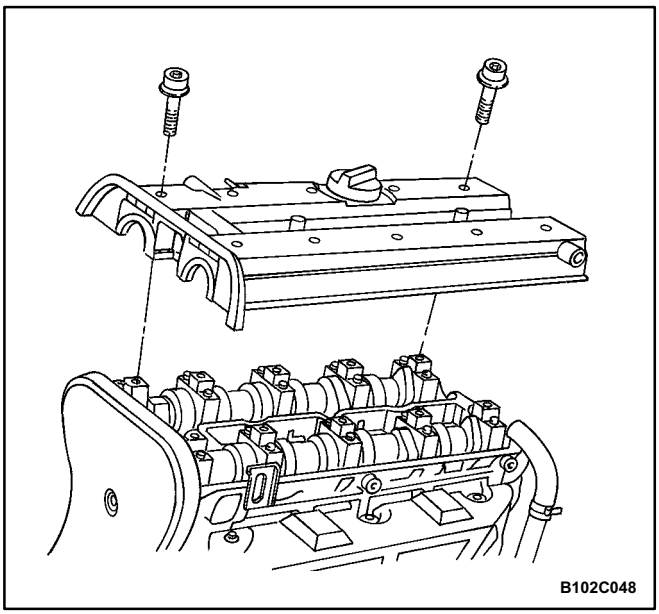


C102C007

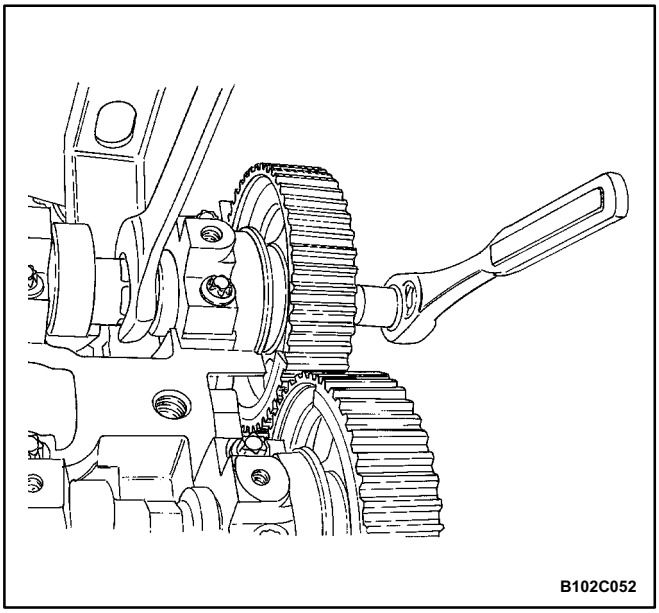
CAMSHAFT GEARS

Removal Procedure

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

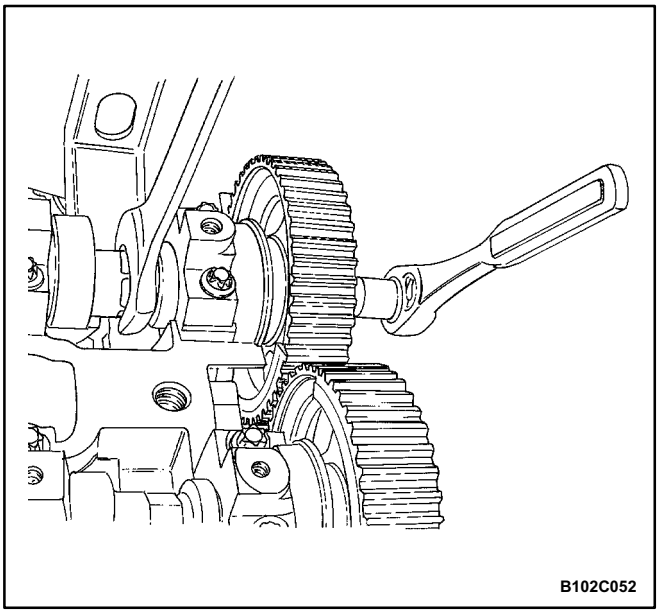


7. Remove the valve cover bolts.
8. Remove the valve cover washers.
9. Remove the valve cover and the valve cover gasket.



Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

10. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
11. Remove the intake camshaft gear.
12. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
13. Remove the exhaust camshaft gear.



Installation Procedure

Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

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

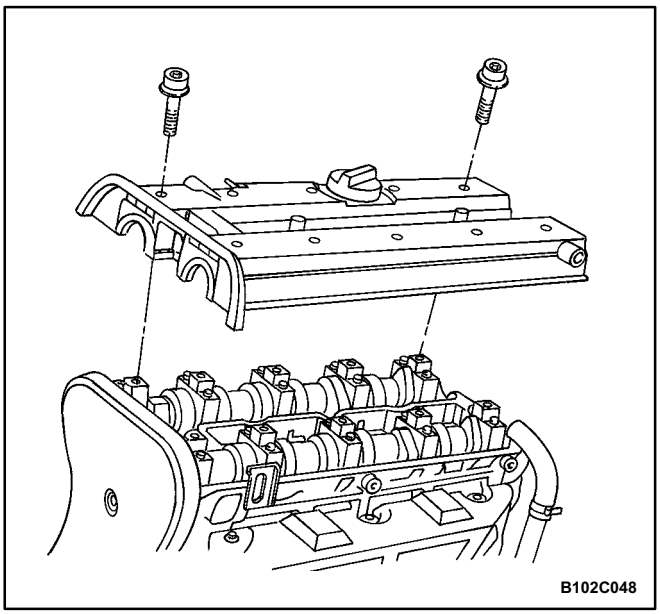
Tighten

Tighten the intake camshaft gear bolt to 50 N•m (37 lb•ft), turn another 60 degrees plus 15 degrees.

3. Install the exhaust camshaft gear.
4. While holding the exhaust camshaft firmly in place, install the exhaust camshaft gear bolt.

Tighten

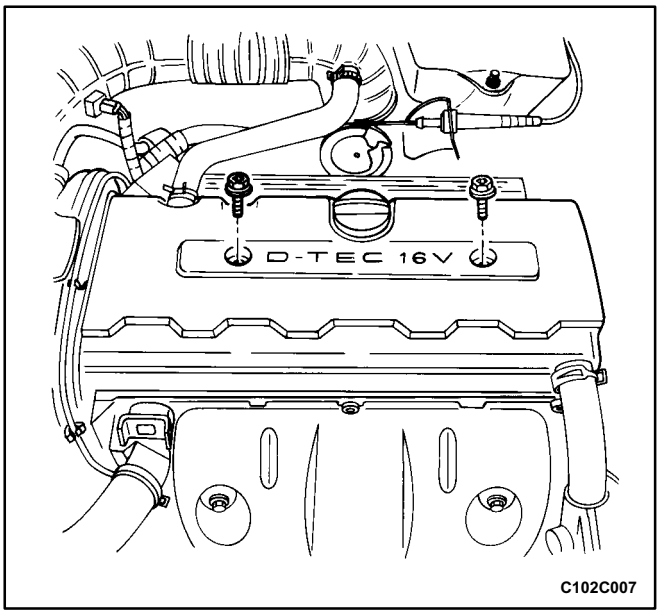
Tighten the exhaust camshaft gear bolt to 50 N•m (37 lb•ft), turn another 60 degrees plus 15 degrees using the angular torque gauge KM-470-B.


B102C048

5. Apply a small amount of gasket sealant to the cor-ners of the front camshaft caps and to the top of the rear valve cover-to-cylinder head seal.
6. Install the valve cover and the valve cover gasket.
7. Install the valve cover washers.
8. Install the valve cover bolts.

Tighten

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



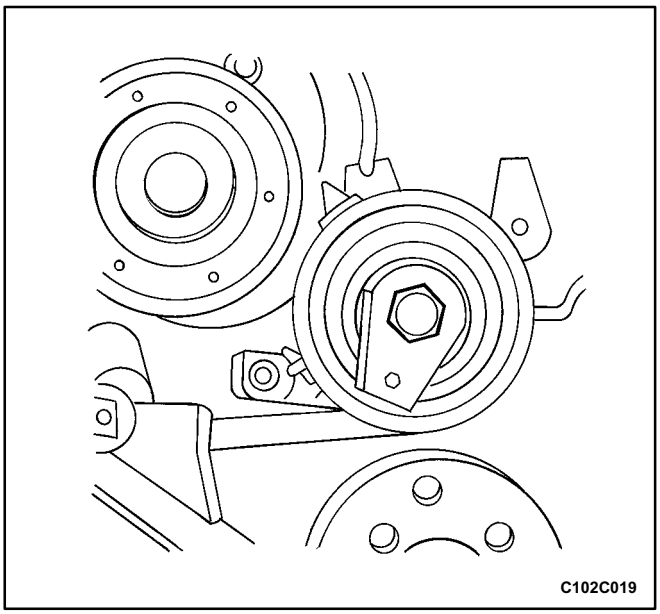
C102C007

9. Connect the crankcase breather tubes to the valve cover.
10. Connect the ignition wires to the spark plugs.
11. Install the spark plug cover.
12. Install the spark plug cover bolts.

Tighten

Tighten the spark plug cover bolts to 3 N•m (27 lb•in).

13. Install the timing belt. Refer to "Timing Belt" in this section.
14. Connect the negative battery cable.


C102C019

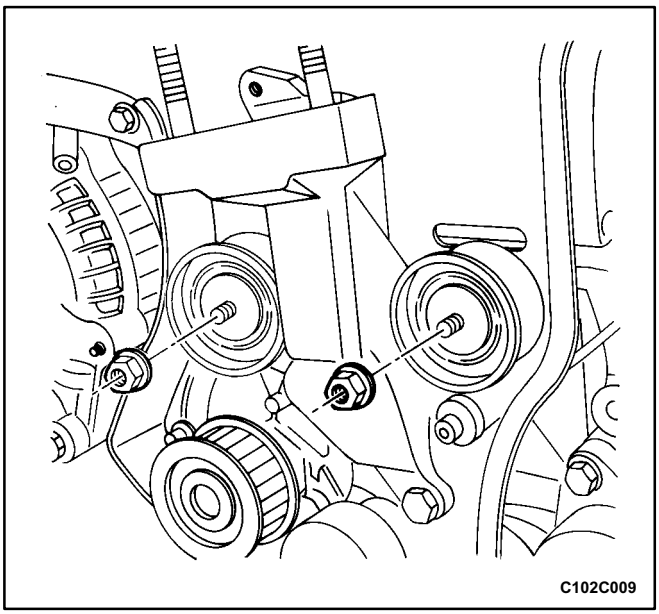
REAR TIMING BELT COVER

Tools Required

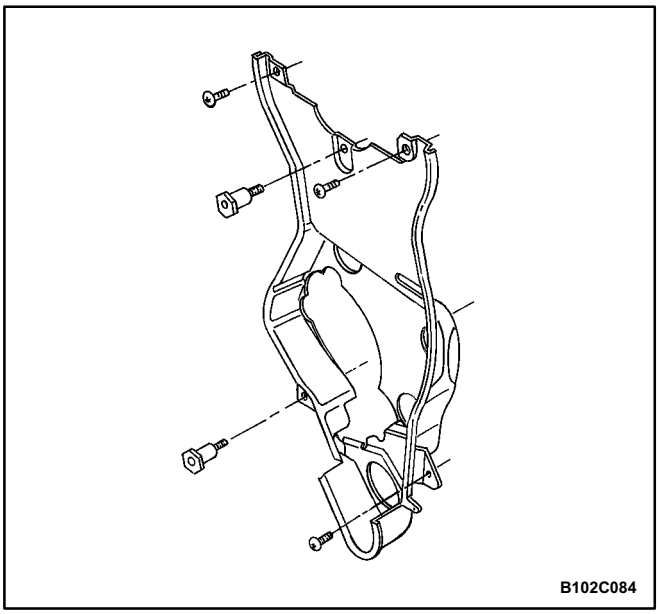
KM-470-B Torque Angular Gauge

Removal Procedure

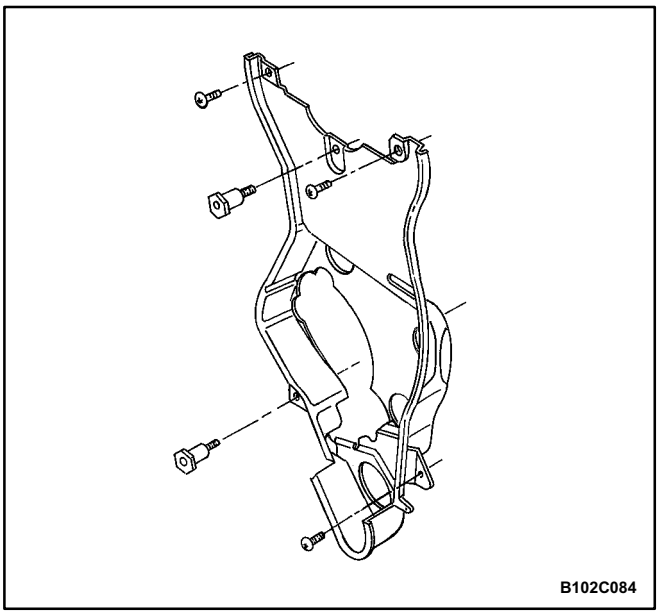
1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to "Timing Belt" in this section.
3. Remove the camshaft gears. Refer to "Camshaft Gears" in this section.
4. Remove the timing belt automatic tensioner bolt.
5. Remove the timing belt automatic tensioner.


C102C009

6. Remove the timing belt idler pulley nuts.
7. Remove the timing belt idler pulleys.
8. Remove the engine mount retaining bolts.
9. Remove the engine mount.
10. Remove the crankshaft timing belt drive gear bolt.
11. Remove the crankshaft gear.


B102C084

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


B102C084

Installation Procedure

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

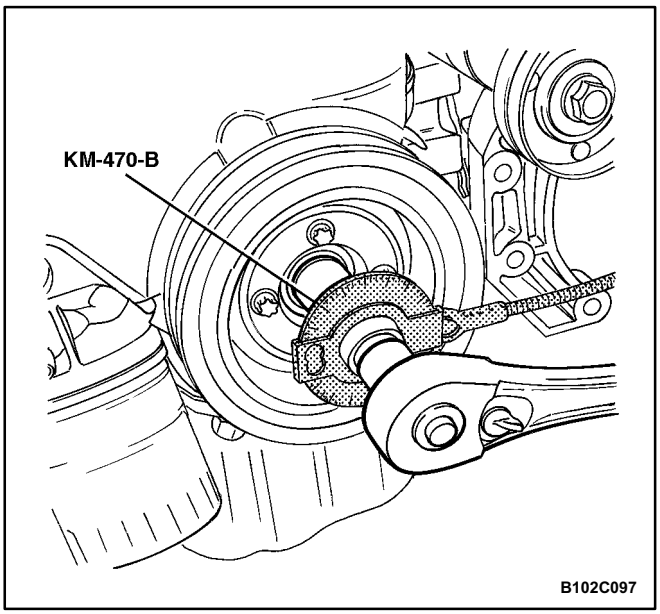
Tighten

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

3. Install the engine mount and retaining bolts.

Tighten

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



4. Install the timing belt idler pulleys.
5. Install the timing belt idler pulley nuts.

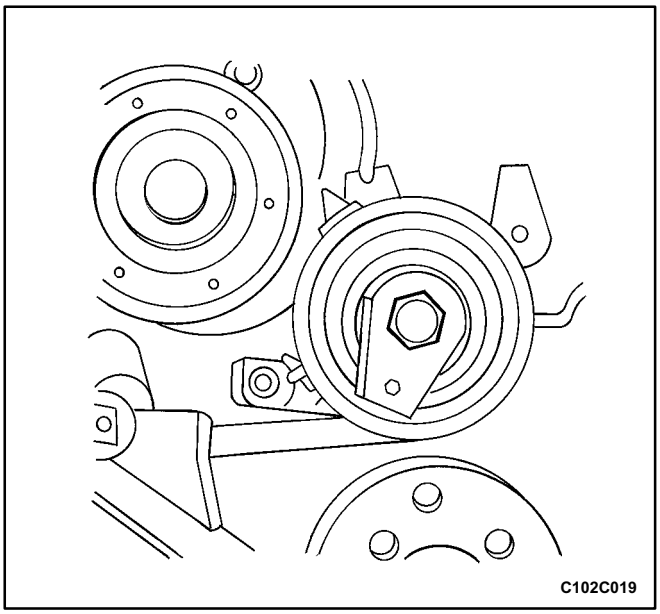
Tighten

Tighten the timing belt idler pulley nuts to 25 N•m (18 lb•ft).

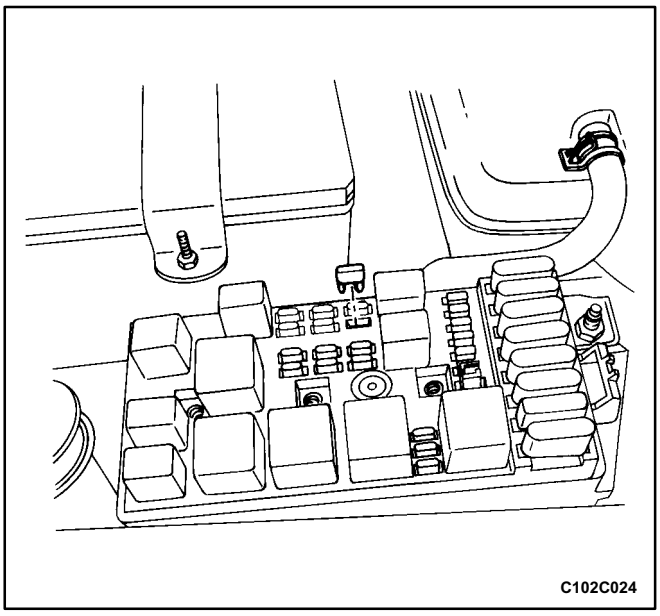
6. Install the crankshaft timing belt drive gear and bolt.

Tighten

Tighten the crankshaft timing belt drive gear bolt to 130 N•m (96 lb•ft) plus 40° plus 50° using the an-gular torque gauge KM-470-B.



7. Install the timing belt automatic tensioner and bolt.
8. Install the camshaft gears. Refer to "Camshaft Gears" in this section.
9. Install the timing belt and timing belt cover. Refer to "Timing Belt" in this section.
10. Connect the negative battery cable.

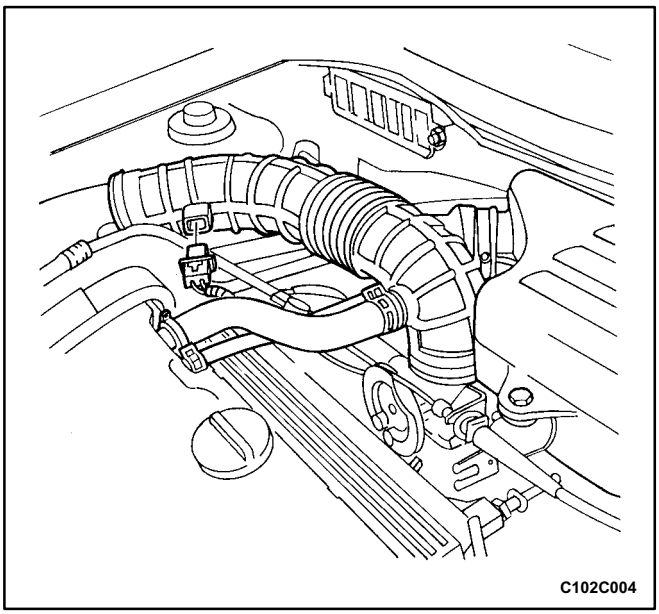


ENGINE

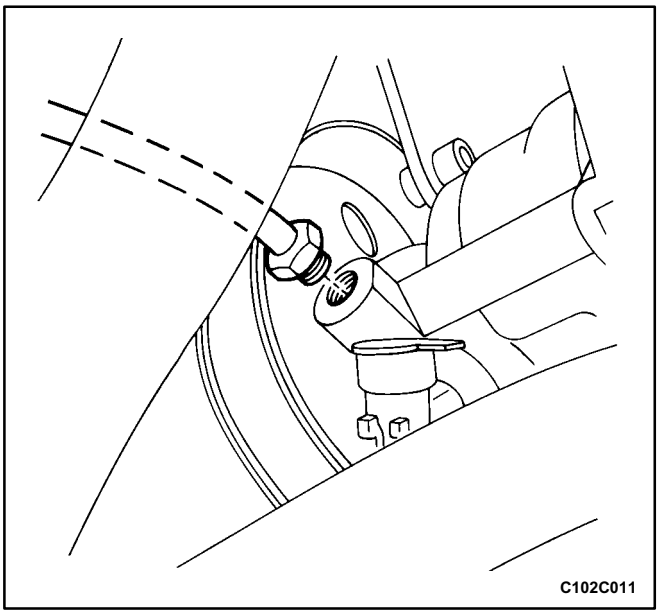
(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal Procedure

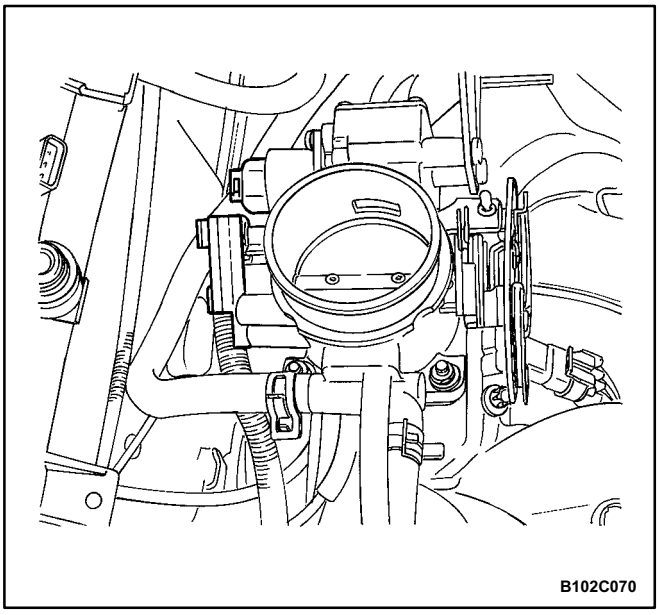
1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine for 10 seconds to rid the fuel system of fuel pressure.
3. Remove the hood. Refer to *Section 9R, Body Front End*.
4. Drain the engine oil.
5. Disconnect the negative battery cable.


C102C004

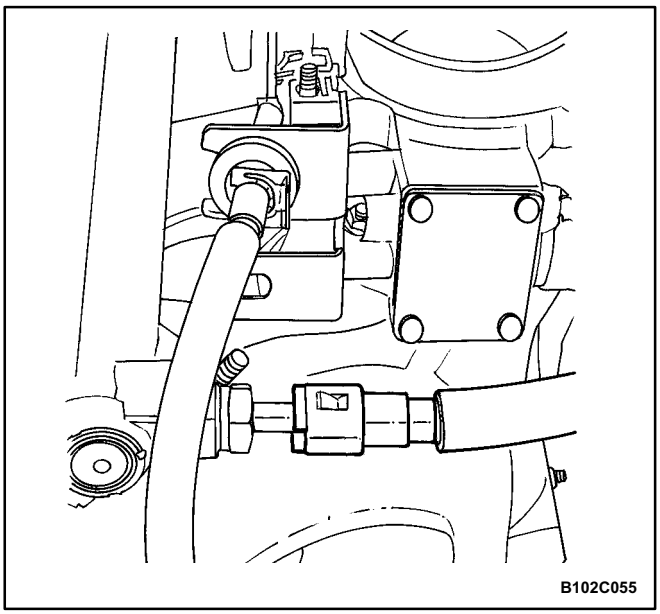
6. Discharge the air conditioning system, if equipped. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System.*
7. Disconnect the manifold air temperature sensor connector.
8. Remove the air intake tube.
9. Disconnect the breather tubes from the valve cover.
10. Remove 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.*


C102C011

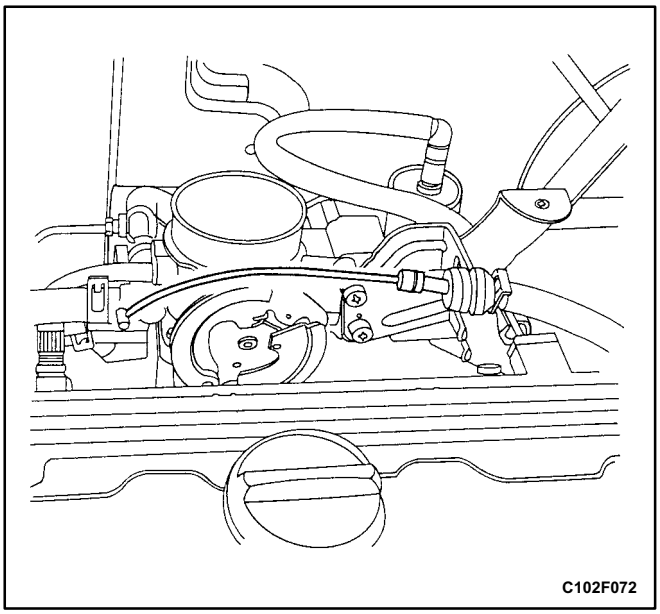
13. Drain the engine coolant. Refer to *Section 1D, En-gine Cooling.*
14. Remove the cooling system radiator and the engine cooling fans. Refer to *Section 1D, Engine Cooling.*
15. Disconnect the upper radiator hose from the ther-mostat housing.
16. Disconnect the power steering return hose from the power steering pump. Collect the oil in a suitable container.
17. Disconnect the power steering pressure hose from the power steering pump. Collect the oil in a suitable container.
18. Disconnect the electrical connector at the DIS igni-tion coil and the ECM ground terminal.


B102C070

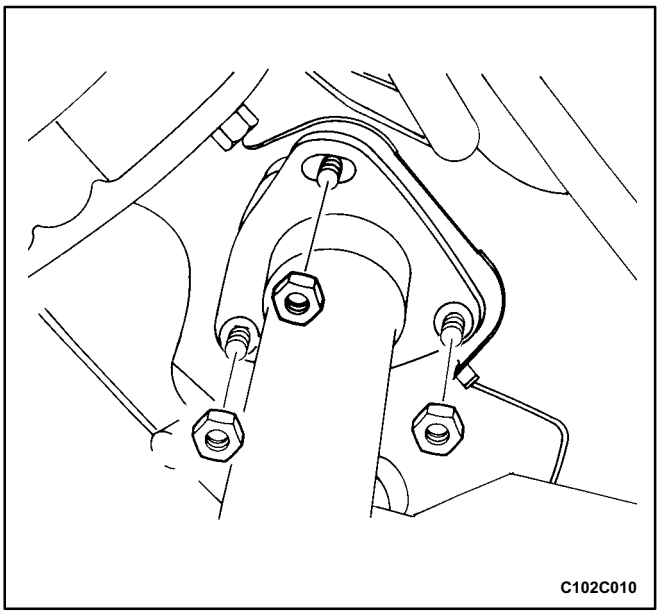
19. Disconnect the oxygen sensor connector.
20. Disconnect the idle air control (IAC) valve connector and the mainfold absolute pressure (MAP) sensor connector.
21. Disconnect the throttle position sensor (TPS) con-nector.
22. Disconnect the engine coolant temperature (ECT) sensor connector.
23. Disconnect the coolant temperature sensor (CTS) connector.
24. Disconnect the alternator voltage regulator con-nector and power lead.
25. Disconnect the camshaft position (CMP) sensor connector.


B102C055

26. Disconnect all of the necessary vacuum lines in-cluding the brake booster vacuum hose.
27. Disconnect the fuel return line at the fuel pressure regulator.
28. Disconnect the fuel feed line at the fuel rail.
29. Remove the fuel rail and injector channel cover as an assembly. Refer to *Section 1F, Engine Controls (2.0L DOHC)*.

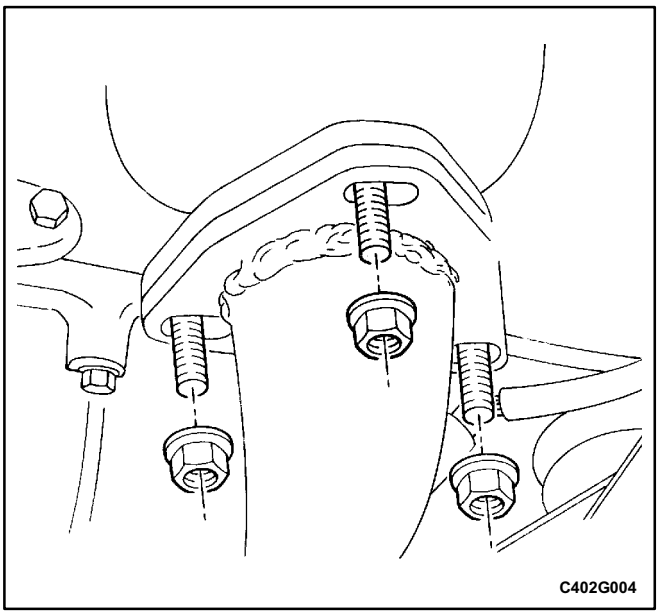

C102F072

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


C102C010

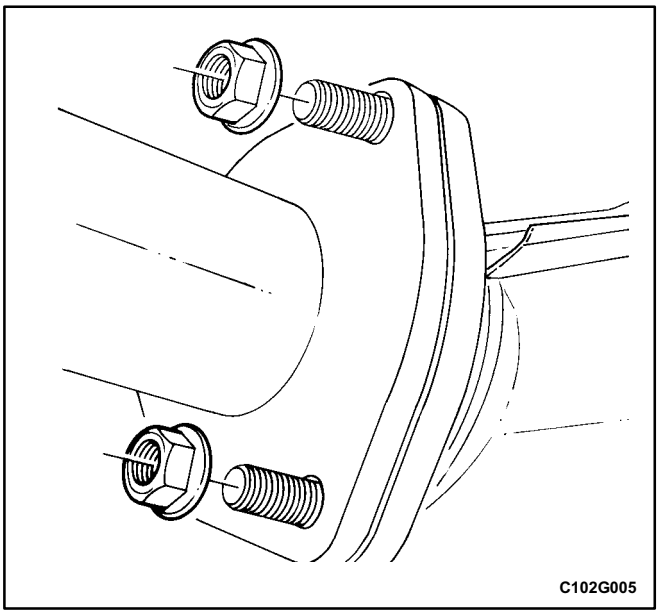
(2.0L DOHC)

38. Remove the exhaust flex pipe retaining nuts from the exhaust manifold studs and the support bracket.
39. Remove the exhaust flex pipe retaining nuts from the catalytic converter.
40. Remove the exhaust flex pipe.

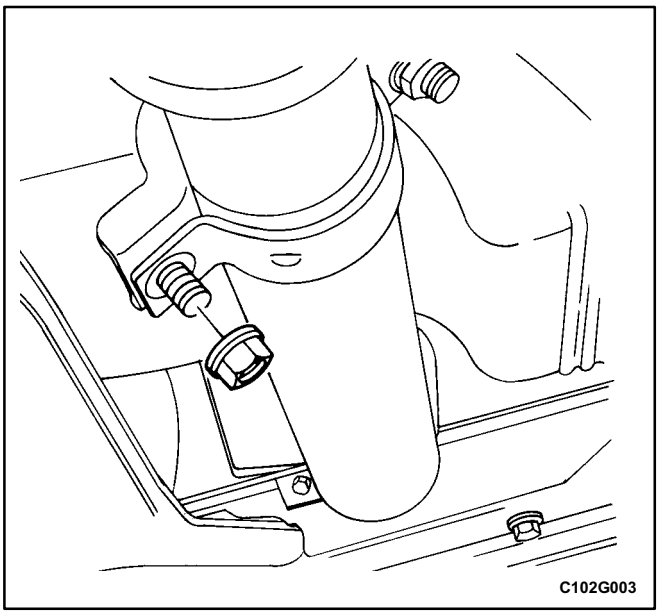


(2.2L DOHC)

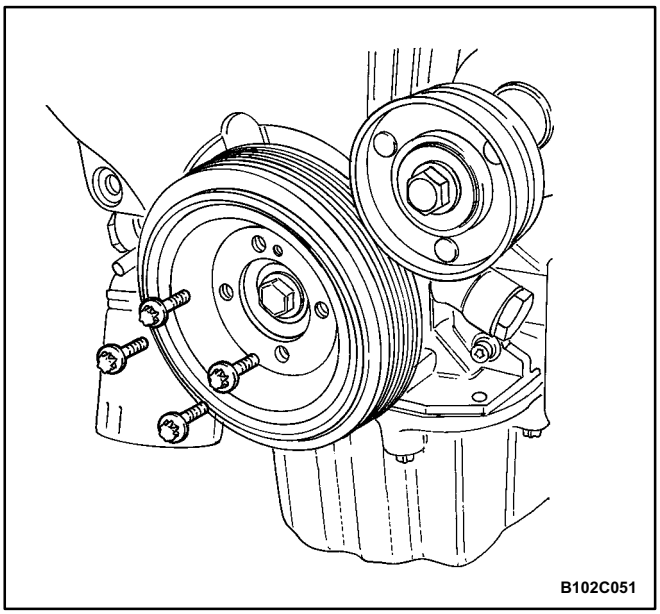
41. Remove the auxiliary catalytic converter lower flange nuts.



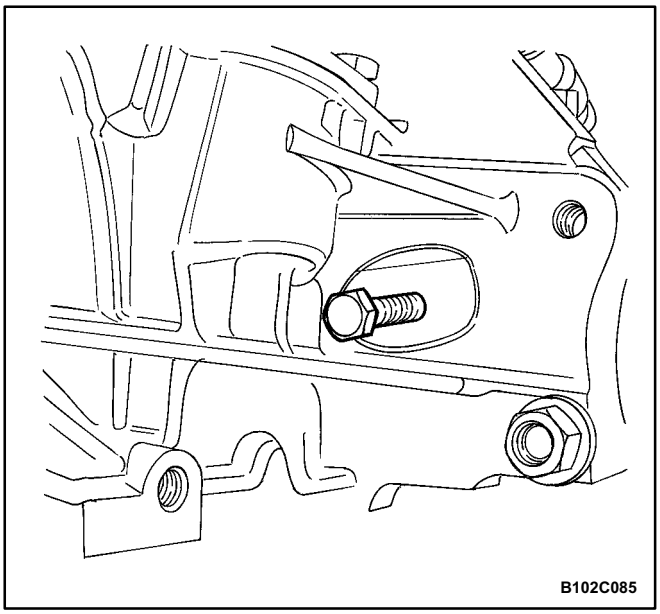
42. Remove the nuts that secure the front muffler pipe to the main catalytic converter.
43. Remove the rubber hangers that attach the con-necting pipe to the vehicle.



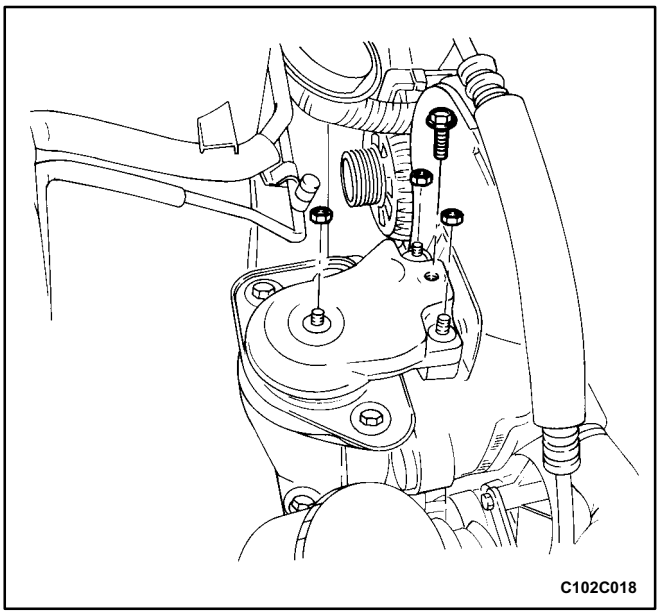
44. Remove the connecting pipe mounting bracket nuts and the bracket.
45. Remove the main catalytic converter and the con-necting pipe.


B102C051

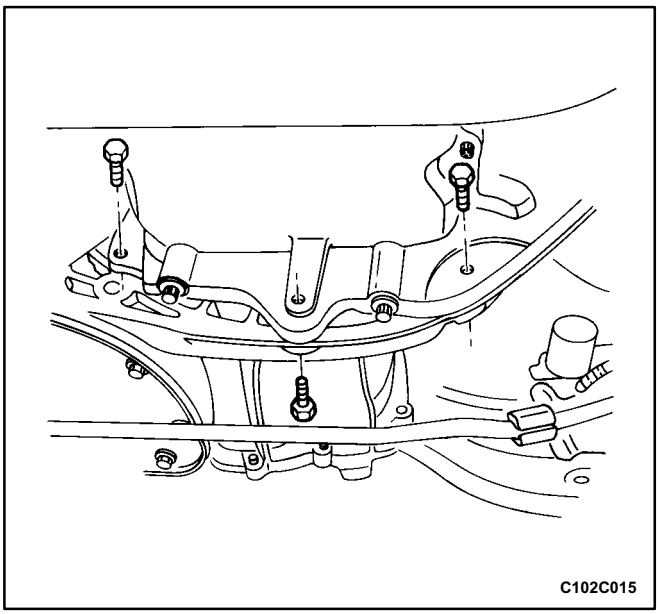
46. Remove the crankshaft pulley bolts.
47. Remove the crankshaft pulley.
48. Disconnect the vacuum lines at the charcoal canis-ter purge (CCP) and the exhaust gas recirculation (EGR) solenoids.
49. Disconnect the electrical connector at the CCP and the EGR solenoid.
50. Disconnect the electrical connector at the oil pres-sure switch.
51. Disconnect the crankshaft position and knock sen-sor connectors.
52. Support the transmission with a floor jack.
53. Remove the center member. Refer to *Section 9N, Frame and Underbody*.
54. Install the engine lifting device.


B102C085

55. Remove the transaxle torque converter bolts, if au-tomatic transaxle equipped.
56. Remove the transaxle bell housing bolts and the oil pan flange bolts.
57. Remove the right engine mount bracket. Refer to *Section 5B, FiveSpeed Manual Transaxle,* or *Section 5A2, ZF4HP14 Automatic Transaxle and 5A3, AISIN 50-40LE Automatic Transaxle.*
58. Remove the resonator bolts and resonator.
59. Remove the air filter housing and bolts.


C102C018

60. Disconnect the right engine mount bracket from the engine mount and engine by removing the retaining bolts.
61. Separate the engine block from the transaxle. Re-move the engine.



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.

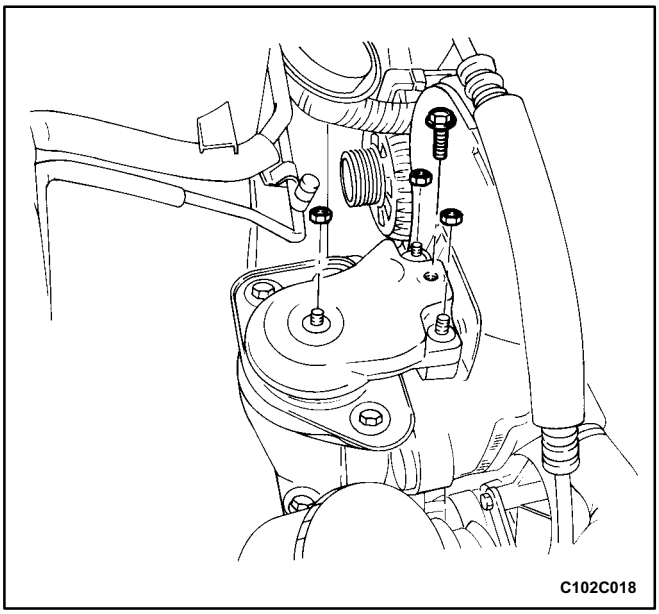
Tighten

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 bolts to 40 N•m (30 lb•ft).

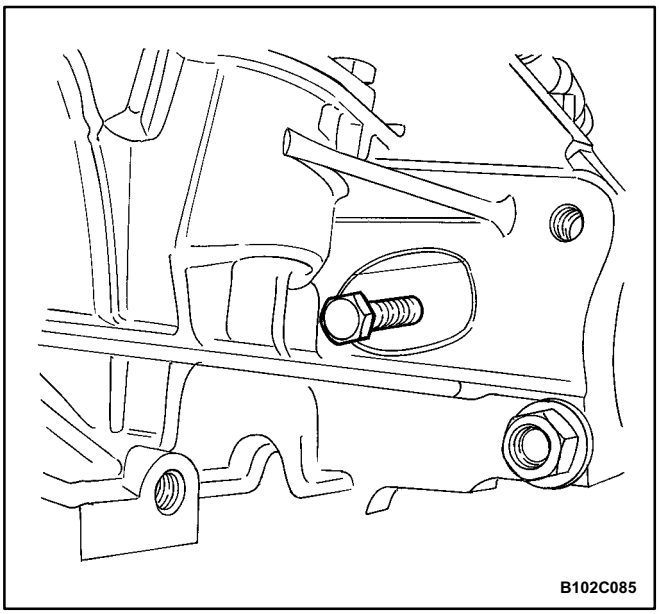


5. Install the right engine mount bracket to the engine block mount and the frame mount.
6. Install the right engine mount bracket retaining bolts and the nut.

Tighten

Tighten the right engine mount bracket retaining bolts and the nut to 60 N•m (44 lb•ft).

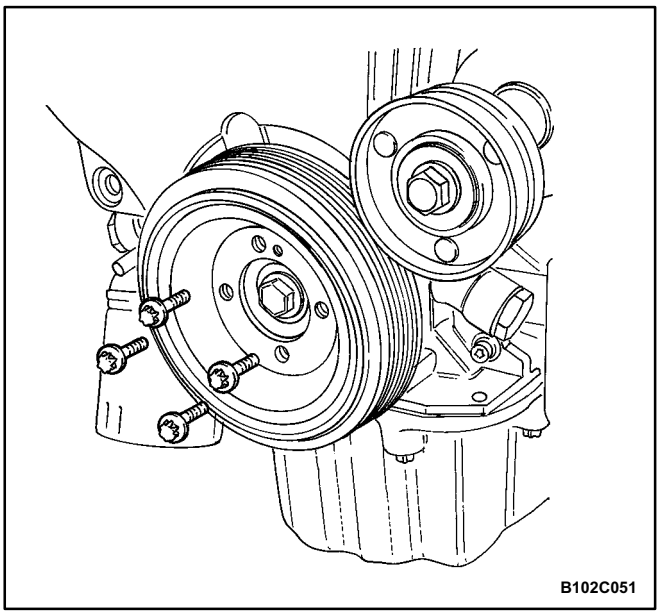
7. Install the rear engine/transmission mount bracket. Refer to S*ection 5A2, ZF-4-HP-14 Automatic Trans-axle and 5A3, AISIN 50-40LE Automatic Transaxle.*
8. Install the center member. Refer to *Section 9N, Frame and Underbody.*



9. Remove the floor jack used for support of the trans-axle.
10. Remove the engine lifting device.
11. Install the transaxle torque converter bolts, if auto-matic transaxle equipped.

Tighten

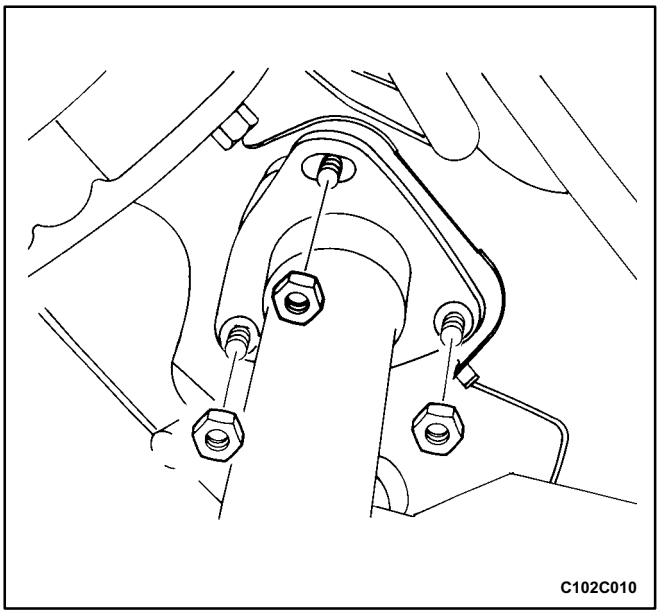
Tighten the transaxle torque converter bolts to 60 N•m (44 lb•ft).


B102C051

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

Tighten

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


C102C010

17. Connect the crankshaft position and knock sensor connectors.

(2.0L DOHC)

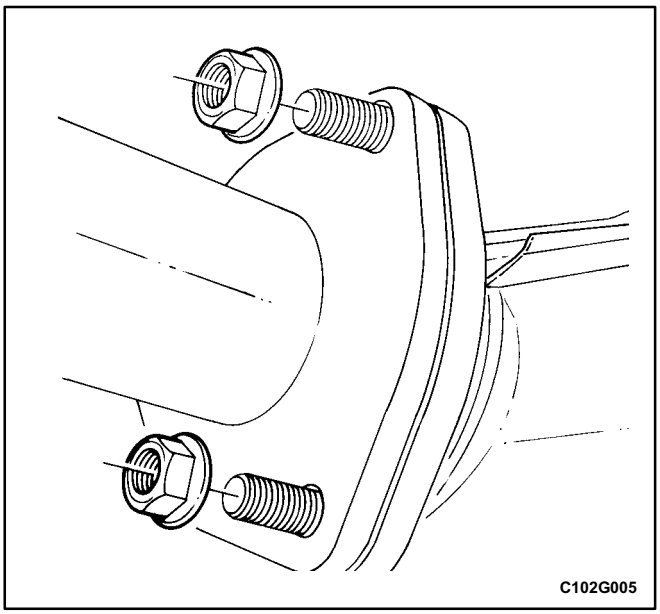
18. Install the exhaust flex pipe.
19. Install the exhaust flex pipe retaining nuts to the ex-haust manifold studs and the support bracket.

Tighten

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

Tighten

Tighten the exhaust support bracket bolts to 30 N•m (22 lb•ft).

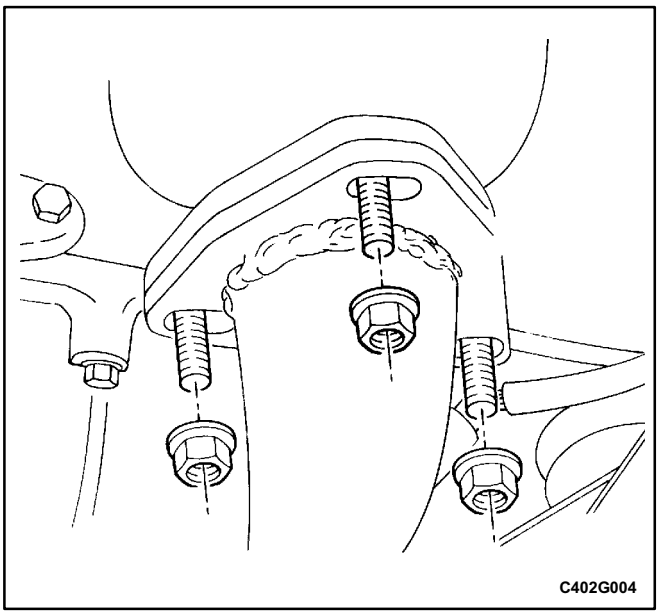

C102G005

(2.2L DOHC)

20. Insert the main catalytic converter bolts into the front muffler flange.
21. Install the rubber hangers that attach the connecting pipe to the vehicle.
22. Install the nuts to secure the front muffler pipe to the main catalytic converter.

Tighten

Tighten the front muffler pipe-to-main catalytic con-verter nuts to 30 N•m (22 lb•ft).

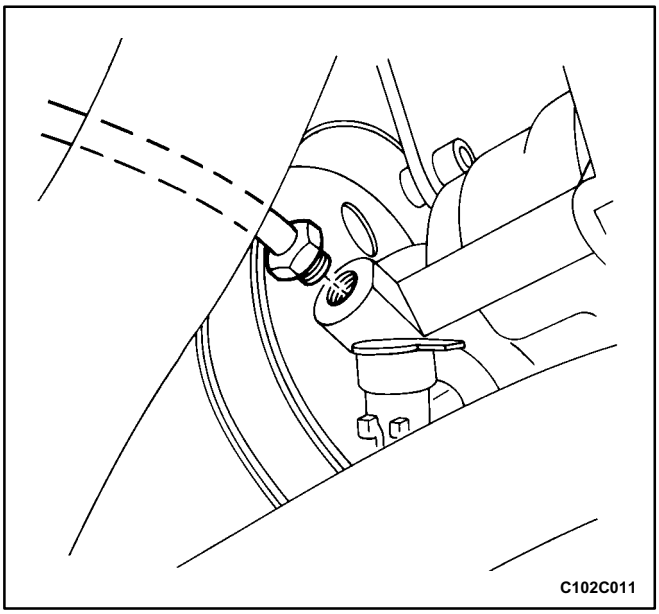


(2.2L DOHC)

23. Install the auxiliary catalytic converter lower flange bolts.

Tighten

Tighten the auxiliary catalytic converter-to-connecting pipe nuts to 40 N•m (30 lb•ft).

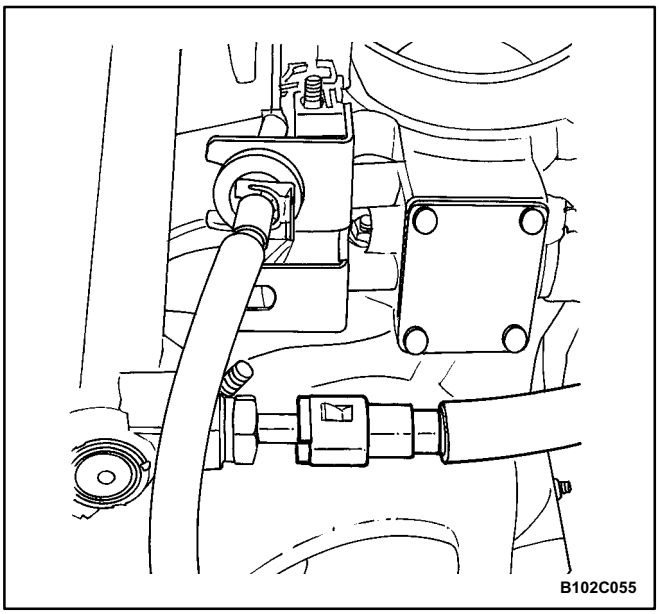


24. Install the exhaust flex pipe retaining nuts to the catalytic converter.

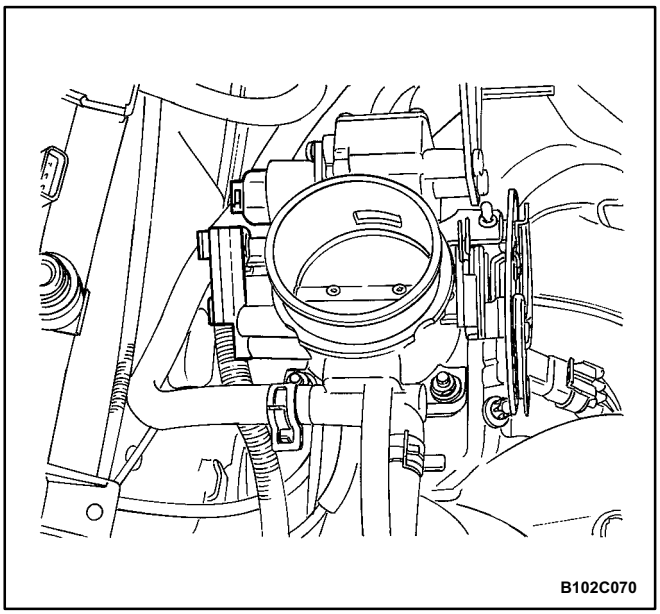
Tighten

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

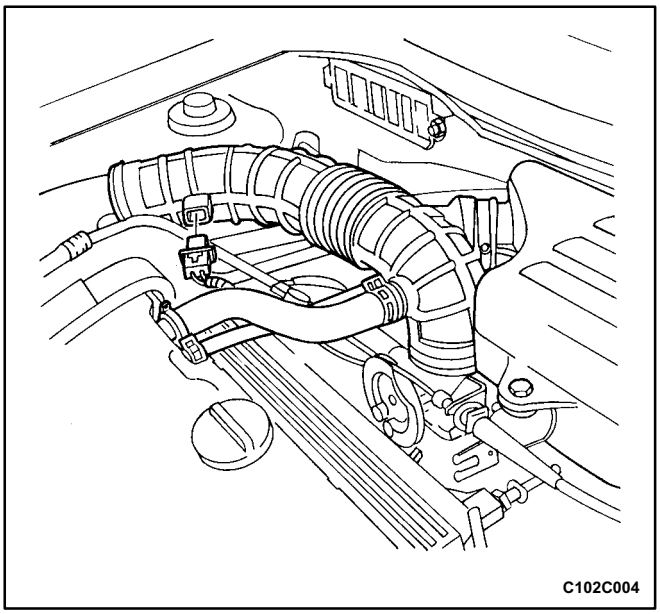
25. Connect the power steering pressure hose.
26. Connect the power steering return hose.
27. Install the A/C compressor, if equipped. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System*.



28. Install the accessory drive belt. Refer to *Section 6B, Power Steering Pump.*
29. Install the right front wheel well splash shield. Refer to *Section 9R, Body Front End.*
30. Install the right front wheel. Refer to *Section 2E, Tires and Wheels*.
31. Connect the fuel feed line to the fuel rail.
32. Connect the fuel return line to the fuel pressure regulator.
33. Install the fuel rail and injector channel cover as an assembly. Refer to *Section 1F, Engine Controls.*


B102C070

34. Connect all of the necessary vacuum lines including the brake booster vacuum hose.
35. Connect the oxygen sensor connector.
36. Connect the starter solenoid "S" terminal wire and power lead.
37. Connect the alternator voltage regulator connector.
38. Connect the CTS connector.
39. Connect the ECT sensor connector.
40. Connect the TPS connector.
41. Connect the IAC valve connector.
42. Connect the MAP sensor connector.
43. Connect the CMP sensor connector (2.2L DOHC).


C102C004

44. Connect the electrical connector at the DIS ignition coil and the ECM ground terminal.
45. Install the air intake tube.
46. Install the air filter housing and the bolts.

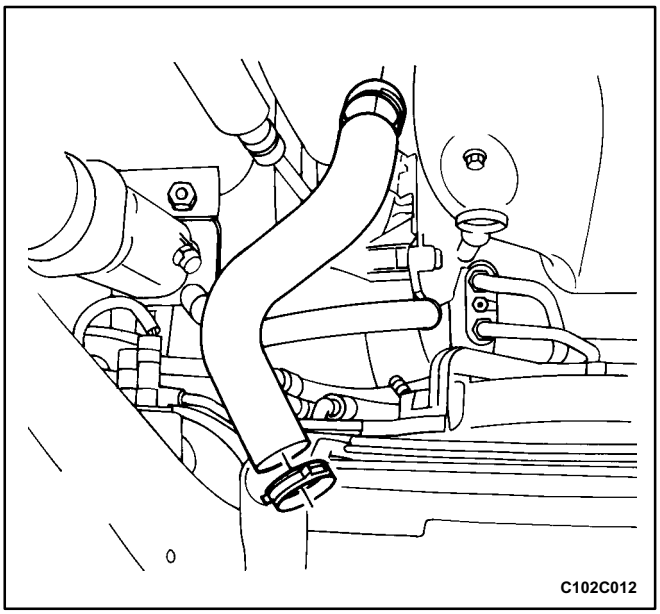
Tighten

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

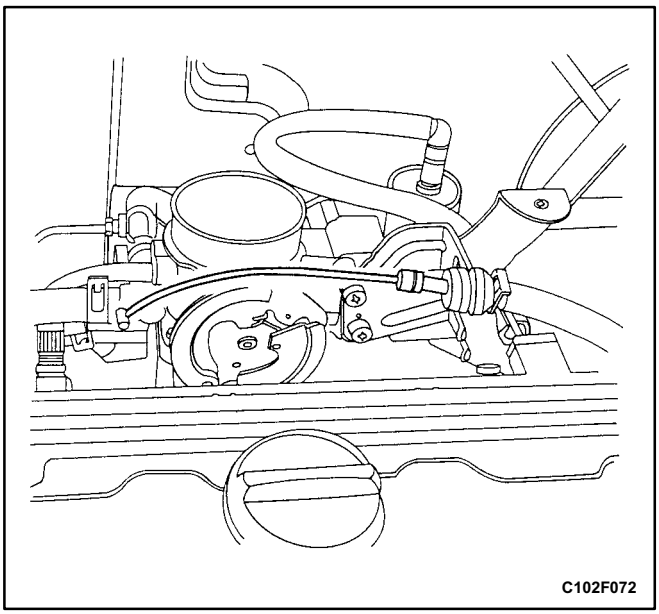
47. Connect the breather tubes to the valve cover.
48. Connect the manifold air temperature sensor con-nector.
49. Install the cooling system radiator and the engine cooling fans. Refer to *Section 1D, Engine Cooling.*
50. Install the resonator and retaining bolts.

Tighten

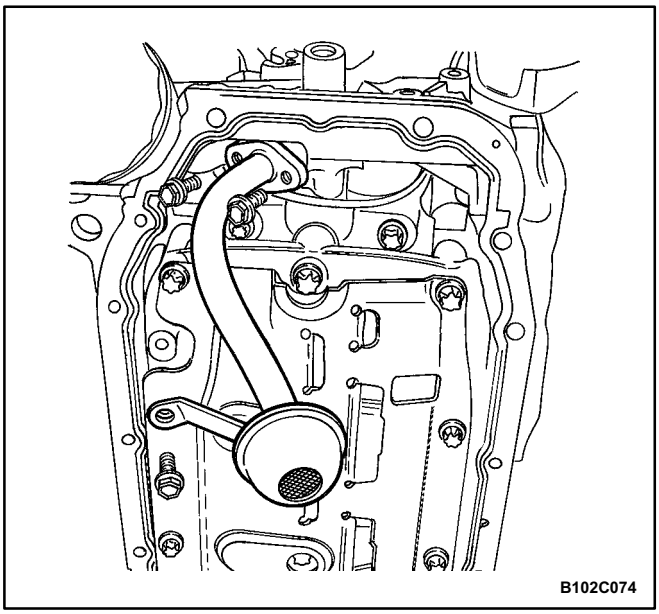
Tighten the resonator bolts to 8 N•m (71 lb•in).


C102C012

51. Connect the lower radiator hose to the coolant pipe.
52. Connect the upper radiator hose to the thermostat housing.
53. Connect the heater inlet hose to the cylinder head.
54. Connect the heater outlet hose to the coolant pipe.
55. Connect the coolant surge tank hose to the coolant pipe.
56. Connect the coolant hose to the throttle body.


C102F072

57. Connect the throttle cable to the throttle body and the intake manifold bracket.
58. Install the fuel pump fuse.
59. Connect the negative battery cable.
60. Refill the engine crankcase with engine oil.
61. Refill the engine coolant system. Refer to *Section 1D, Engine Cooling.*
62. Fill and bleed the power steering system. Refer to *Section 6A, Power Steering System.*
63. Refill the A/C refrigerant system, if equipped. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System*.
64. Install the hood. Refer to *Section 9R, Body Front End*.

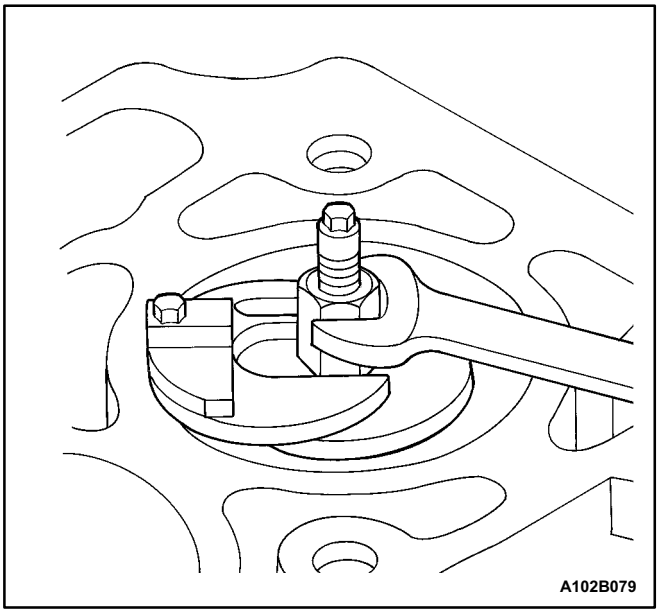

B102C074

PISTONS AND CONNECTING RODS

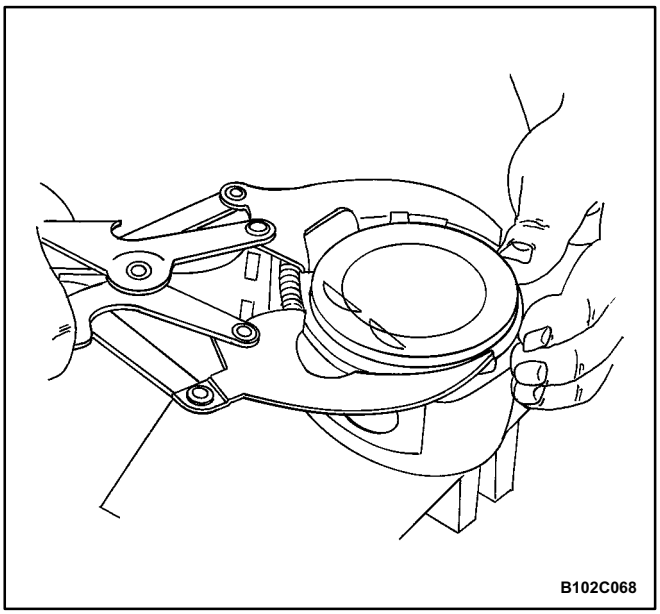
Tools Required
J-8037 Universal Piston ring Compressor
J-8087 Cylinder Bore Check Gauge
KM-427 Piston Pin Service Set
KM-470-B Angular Torque Gauge

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.

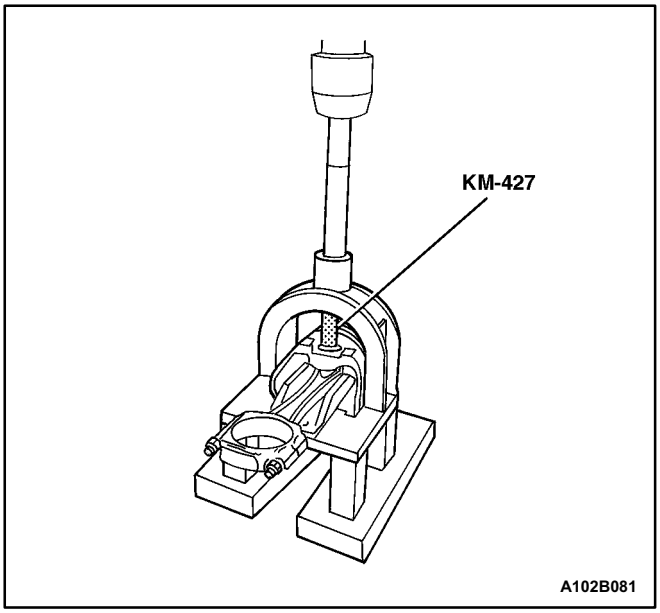

A102B079

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 the lower con-necting rod bearing.
11. Remove the upper piston connecting rod bearing.
12. Ridge ream the cylinder wall.


B102C068

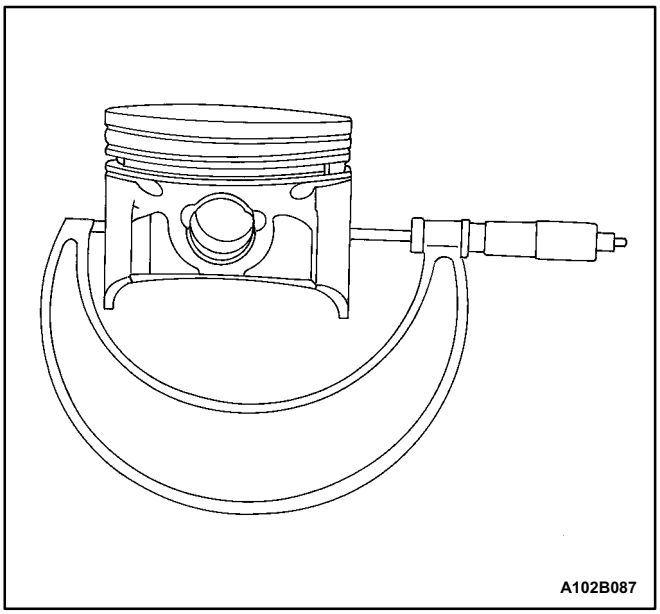
Caution: Use care when handling the piston. Worn piston rings are sharp and may cause injury.

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



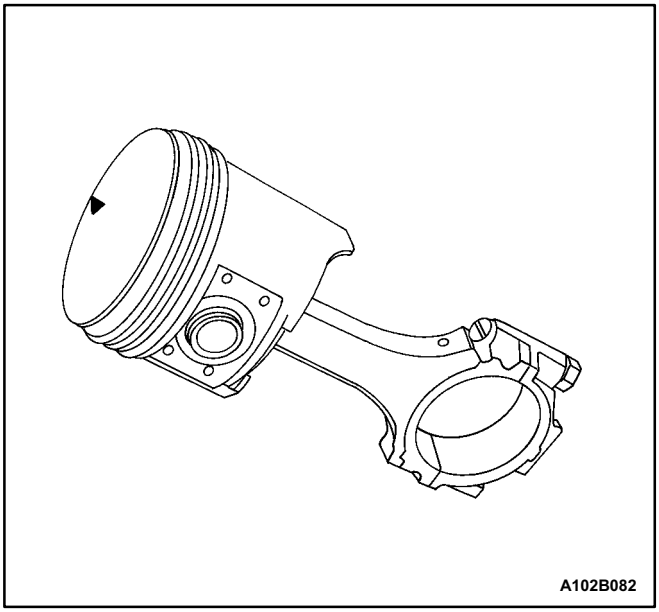
A102B081

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

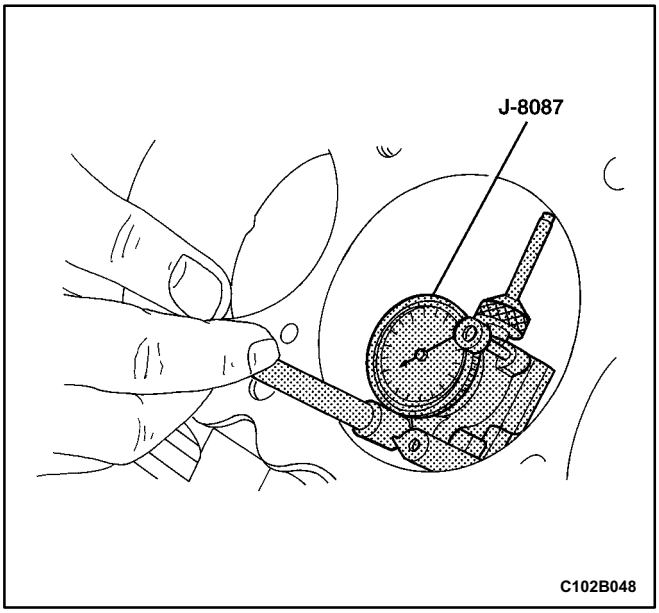

A102B087

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.

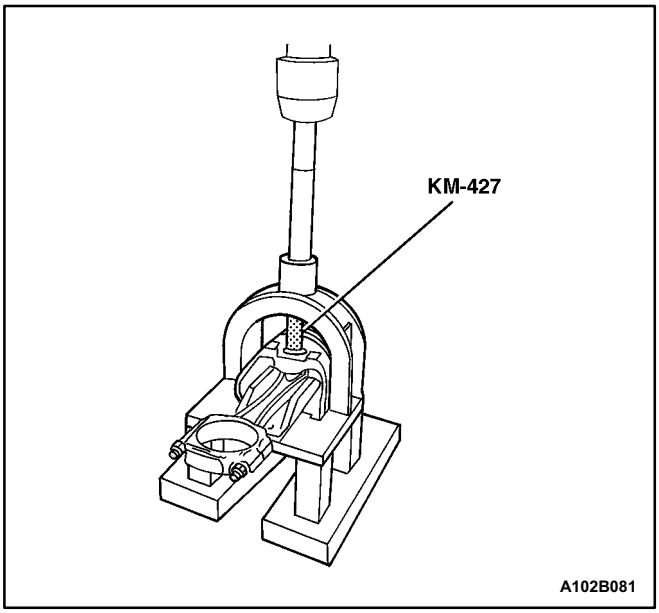

A102B082

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



C102B048

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 align-ment using 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.

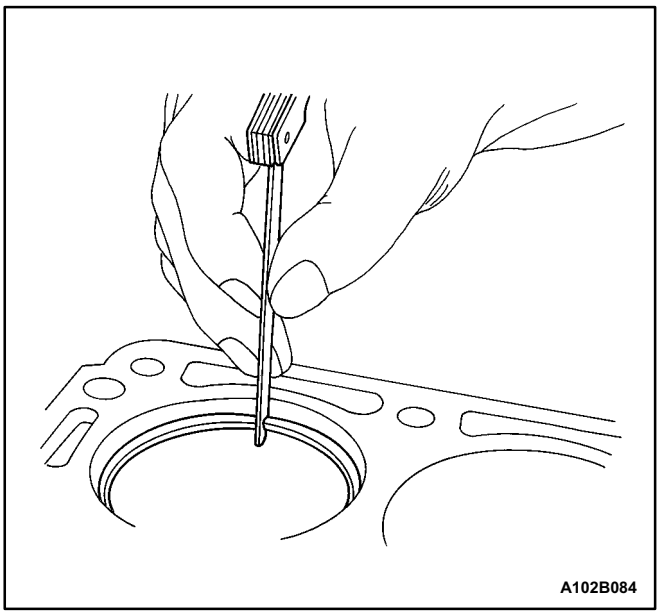


A102B081

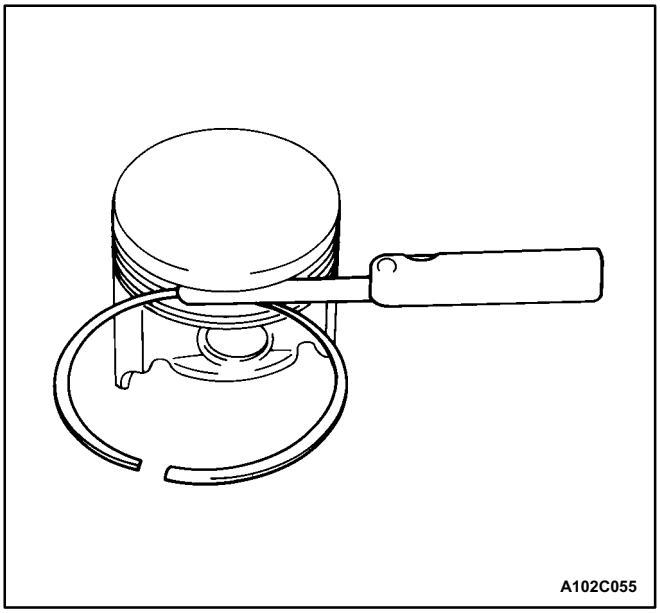
Installation Procedure

Important: For ease of installation of the piston pin, the connecting rod should be heated to 280°C. Heat the upper connecting rod only. Use commercial ther-mocolor material to determine the correct temperature. When the thermocolor material changes from black to green, the temperature is correct for installation.

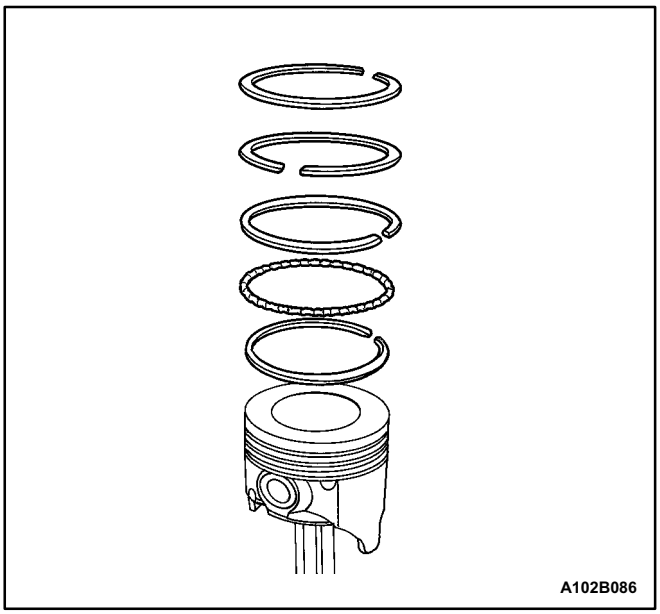
1. Align the notch on the piston and connecting rod so that the proper sides will be facing the front of the en-gine.
2. Install the piston pin guide through the piston and the connecting rod.
3. Coat the piston pin with clean oil.
4. Install the piston pin into the opposite side of the pis-ton.
5. Install the piston pin into the piston and connecting rod assembly using the piston pin service set KM427.


A102B084

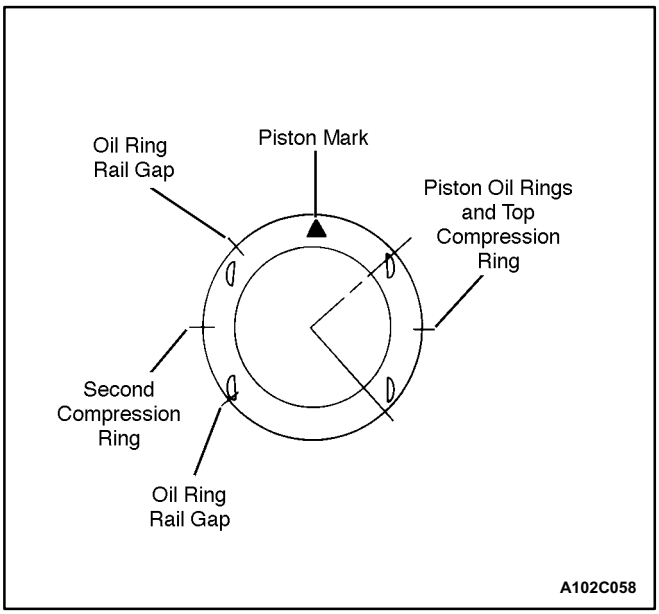
6. Select a set of new piston rings.
7. Measure the piston ring gap using a feeler gauge. Refer to "Engine Specifications" in this section.
8. Increase the piston ring gap by carefully filing off ex-cess material if the piston ring gap is below specifi-cations.


A102C055

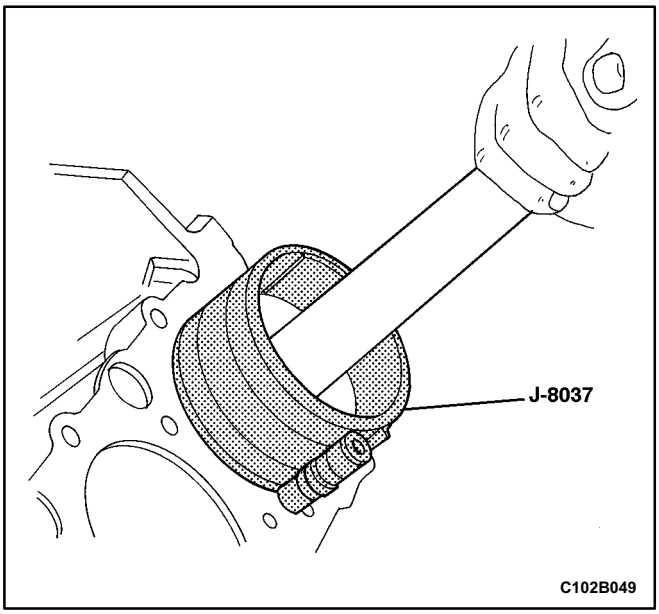
9. Measure the piston ring side clearance using a feeler gauge. Refer to "Engine Specifications" in this section.
10. If the piston ring is too thick, try another piston ring.
11. If no piston ring can be found that fits to specifica-tions, the piston ring may be ground to size with emery paper placed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


A102B086

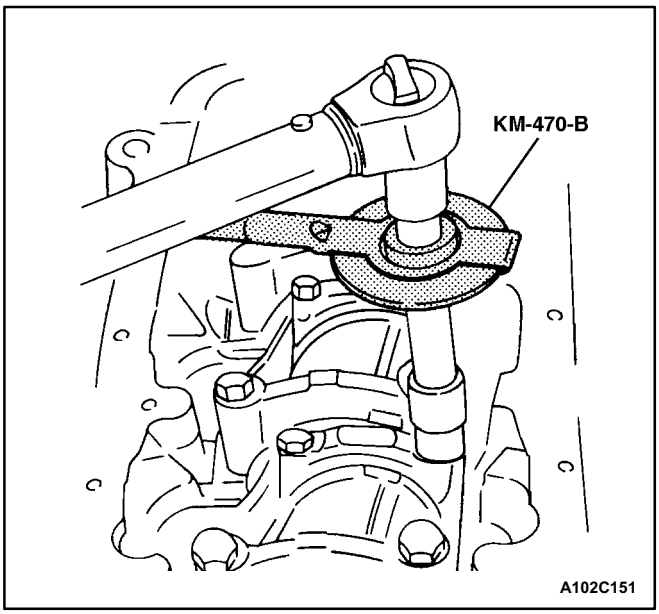
12. Install a piston oil ring, the expander, then the sec-ond piston oil ring to the bottom ring groove of the piston.
13. Install the second compression ring to the middle ring groove of the piston.
14. Install the top compression ring to the top ring groove of the piston.



15. Use a piston ring expander to install the piston rings. Do not expand the piston rings beyond the expan-sion 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 cap bearing bolts.

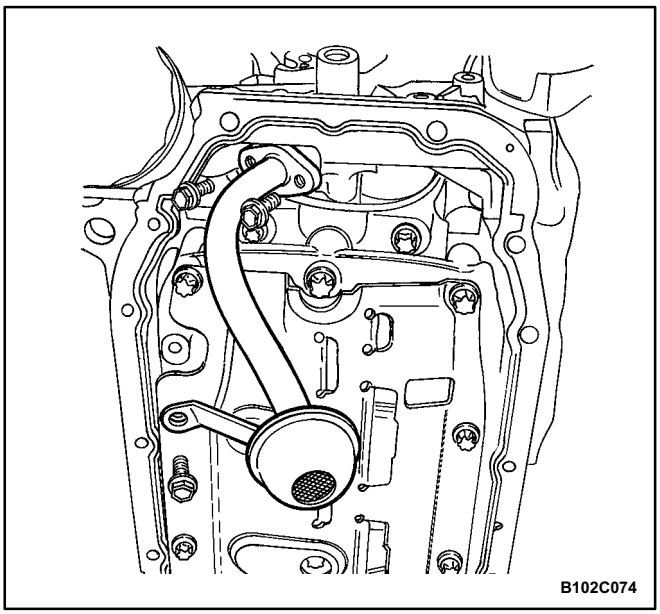
Tighten

Tighten the connecting rod cap bearing bolts to 35 N•m (26 lb•ft). Using the angular torque gauge KM470B, tighten the bolts one turn of 45 degrees plus 15 degrees.

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

Tighten

Tighten the engine block lower support bracket/splash shield bolts to 35 N•m (26 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).

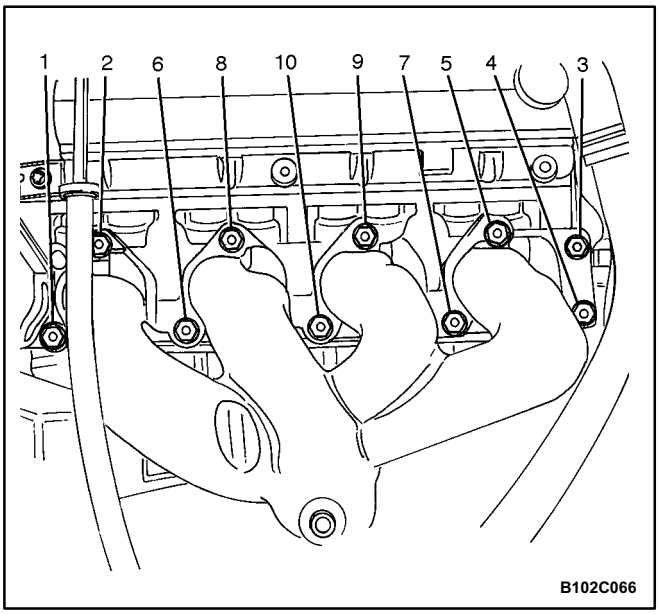
24. Install the oil pan. Refer to "Oil Pan" in this section.
25. Install the cylinder head with the intake manifold and exhaust manifold attached. Refer to "Cylinder Head and Gasket" in this section.

UNIT REPAIR

CYLINDER HEAD AND VALVE TRAIN COMPONENTS

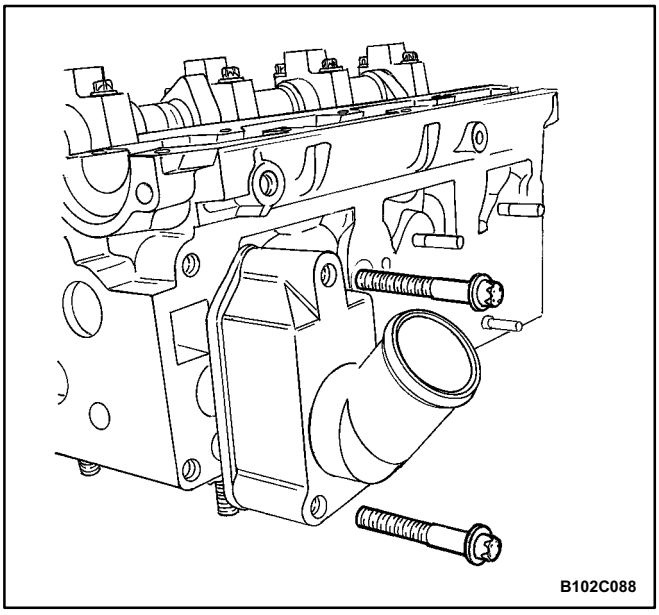
Tools Required

KM-571-B Gauge
KM-340-0 Cutter Set
KM-340-7 Guide Drift
KM-340-13 Cutters
KM-340-26 Cutters
KM-348 Valve Spring Compressor
KM-653 Adapter
KM-805 Reamer

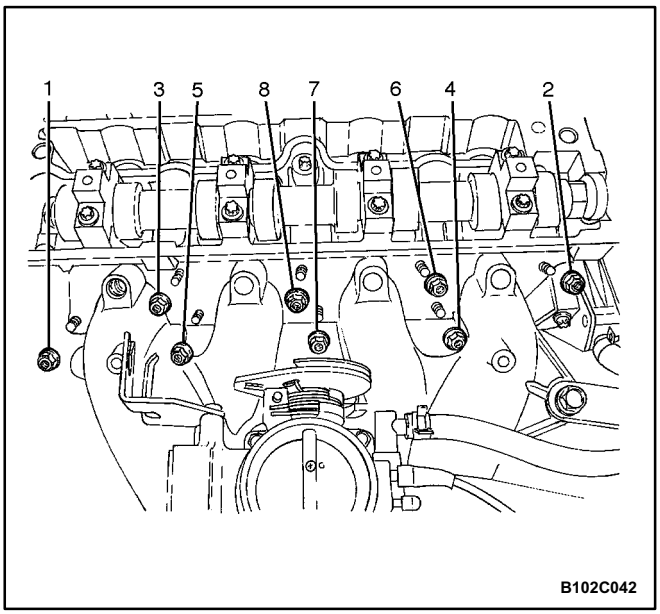


Disassembly Procedure

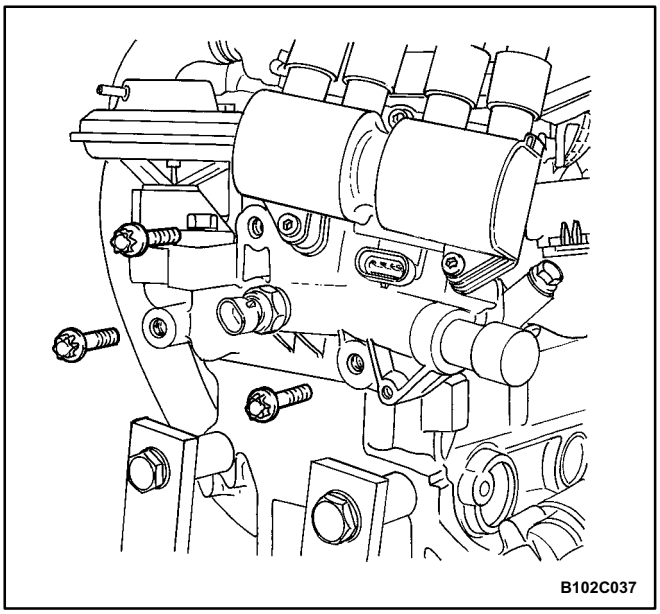
1. Remove the cylinder head with the intake manifold and the exhaust manifold attached. Refer to "Cylin-der Head and Gasket" in this section.
2. Remove the coolant temperature sensor.
3. Remove the exhaust manifold heat shield bolts.
4. Remove the exhaust manifold heat shield.
5. Remove the exhaust manifold retaining nuts in the sequence shown.
6. Remove the exhaust manifold.
7. Remove the exhaust manifold gasket.
8. Remove the exhaust manifold studs.



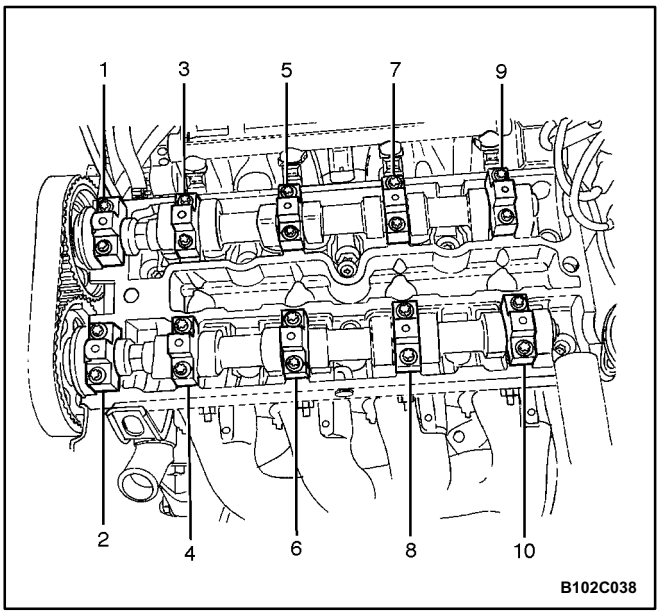
9. Remove the thermostat housing mounting bolts.
10. Remove the thermostat housing assembly.
11. Remove the fuel rail assembly. Refer to *Section 1F, Engine Controls (2.0L DOHC)*.
12. Remove the coolant bypass housing mounting bolts and the housing.



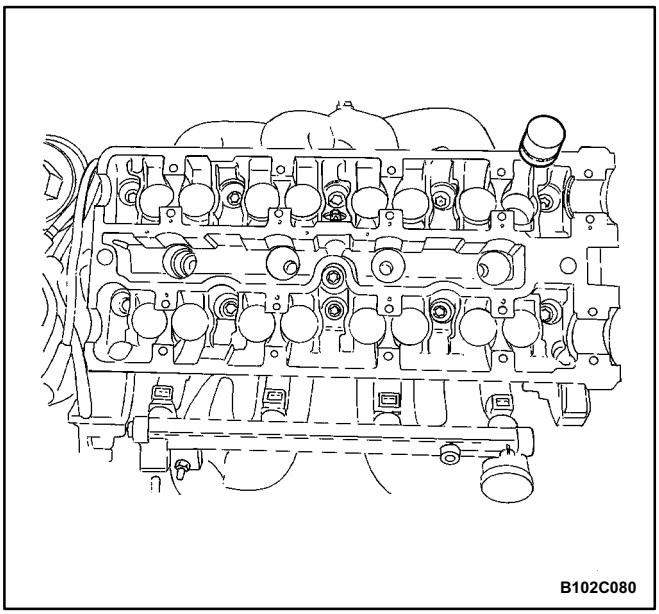
13. Remove the intake manifold retaining nuts and re-taining bolt in the sequence shown.
14. Remove the intake manifold.
15. Remove the intake manifold gasket.



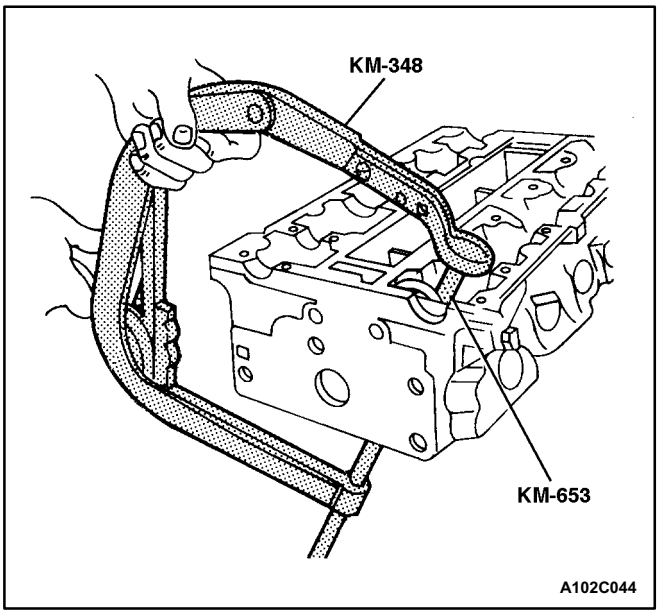
16. Remove the DIS ignition coil and EGR mounting bracket bolts.
17. Remove the DIS ignition coil and EGR mounting bracket and ignition wires.
18. Remove the intake manifold studs.
19. Remove the spark plugs.



20. Remove the camshaft bearing cap bolts gradually and in the sequence shown for each camshaft cap.

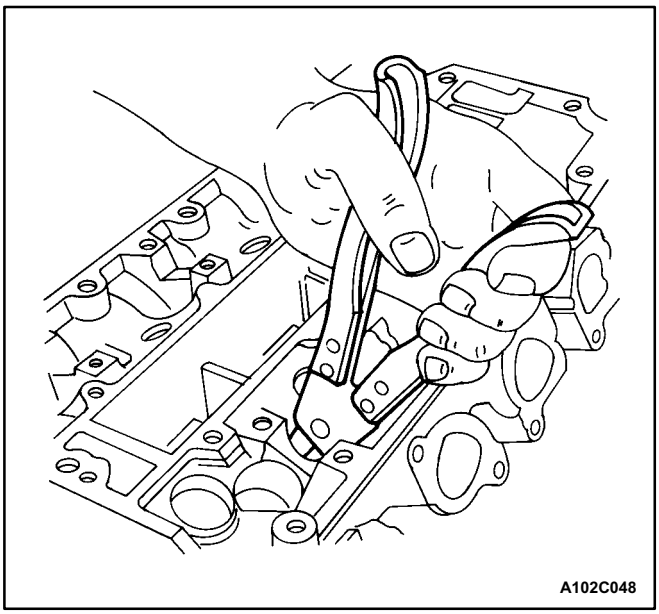

B102C080

21. Remove the intake camshaft caps. Maintain the correct positions for installation.
22. Remove the intake camshaft.
23. Remove the intake valve lash adjusters.
24. Remove the exhaust camshaft caps. Maintain the correct positions for installation.
25. Remove the exhaust camshaft.
26. Remove the exhaust valve lash adjusters.

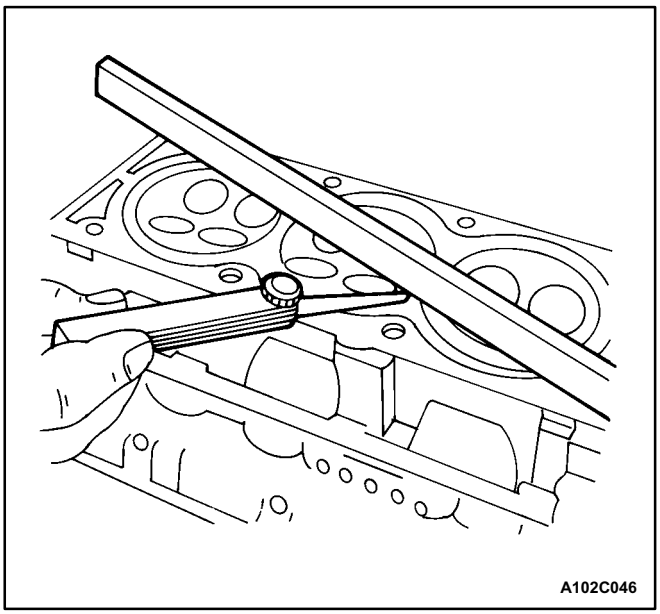


A102C044

27. Compress the valve springs with the valve spring compressor KM-348 and the adapter KM-653.
28. Remove the valve retainers.
29. Remove the valve spring compressor KM-348 and the adapter KM-653.
30. Remove the valve spring caps.
31. Remove the valve springs. Maintain the original position of the valve springs for installation.

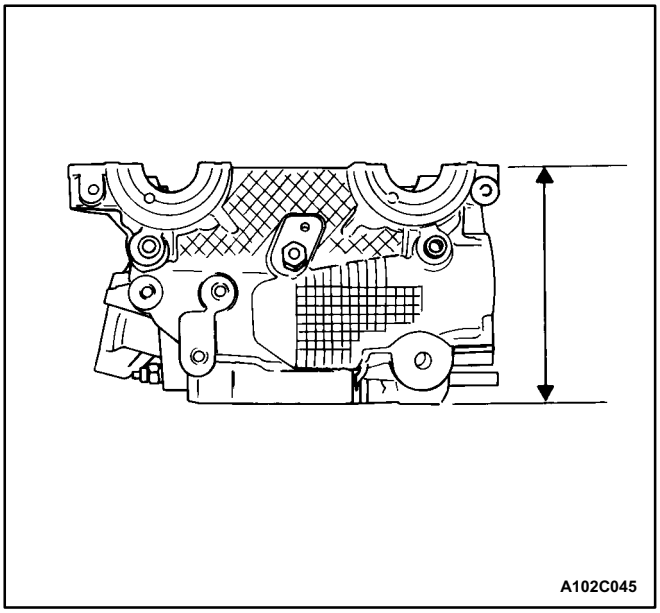

A102C048

32. Remove the valves. Maintain the original position of the valves for installation.
33. Remove the valve stem seals.

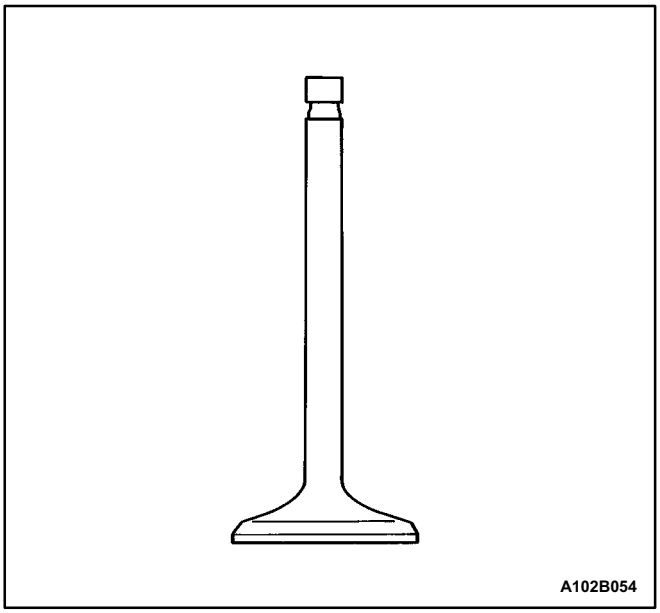

A102C046

Cylinder Head Inspection

1. Clean the sealing surfaces.
2. Inspect the cylinder head gasket and mating surfaces for leaks, corrosion and blow-by.
3. Inspect the cylinder head for cracks.
4. Inspect the length and width of the cylinder head us-ing 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.

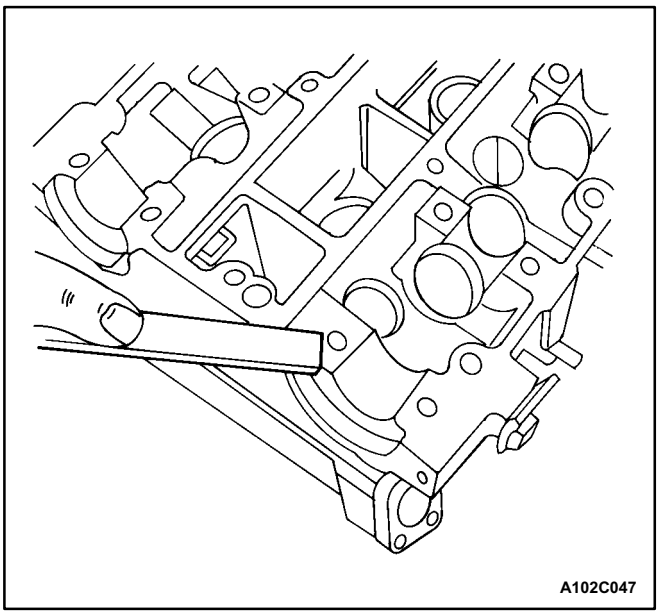

A102C045

6. Measure the height of the cylinder head from sealing surface to sealing surface. The cylinder head height should be 133.975 to 134.025 mm (5.274 to 5.276 inches). If the cylinder head height is less than 133.9 mm (5.271 inches), replace the cylinder head.
7. Inspect all threaded holes for damage.
8. Inspect valve seats for excessive wear and burned spots.


A102B054

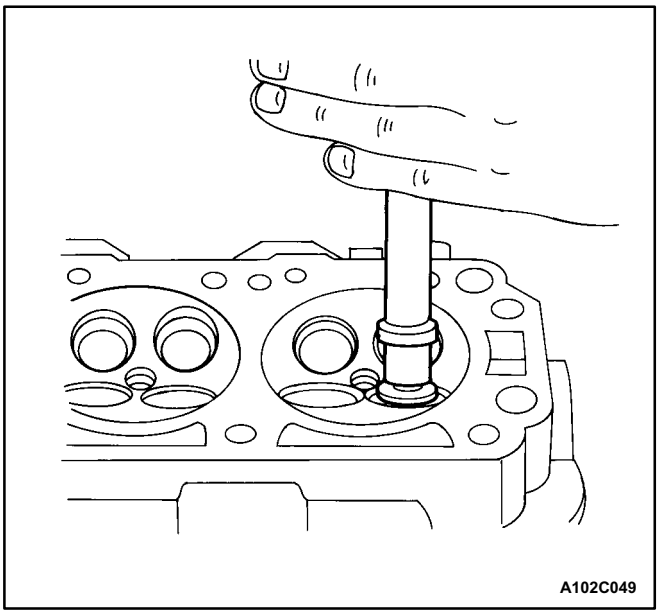
Valve Inspection

1. Inspect the valve stem tip for wear.
2. Inspect the valve retainer grooves and the 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 that refacing the valve 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.


A102C047

Cleaning Procedure

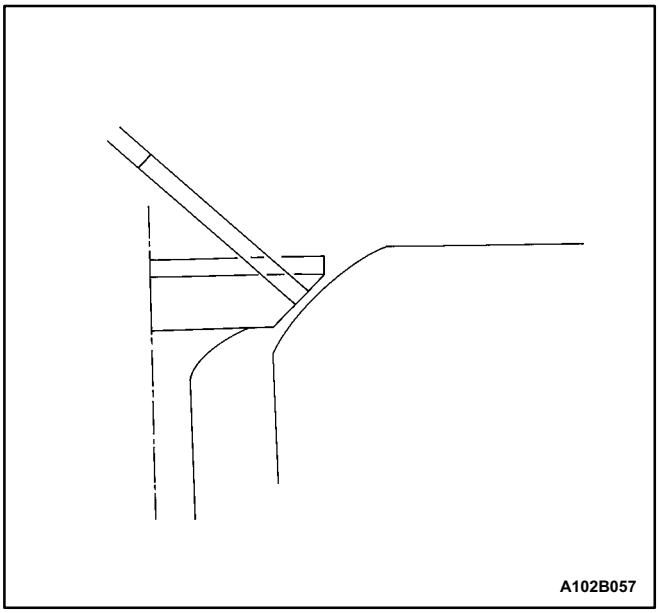
1. Clean the cylinder head.
2. Clean the valve guides.
3. Clean all of the threaded holes.
4. Clean the valves of carbon, oil and varnish.


A102C049

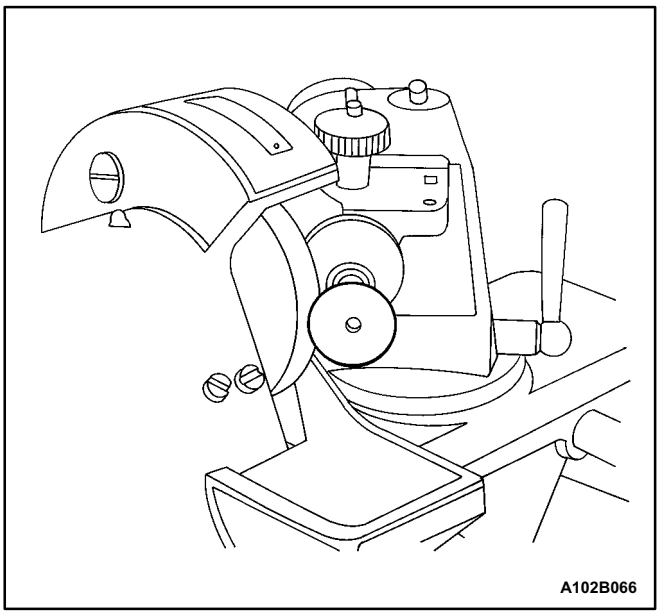
Cylinder Head Overhaul

Valve Grind-in

1. Lubricate the valve seat using a fine-grained paste.
2. Lift the valve rhythmically from the seat with a com-mercially available valve grinding tool in order to dis-tribute the paste.

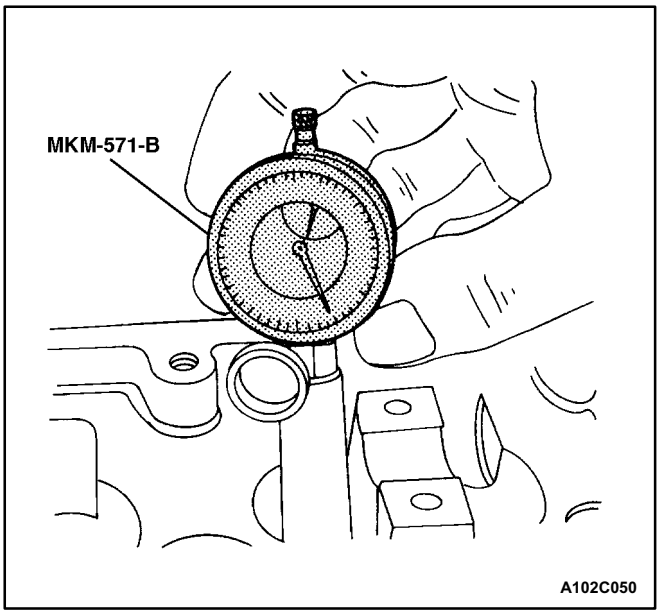

A102B057

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.



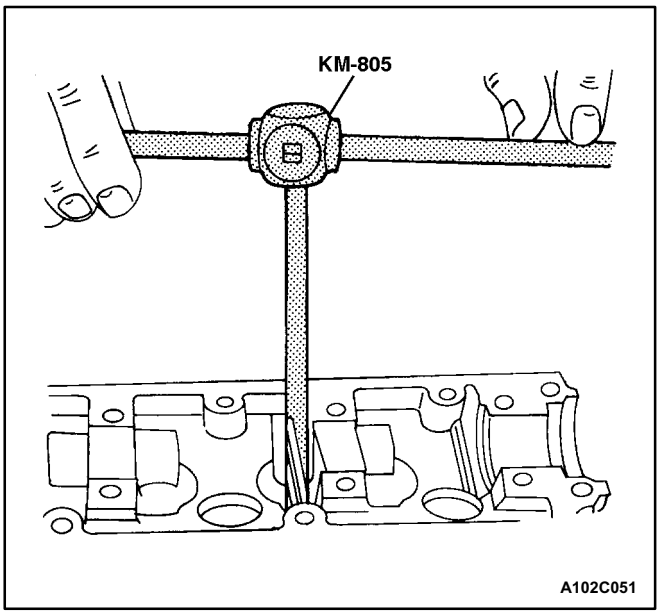
Valve Grind

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.



Valve Guide - Ream

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

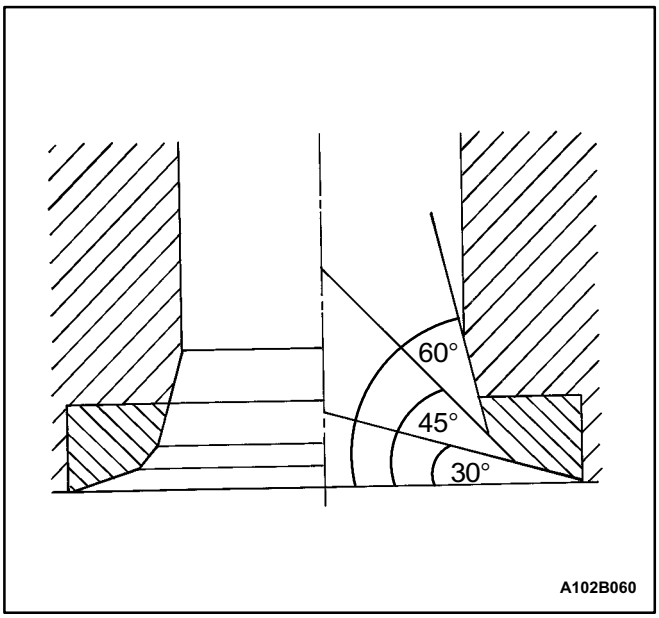


Important: Valve oversizes may already have been fitted in production.

2. An oversize service 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.

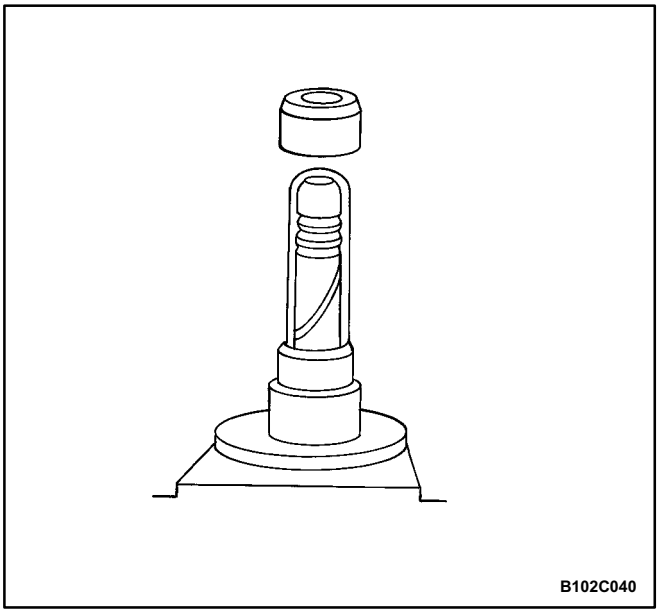
Size	Reamer	Production Code	Service Code
Normal	□	□	K
0.075	KM805	1	K1
0.150		2	K2

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



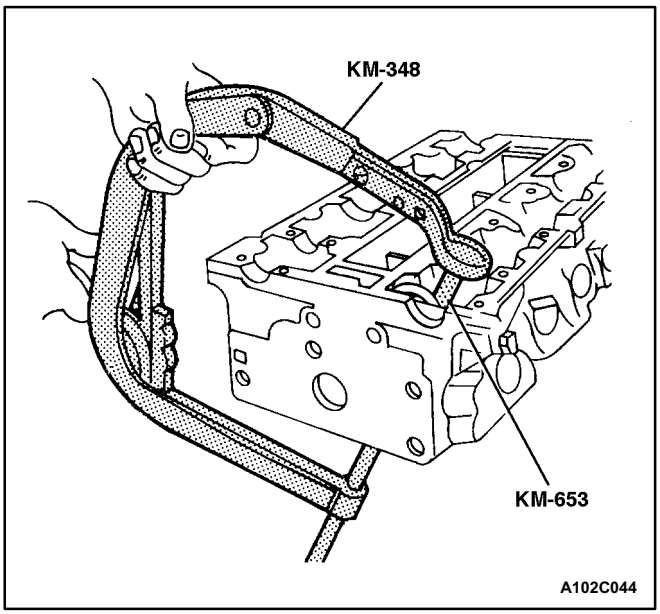
Valve Seat - Cut

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 the cutter KM-340-13.
   - Upper correction angle - A 30 degree surface us-ing the cutter KM-340-13.
   - Lower correction angle - A 60 degree surface us-ing the cutter KM-340-26.
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 re-placing the valves, replace the cylinder head.

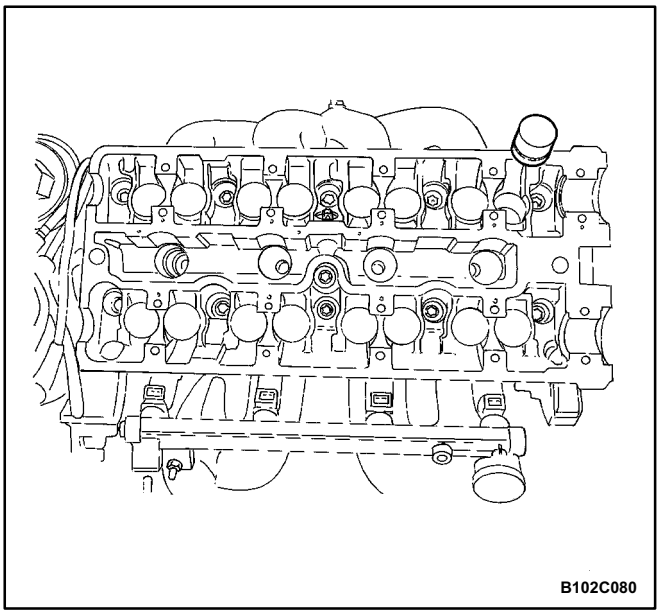


Assembly Procedure

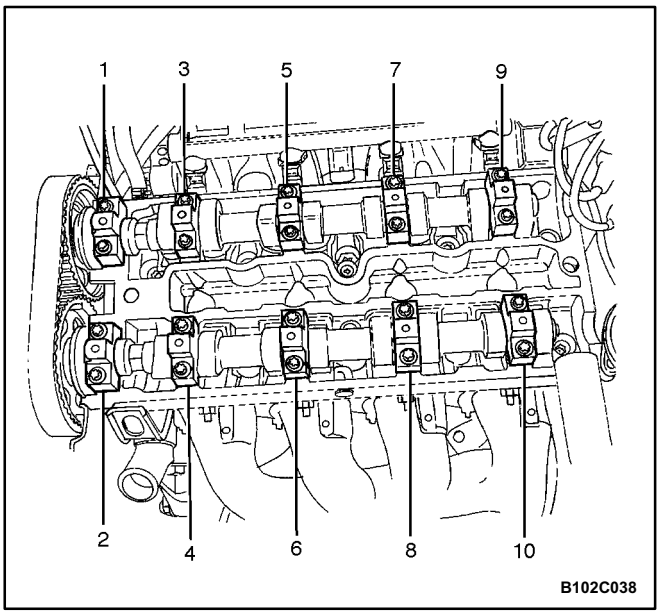
1. Coat the valve stems with engine oil.
2. Insert the valves in the cylinder head in their original positions.
3. Insert the valve spring seats.
4. Push the accompanying assembly sleeve onto the valve stem.
5. Insert the new valve stem seat.
6. Carefully drive the valve stem seal onto the stop with 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 and adapter KM-653.
10. Install the valve retainers.
11. Remove the valve spring compressor KM-348 and adapter KM-653.



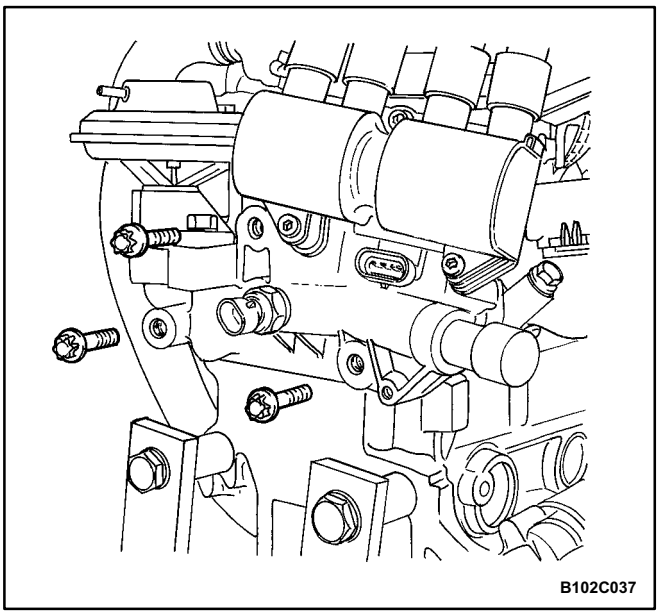
12. Lubricate the valve lash adjusters with engine oil.
13. Install the valve lash adjusters.



14. Install the intake camshaft.
15. Install the intake camshaft bearing caps in their original positions.
16. Install the exhaust camshaft.
17. Install the exhaust camshaft bearing caps in their original positions.
18. Install the camshaft bearing cap bolts.
19. Tighten the camshaft bearing cap bolts gradually and in the sequence shown for each camshaft cap.

Tighten

Tighten the camshaft bearing cap bolts to 8 N•m (71 lb•in).


B102C037

20. Install the spark plugs.

Tighten

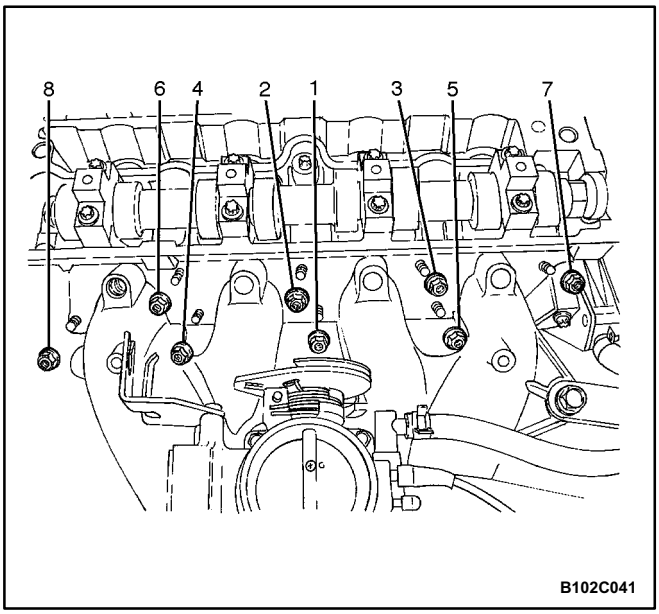
Tighten the spark plugs to 20 N•m (15 lb•ft).

21. Install the DIS ignition coil and EGR mounting bracket and bolt.
    Tighten the DIS ignition coil and EGR mounting bracket bolts to 25 N.m (18 lb•ft).

22. Install the DIS ignition coil and EGR.

Tighten

Tighten the DIS ignition coil and EGR 10 N•m (89 lb•in).

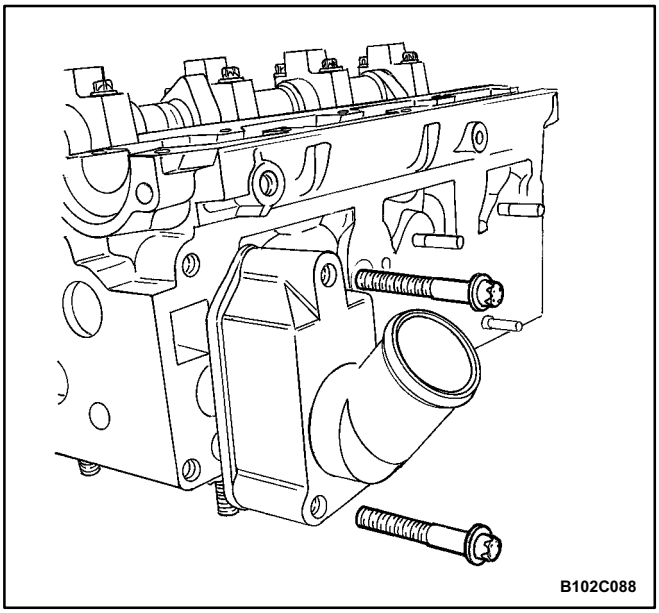


B102C041

23. Install the intake manifold studs.
24. Install the intake manifold gasket.
25. Install the intake manifold.
26. Install the intake manifold retaining nuts and retain-ing bolt in the sequence shown.

Tighten

Tighten the intake manifold retaining nuts and retain-ing bolt to 22 N•m (16 lb•ft).


B102C088

27. Install the fuel rail assembly. Refer to *Section 1F, Engine Controls (2.0L DOHC).*
28. Install the thermostat housing assembly.
29. Install the thermostat housing mounting bolts.

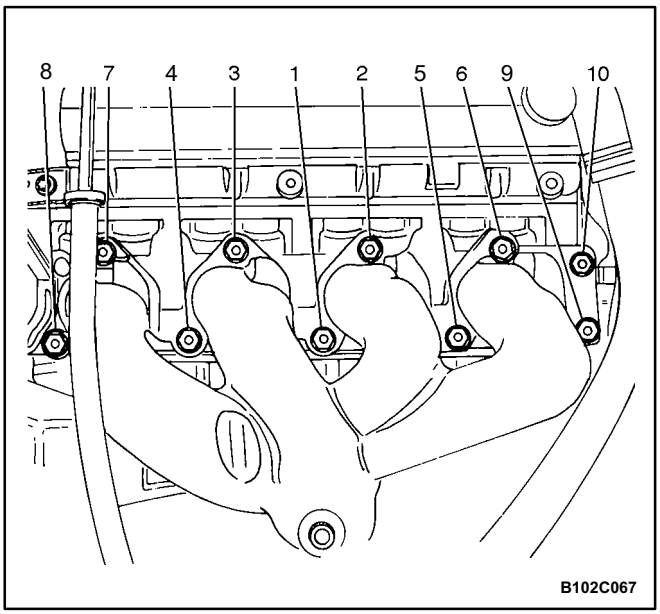
Tighten

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

30. Install the coolant bypass housing bolts.

Tighten

Tighten the coolant bypass housing bolts to 15 N•m (11 lb•ft).



31. Install the exhaust manifold studs.
32. Install the exhaust manifold gasket.
33. Install the exhaust manifold.
34. Install the exhaust manifold retaining nuts in the se-quence shown.

Tighten

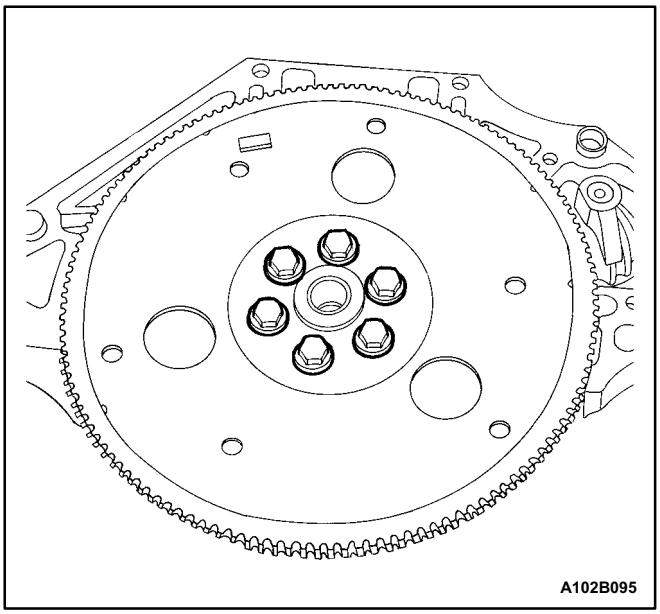
Tighten the exhaust manifold retaining nuts to 15 N•m (11 lb•ft).

35. Install the exhaust manifold heat shield.
36. Install the exhaust manifold heat shield bolts.

Tighten

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

37. 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

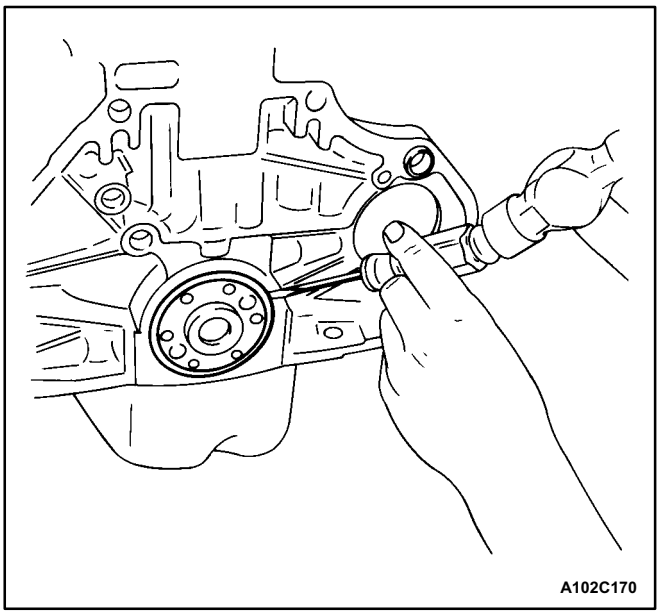
KM-470-B Angular Torque Gauge

J-36972 Crankshaft Rear Oil Seal Installer (or KM-635)

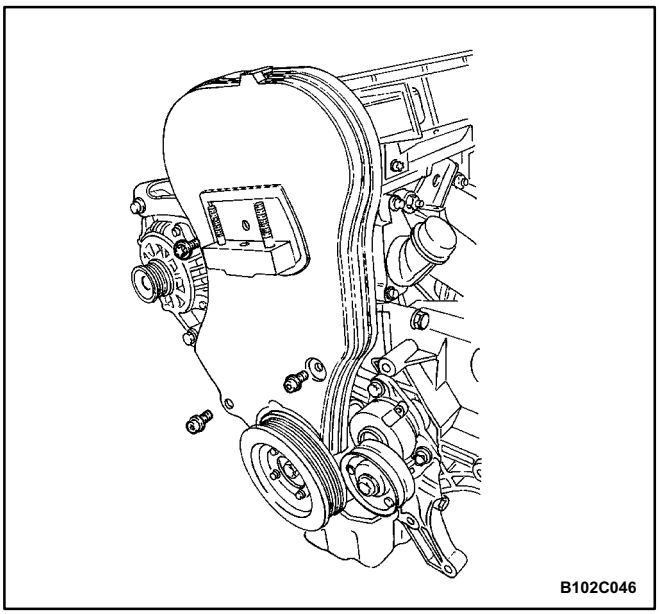
Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshafts.

Disassembly Procedure

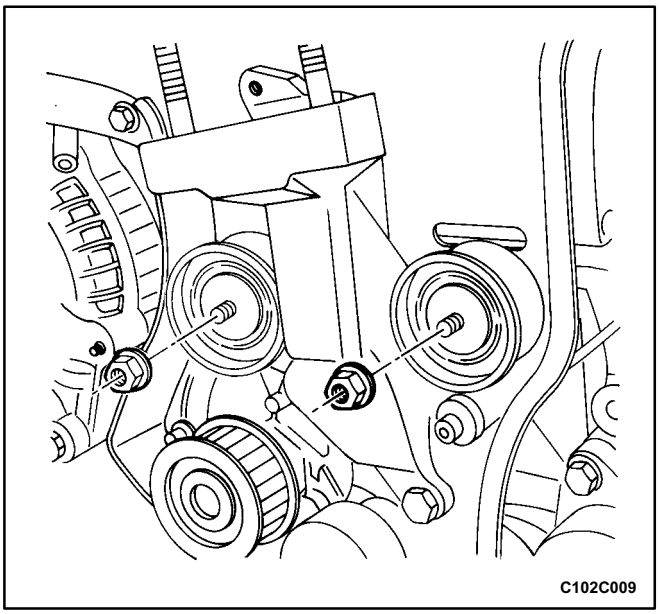
1. Remove the engine. Refer to ``Engine'' in this sec-tion.
2. Remove the flywheel or flexible plate bolts.
3. Remove the flywheel or the flexible plate.



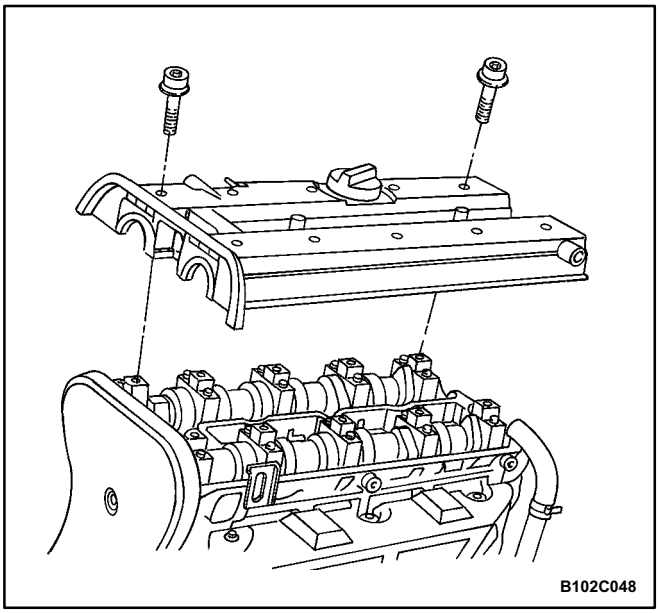
4. Remove the crankshaft rear oil seal.
5. Mount the engine assembly on the engine overhaul stand KM-412.



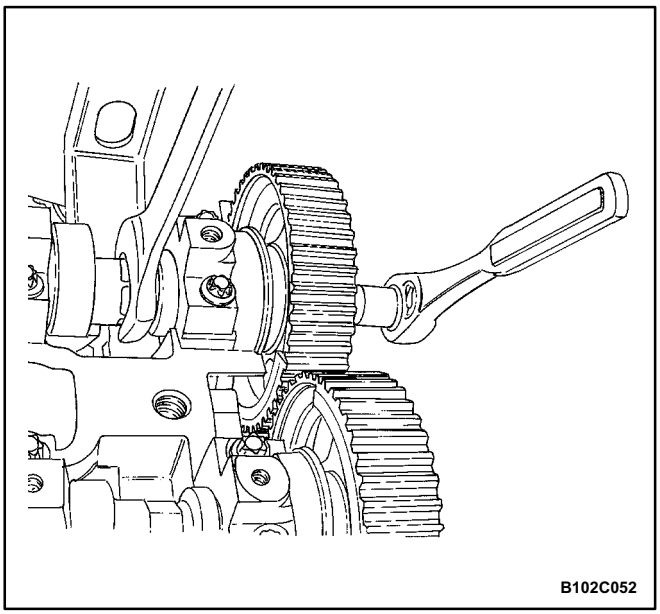
6. Remove the front timing belt cover bolts.
7. Remove the front timing belt cover.
8. Remove the crankshaft pulley bolts.
9. Remove the crankshaft pulley.



10. Loosen the timing belt automatic tensioner bolt.
11. Rotate the timing belt automatic tensioner hex-key clockwise to release the tension.
12. Remove the timing belt idler pulley nuts.
13. Remove the timing belt idler pulleys.
14. Remove the timing belt.
15. Remove the engine mount retaining bolts.
16. Remove the engine mount.

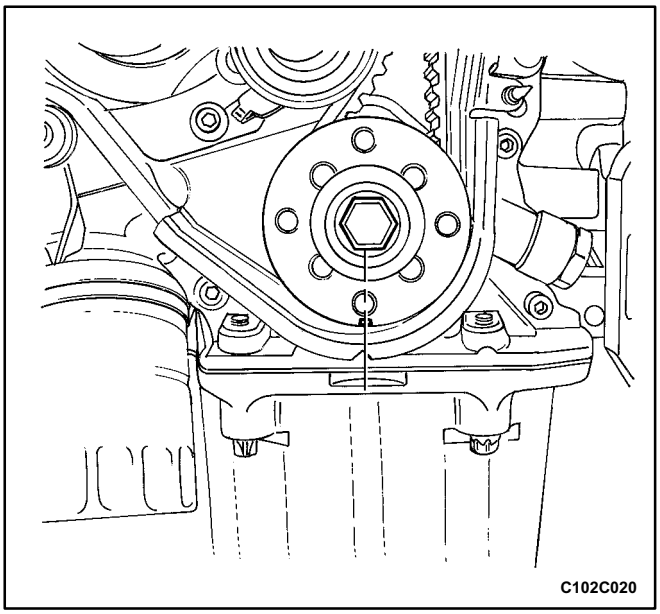


17. Disconnect the crankcase breather tubes from the valve cover.
18. Remove the spark plug cover bolts.
19. Remove the spark plug cover.
20. Disconnect the ignition wires from the spark plugs.
21. Remove the valve cover bolts.
22. Remove the valve cover washers.
23. Remove the valve cover and the valve cover gasket.

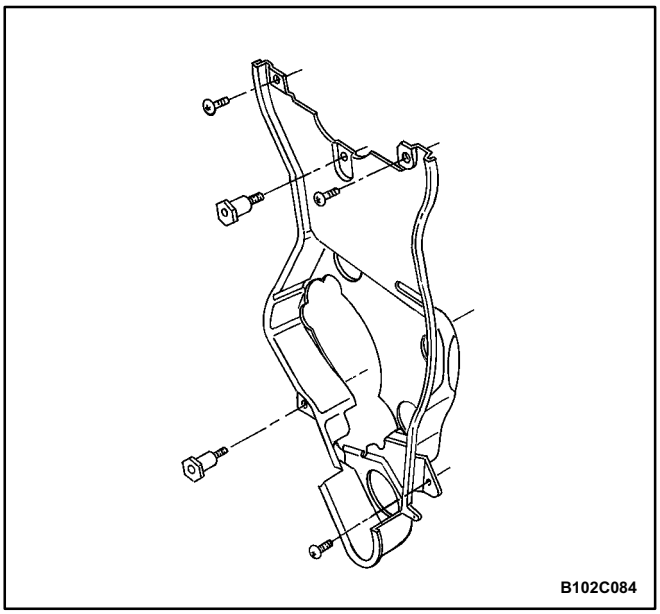

B102C052

Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

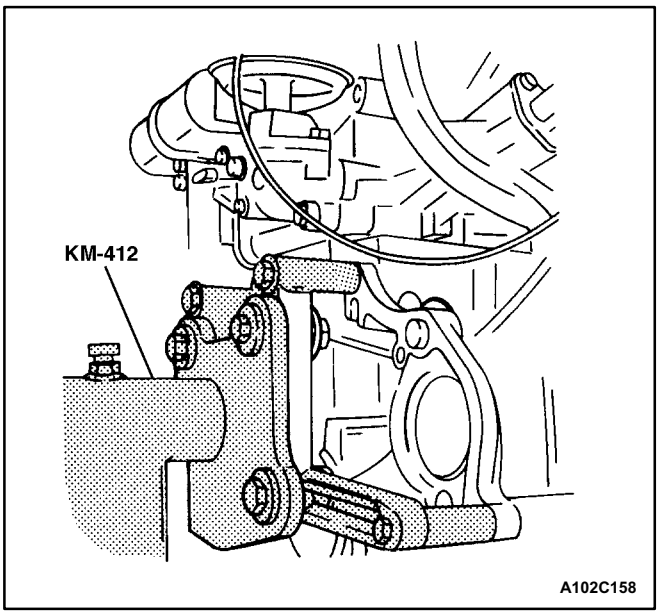
24. While holding the intake camshaft firmly in place, remove the intake camshaft bolt.
25. Remove the intake camshaft gear.
26. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft bolt.
27. Remove the exhaust camshaft gear.


C102C020

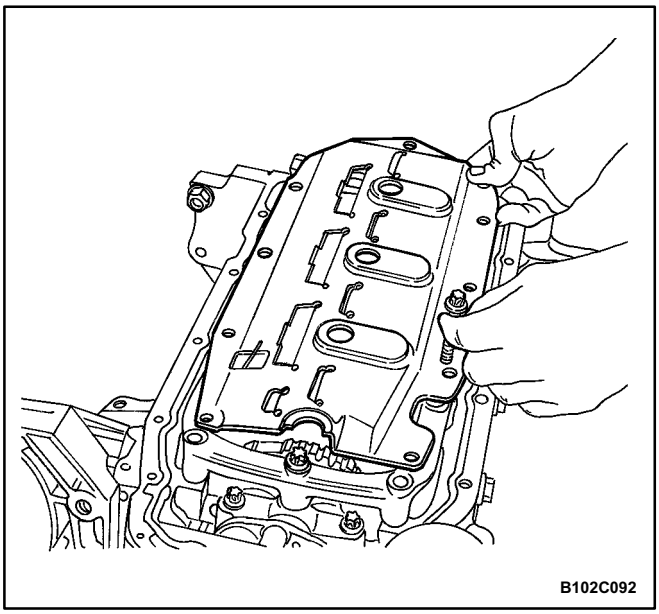
28. Remove the crankshaft timing belt gear.


B102C084

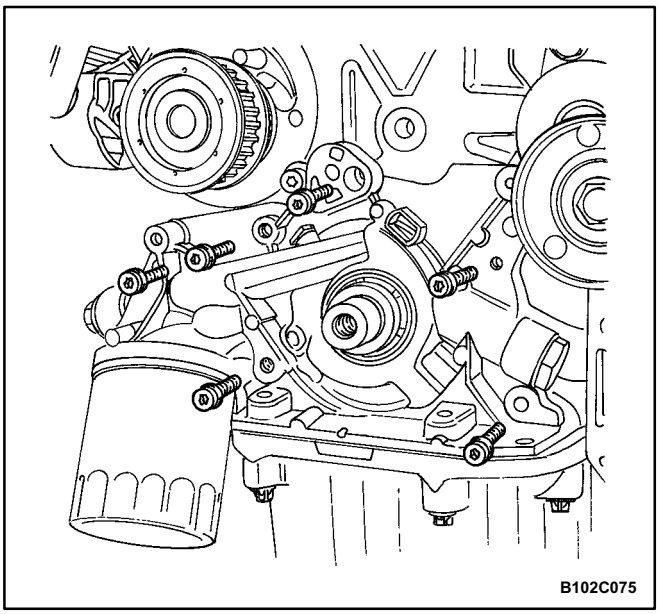
29. Remove the rear timing belt cover bolts and cover.



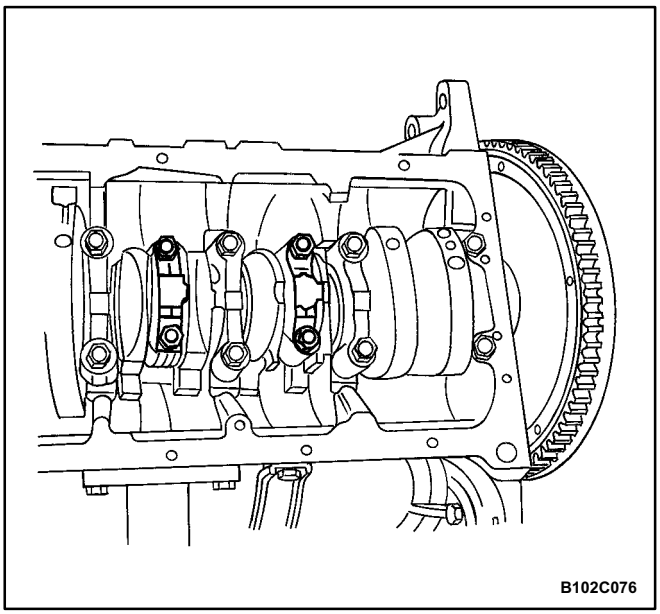
30. Rotate the engine on the engine overhaul stand KM-412.



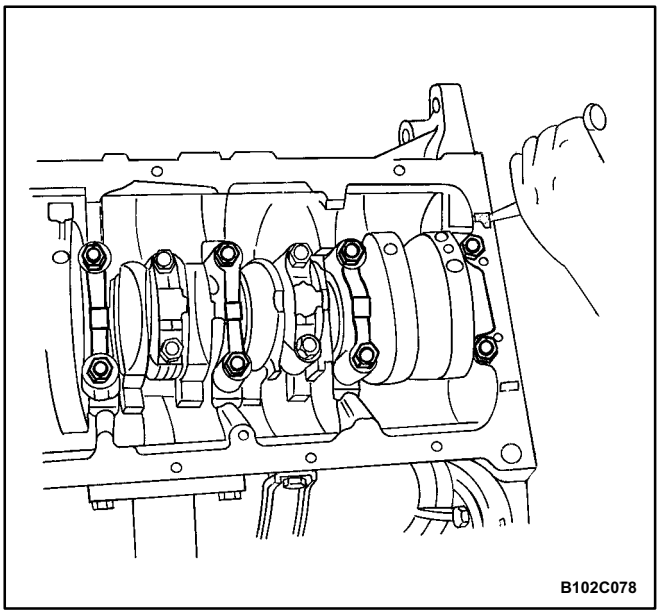
31. Remove the oil pan retaining bolts.
32. Remove the oil pan.
33. Remove the oil pump/pickup tube bolts.
34. Remove the oil pump/pickup tube.
35. Remove the lower block support bracket/splash shield bolts.
36. Remove the splash shield.
37. Remove the lower block support bracket bolts.
38. Remove the lower block support bracket.



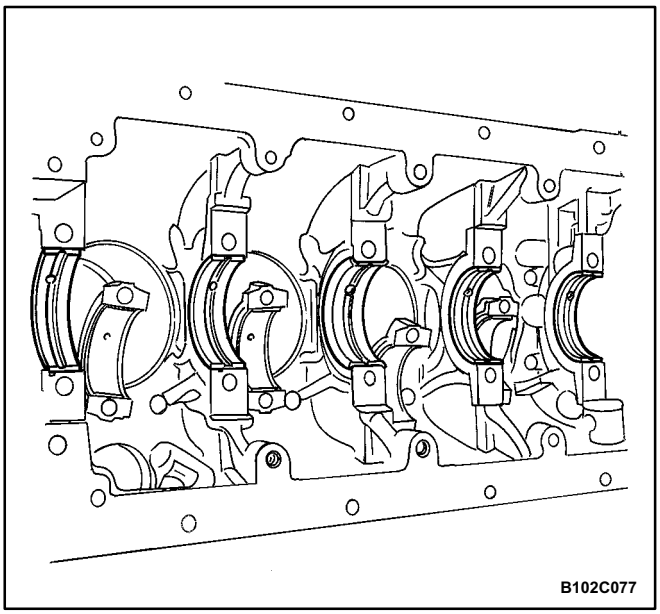
39. Remove the oil pump retaining bolts.
40. Remove the oil pump.


B102C076

41. Mark the order of the connecting rod bearing caps.
42. Remove the connecting rod bearing cap bolts for all of the pistons.
43. Remove the connecting rod bearing caps and the lower connecting rod bearings.


B102C078

44. Mark the order of the crankshaft bearing caps.
45. Remove the crankshaft bearing cap bolts.
46. Remove the crankshaft bearing caps and the lower crankshaft bearings.
47. Remove the crankshaft.
48. Clean any necessary parts.

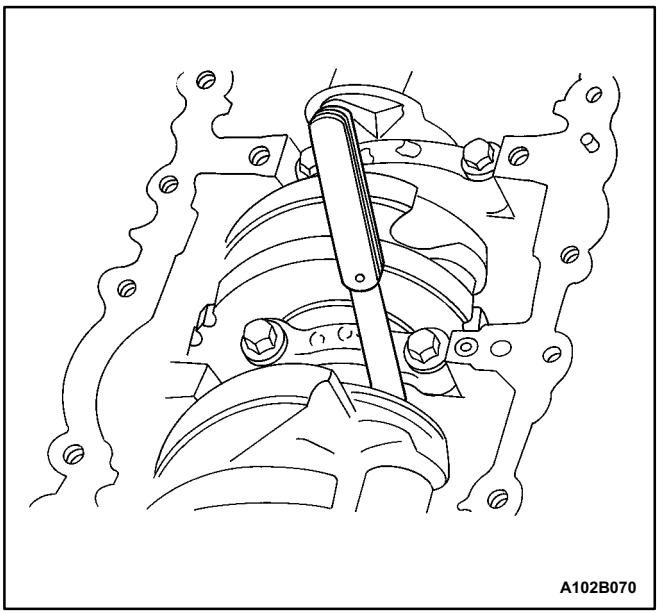

B102C077

Assembly Procedure

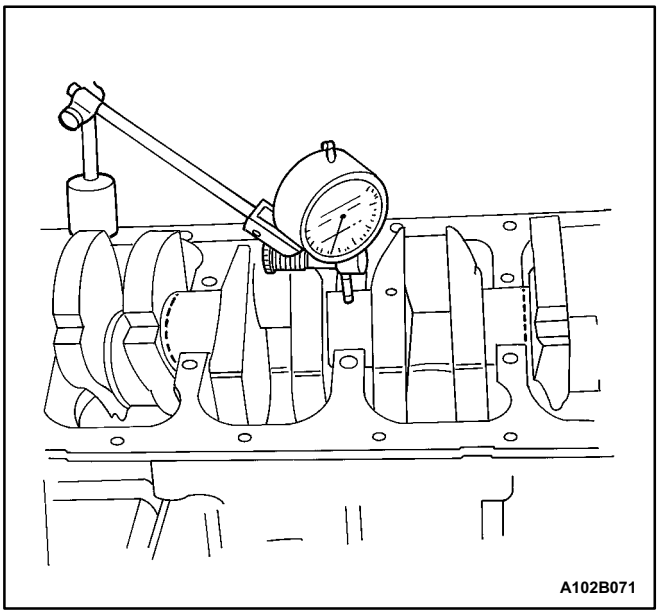
1. Coat the crankshaft bearings with engine oil.
2. If replacing the crankshaft, transfer the pulse pick-up sensor disc to the new crankshaft.

Tighten

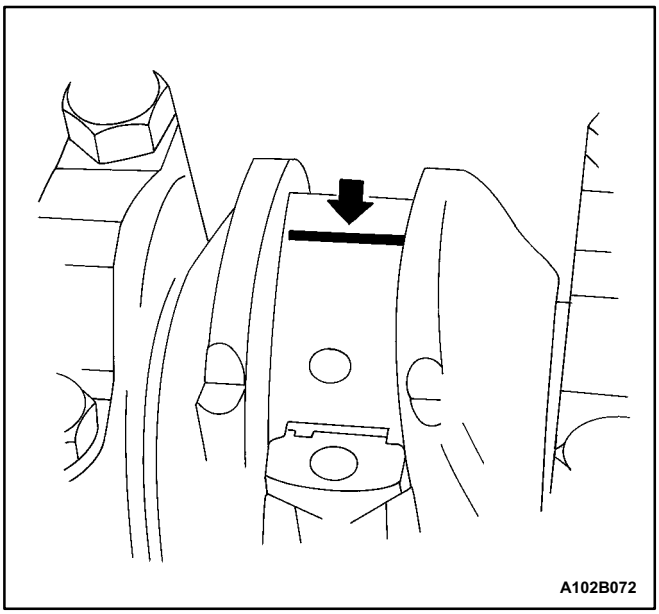
Tighten the pulse pickup sensor disc to 13 N•m (115 lb•in).


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

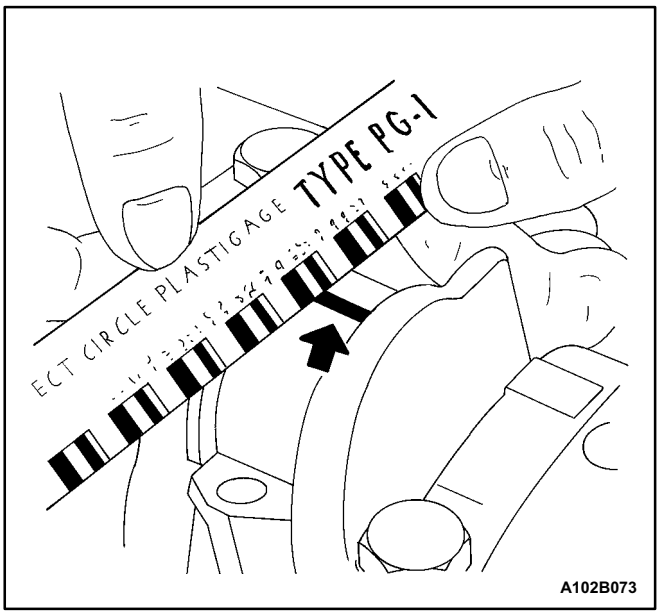

A102B072

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.

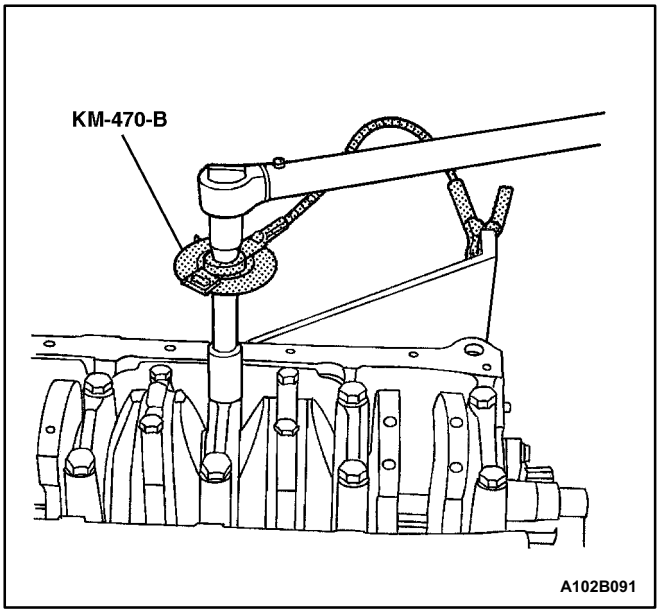
8. Inspect all of the crankshaft bearing clearances us-ing a commercially available plastic gauging (ductile plastic threads).
9. Cut the plastic gauging threads to the length of the bearing width. Lay them axially between the crank-shaft journals and the crankshaft bearings.
10. Install the crankshaft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

Tighten

Tighten the crankshaft bearing cap bolts to 50 N•m (37 lb•ft). Using the angular torque gauge KM-470 -B, tighten the bolt an additional turn of plus 45 degrees plus 15 degrees.



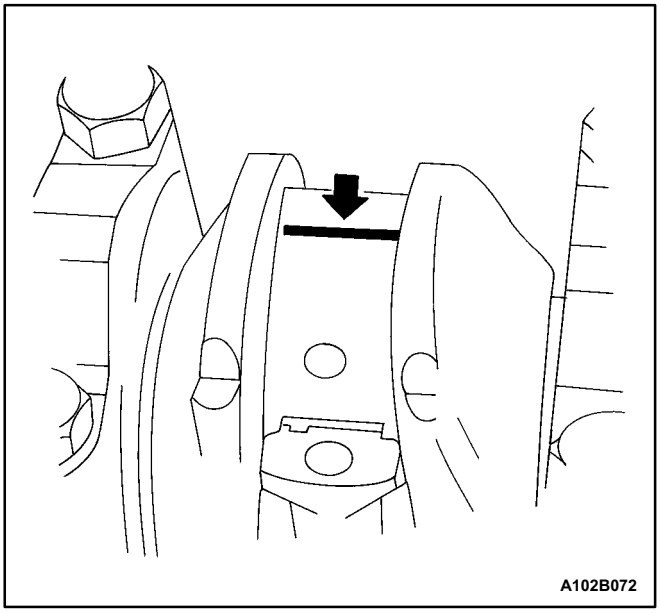
11. Remove the crankshaft bearing cap bolts and the caps.
12. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
13. Inspect the bearing clearance for permissible toler-ance ranges. Refer to "Engine Specifications" 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 50 N•m (37 lb•ft) using a torque wrench. Use the angular torque gauge KM-470-B to tighten the crankshaft bearings plus 45 degrees plus 15 degrees.

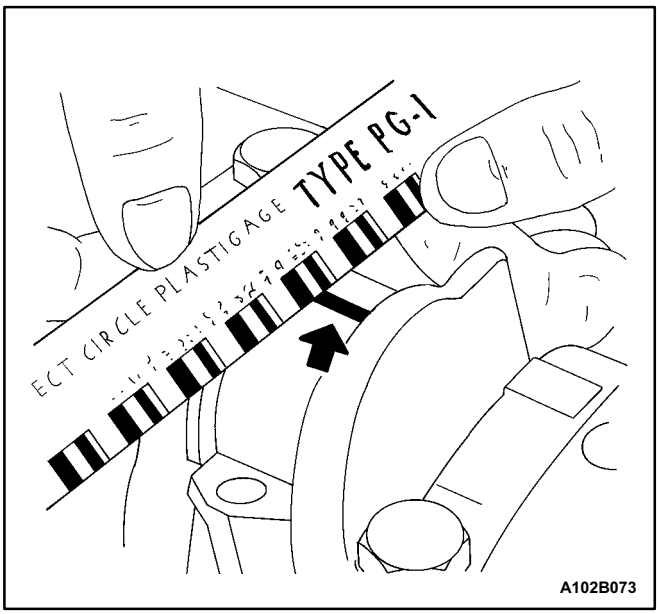


Important: Grease the connecting rod journals and lu-bricate the connecting rod bearings slightly so that the plastic gauging thread does not tear when the connect-ing rod bearing caps are removed.

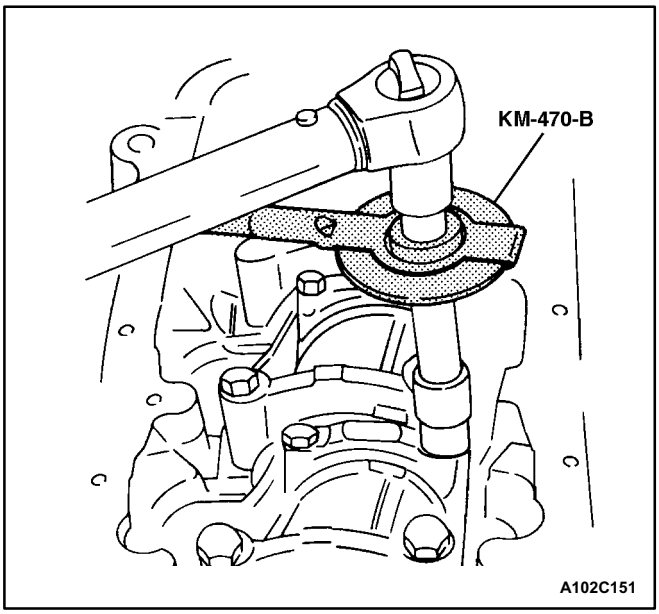
17. Inspect all of the connecting rod bearing clearances using a commercially available plastic gauging (ductile plastic threads).
18. Cut the plastic gauging threads to the length of the connecting rod bearing width. Lay them ax-ially between the connecting rod journals and the connecting rod bearings.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

Tighten

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



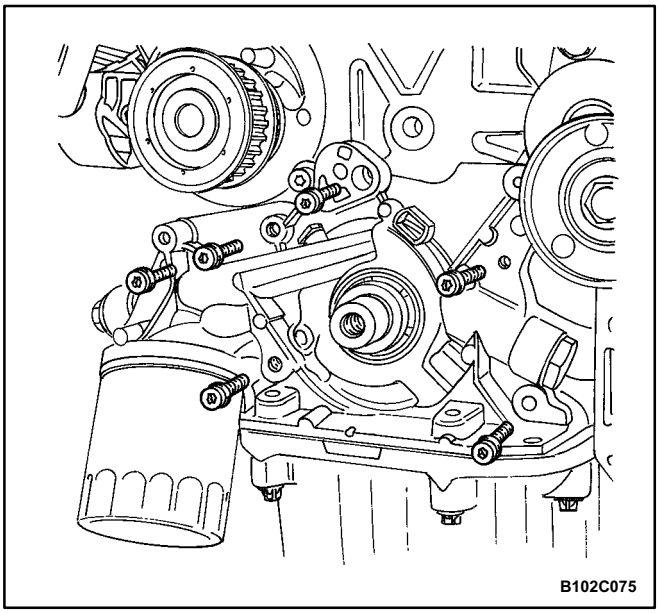
20. Remove the connecting rod bearing caps.
21. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
22. Inspect the bearing clearance for permissible toler-ance ranges. Refer to "Engine Specifications"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



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

Tighten

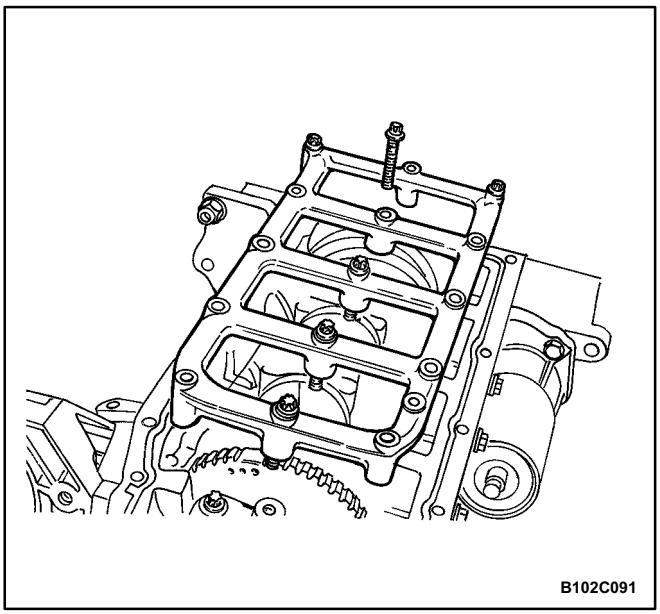
Tighten the connecting rod bearing cap bolts to 35 N•m (26 lb•ft) using a torque wrench. Use the angular torque gauge KM-470-B to tighten the connecting rod cap bolts to plus 45 degrees plus 15 degrees.



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).


B102C091

27. Install the lower block support bracket and bolts.

Tighten

Tighten the lower block support bolts to 35 N•m (26 lb•in).

28. Install the lower block support bracket splash shield and bolts.

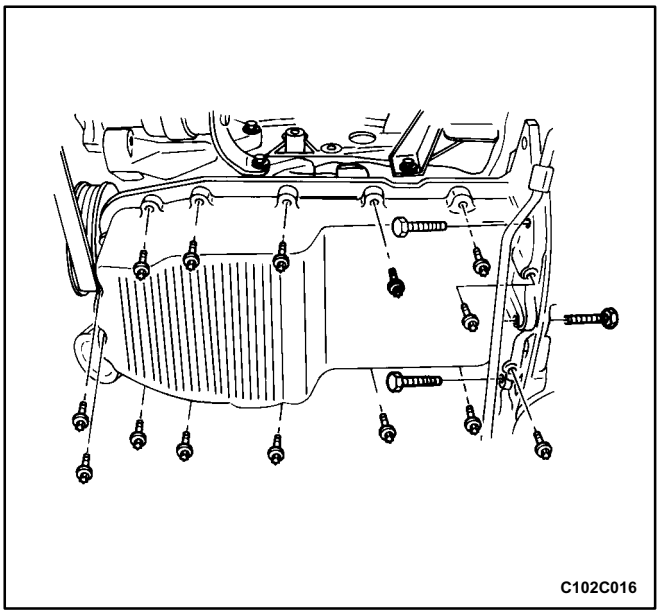
Tighten

Tighten the lower block support bracket and splash shield bolts to 35 N•m (26 lb•ft).

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

Tighten

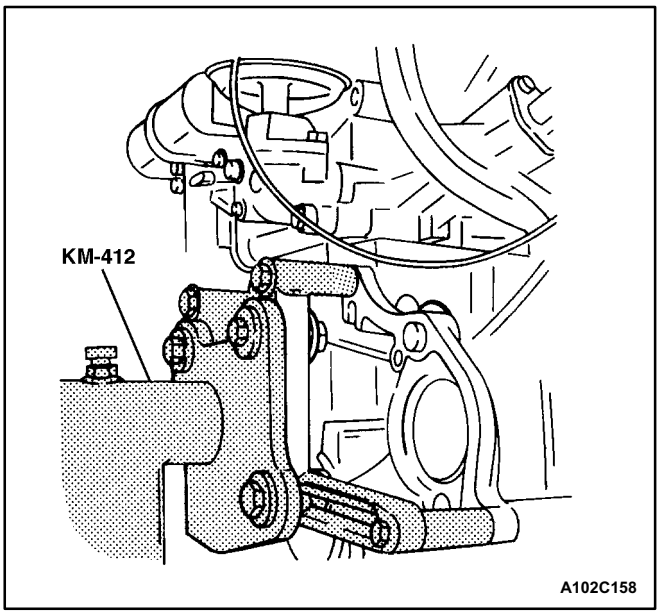
Tighten the oil pump/pickup tube bolts to 8 N•m (71 lb•in).


C102C016

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

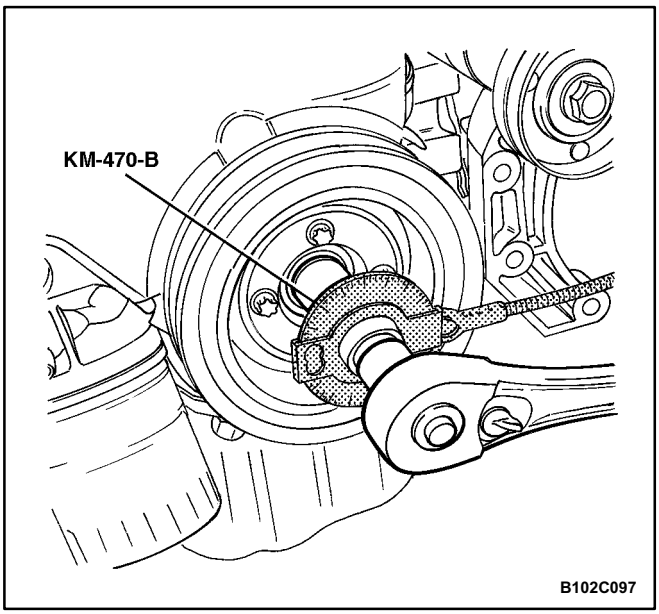
Tighten

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



A102C158

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



36. Install the rear timing belt cover.
37. Install the rear timing belt cover bolts.

Tighten

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

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

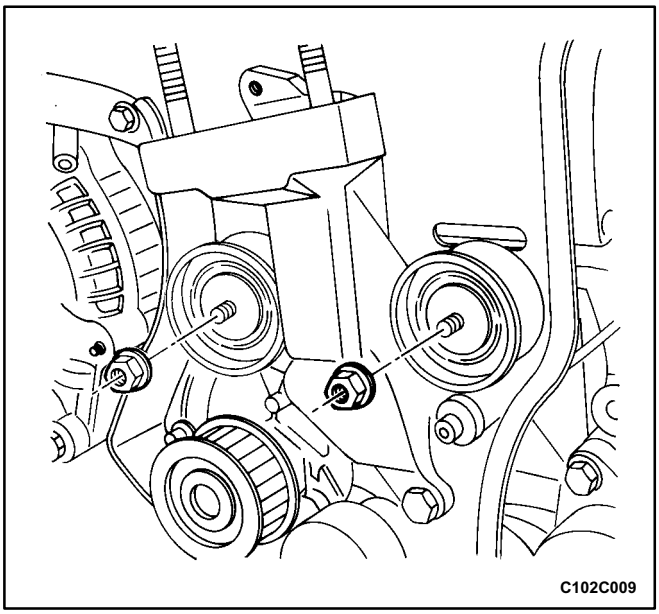
Tighten

Tighten the crankshaft timing belt drive gear bolt to 130 N•m (96 lb•ft) plus 40 degrees to 50 degress us-ing the torque angular gauge KM-470-B.

39 Install the engine mount and retaining bolts.

Tighten

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



40. Install the timing belt automatic tensioner.
41. Install the timing belt automatic tensioner bolts.

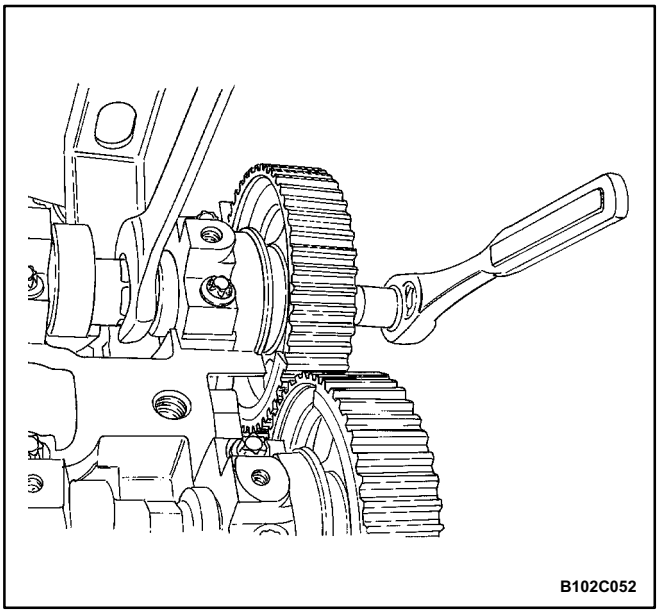
Tighten

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

42. Install the timing belt idler pulley.
43. Install the timing belt idler pulley nuts.

Tighten

Tighten the timing belt idler pulley nuts to 25 N•m (18 lb•ft).



Notice: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

44. Install the intake camshaft gear.
45. Install the intake camshaft gear bolt while holding the intake camshaft firmly in place.

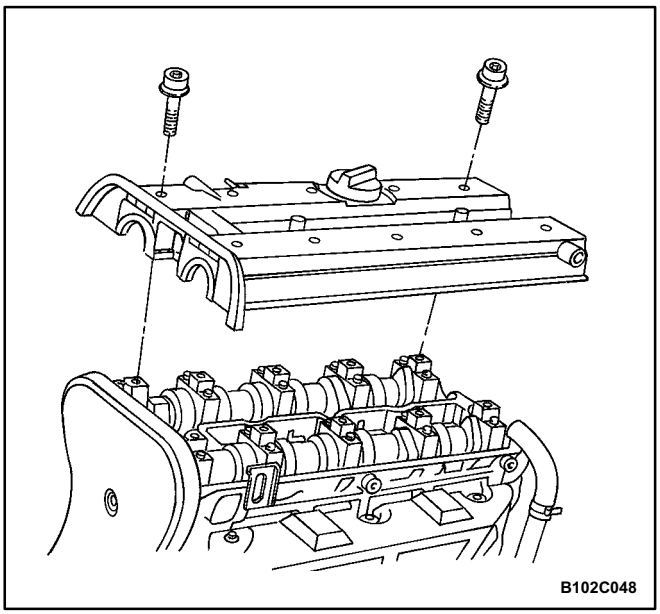
Tighten

Tighten the intake camshaft gear bolt to 50 N•m (37 lb•ft) plus 60 degrees and 15 degrees.

46. Install the exhaust camshaft gear.
47. Install the exhaust camshaft gear bolt while holding the exhaust camshaft firmly in place.

Tighten

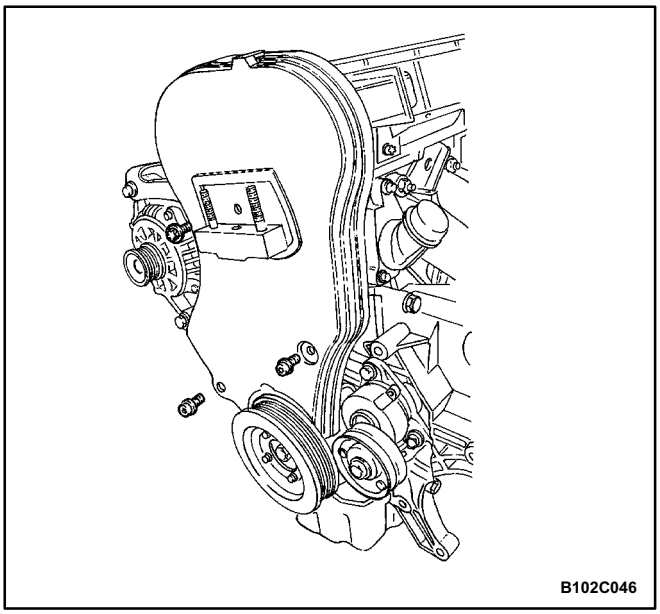
Tighten the exhaust camshaft gear bolt to 50 N•m (37 lb•ft) plus 60 degrees and 15 degrees.


B102C048

48. Install the timing belt. Refer to "Timing Belt" in this section.
49. Adjust the timing belt tension. Refer to "Timing Belt Check and Adjust" in this section.
50. Apply a small amount of gasket sealant to the cor-ners of the front camshaft caps and to the top of the rear valve cover to cylinder head seal.
51. Install the valve cover and the valve cover gasket.
52. Install the valve cover washers.
53. Install the valve cover bolts.

Tighten

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


B102C046

54. Connect the ignition wires to the spark plugs.
55. Install the spark plug cover.
56. Install the spark plug cover bolts.

Tighten

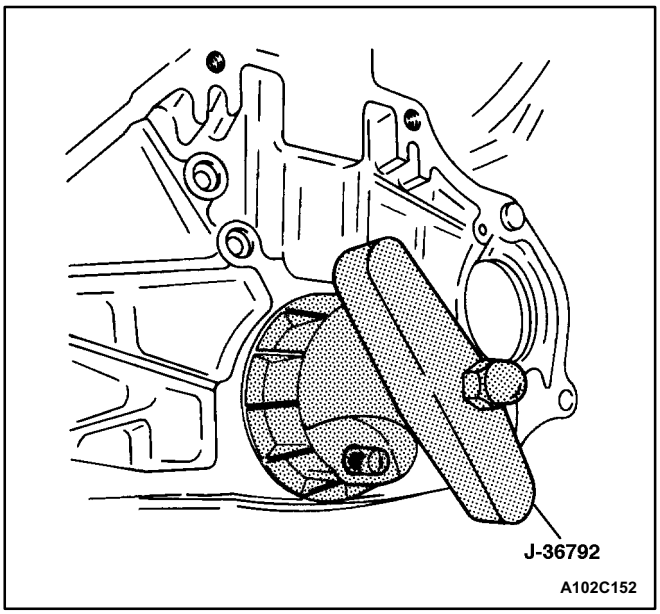
Tighten the spark plug cover bolts to 3 N•m (27 lb•in).

57. Connect the crankcase breather tube to the valve cover.
58. Install the front timing belt cover.
59. Install the front timing belt cover bolts.

Tighten

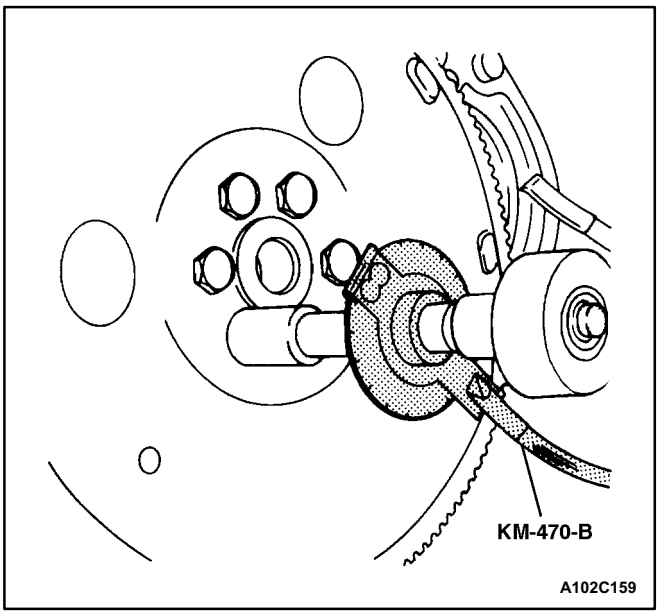
Tighten the front timing belt cover bolts to 8 N•m (71 lb•in).

60. Install the engine lifting device.
61. Remove the engine from the engine overhaul stand KM-412.



A102C152

62. Install a new crankshaft rear oil seal using installer J-36972 (or KM-635).

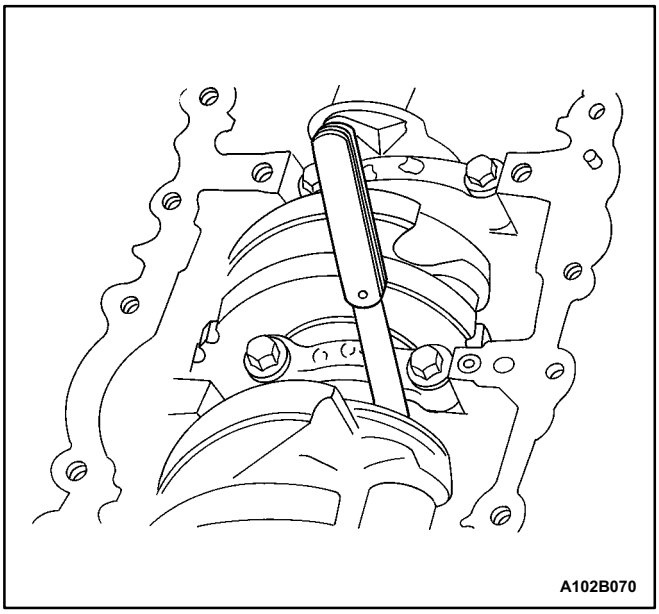


63. Install the flywheel or flexible plate.
64. Install the flywheel or the flexible plate bolts.

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 to 30 degrees plus 15 degrees. For the automatic transmission, tighten the flexible plate bolts to 65 N•m (48 lb•ft).

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



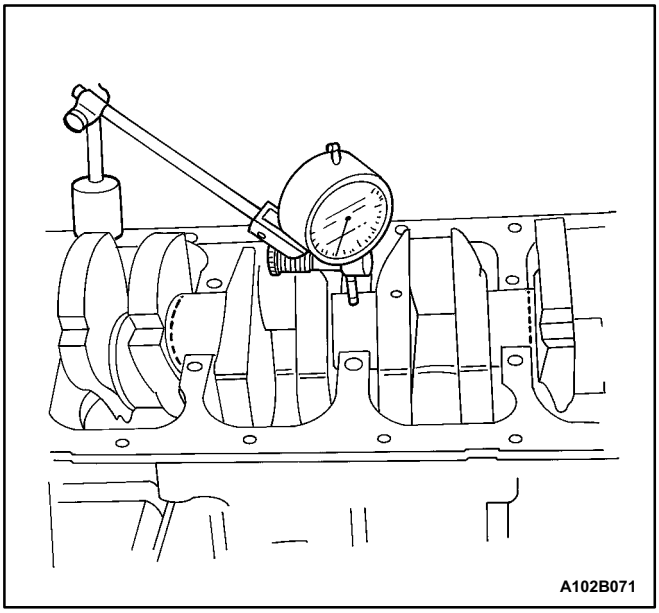
CRANKSHAFT BEARINGS AND CONNECTING ROD BEARINGS - GAUGING PLASTIC

Tools Required

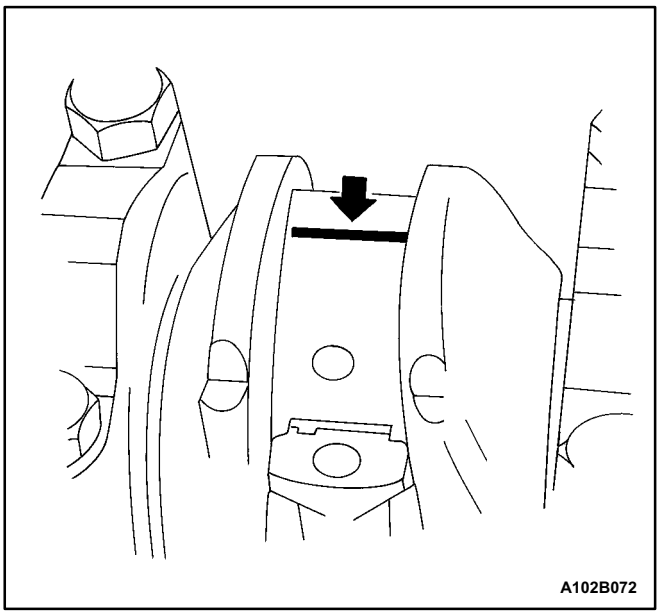
KM-470-B Angular Torque Gauge

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 crank-shaft 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.

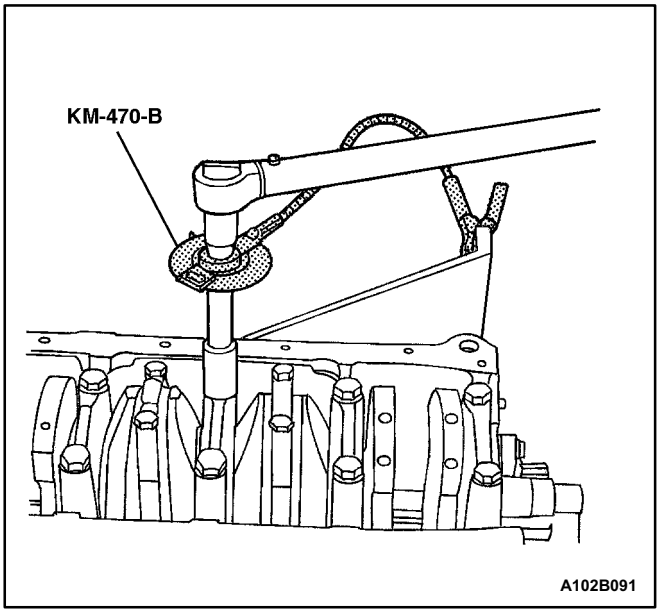


7. With the crankshaft mounted on the front and rear crankshaft bearings, check the middle crankshaft journal for permissible out-of-round (runout). Refer to "Engine Specifications" in this section.


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 crank-shaft journals and the crankshaft bearings.

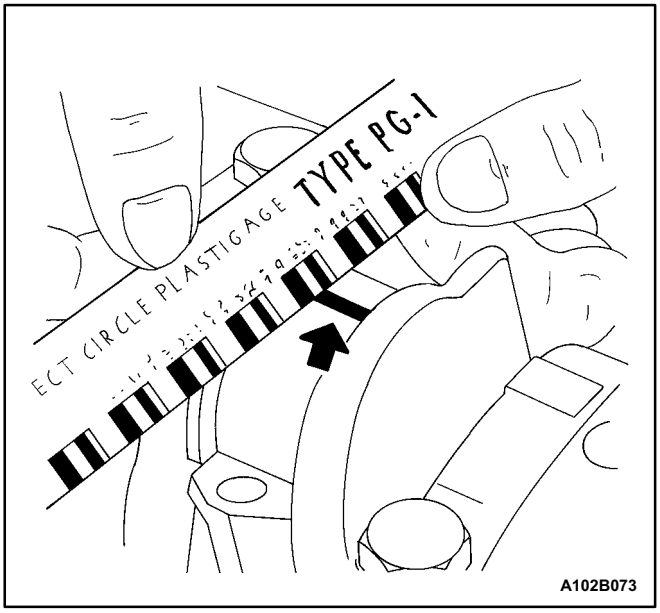


A102B091

10. Install the crankshaft bearing caps.
11. Install the crankshaft bearing cap bolts.

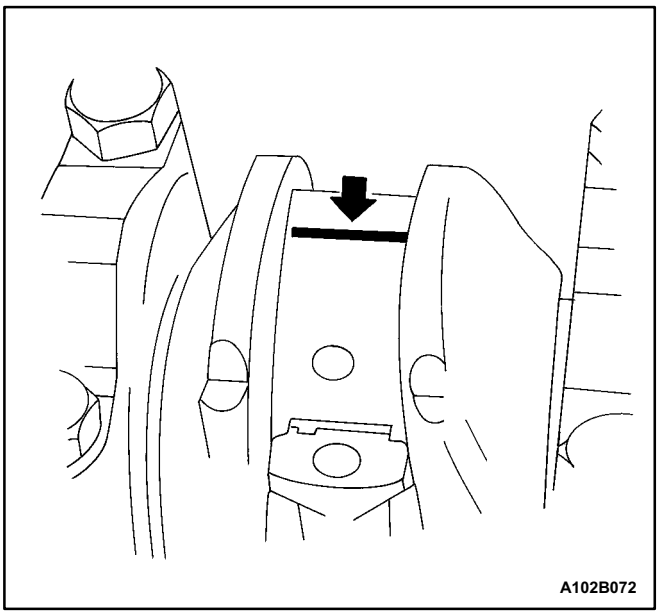
Tighten

Tighten the crankshaft bearing cap bolts to 50 N•m (37 lb•ft). Using the angular torque gauge KM-470-B, tighten the crankshaft bearing cap bolts to plus 45 de-grees plus 15 degrees.



A102B073

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

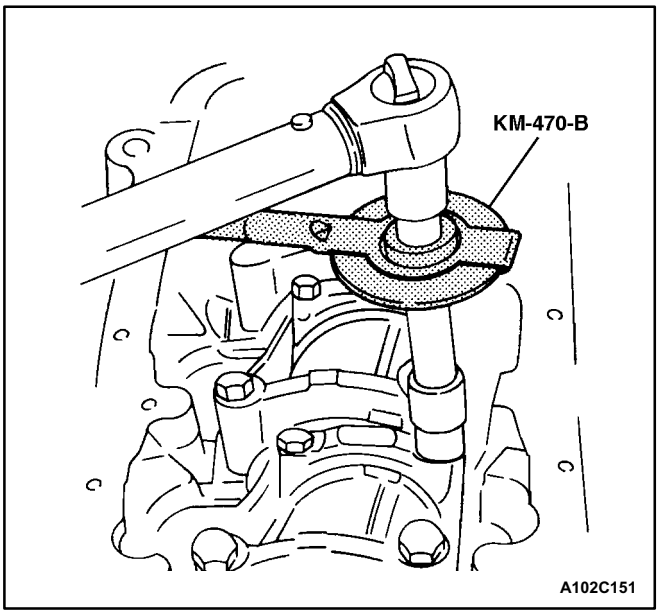

A102B072

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 lu-bricate the connecting rod bearings slightly so that the plastic gauging thread does not tear when the connect-ing 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.

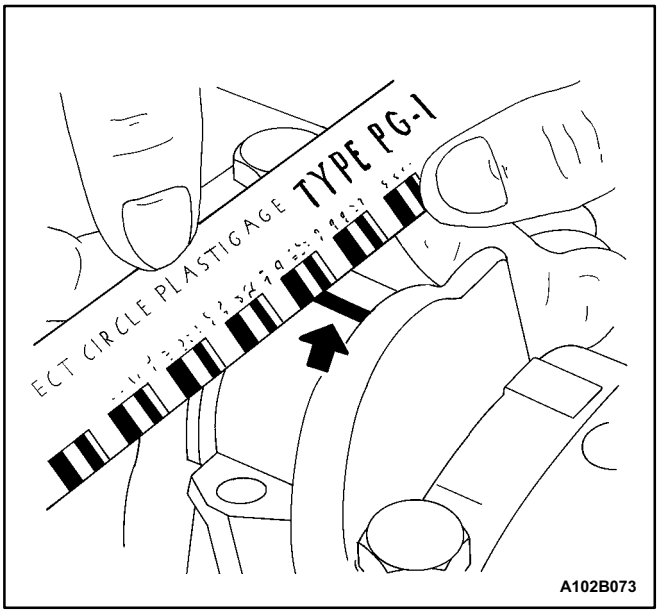


A102C151

6. Install the connecting rod bearing caps.
7. 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 connecting rod cap bolts to plus 45 degrees plus 15 degrees.



A102B073

8. Remove the connecting rod bearing caps.
9. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
10. Inspect the bearing clearance for permissible toler-ance 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 cross-flow intake and exhaust ports. A spark plug is located in the center of each combustion chamber. The cylinder head houses the dual camshafts.

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 dual overhead camshafts and keeps them 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. There are two idler pulleys. An automatic tensioner pulley maintains the timing belt's correct ten-sion. The timing belt is made of a tough reinforced rub-ber 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 other engine components. When the crank-shaft 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 nar-rows.

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 by-pass 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 cyl-inder block. The engine oil pan houses the crankcase and is made of cast aluminum.

Engine oil is pumped from the oil pan by the oil pump. After it passes through the oil filter, it is fed through two paths to lubricate the cylinder block and cylinder head. In one path, the oil is pumped through oil passages in the crankshaft to the connecting rods, then to the pis-tons and 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 pas-sageways in the camshafts to lubricate the valve as-semblies before draining back to the oil pan.

EXHAUST MANIFOLD

A single fourport, reartakedown manifold is used with this engine. The manifold is designed to direct es-caping exhaust gases out of the combustion chambers with aminimum of back pressure. 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 en-gine torque at low and moderate speeds.

CAMSHAFTS

This engine is a dual overhead camshaft (DOHC) type, which means there are two camshafts. One camshaft operates the intake valves, and the other camshaft op-erates the exhaust valves. The camshafts sit in journals on the top of the engine (in the cylinder head) and are held in place by camshaft caps. The camshaft journals of the cylinder head are drilled for oil passages. Engine oil travels to the camshafts under pressure where it lu-bricates each camshaft journal. The oil returns to the oil pan through drain holes in the cylinder head. The cam-shaft lobes are machined into the solid camshaft to pre-cisely 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 es-caping from the camshaft journals.

EXHAUST GAS RECIRCULATION VALVE

The exhaust gas recirculation (EGR) system is used to lower oxides of nitrogen (NOX) emission levels caused by high combustion temperature. The main element of the system is the EGR valve operated by

The EGR valve feeds small amounts of exhaust gas into the intake manifold to decrease combustion tempera-ture. The amount of exhaust gas recirculated is con-trolled by variations in vacuum and exhaust back pressure. If too much exhaust gas enters, combustion will not take place. For this reason, very little exhaust gas is allowed to pass through the valve, especially at idle.

The EGR valve is usually open under the following con-ditions:

- Warm engine operation.
- Above idle speed.