
SECTION 1B

SOHC ENGINE MECHANICAL

CAUTION Do not throw or drop any tools or parts from a vehicle or work area. To do so could cause injury or damage. Do not use tools or parts that are damaged or worn. Do not use tools or parts that are not specified in this manual. Do not use tools or parts that are not approved by the manufacturer. Do not use tools or parts that are not approved by the manufacturer.

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1B - 2 SOHC ENGINE MECHANICAL

SPECIFICATIONS

ENGINE SPECIFICATIONS

Application	Description (Manual and Automatic)
General Data:	
Engine Type	4 Cylinder (In-Line)
Displacement:	
1.3 SOHC	1 349 cm ³ (82.30 in ³)
1.5 SOHC	1 498 cm ³ (91.44 in ³)
Bore Stroke:	
1.3 SOHC	76.5 x 73.4 mm (3.01 in. x 2.89 in.)
1.5 SOHC	76.5 X 81.5 mm (3.01 in. X 3.21 in.)
Compression Ratio	9.5 \$ 0.2:1
Firing Order	1 - 3 - 4 - 2
Cylinder Bore:	
Diameter	76.5 mm (3.01 in.)
Out of Round (Maximum)	0.0065 mm (0.00025 in.)
Taper (Maximum):	
1.3 SOHC	0
1.5 SOHC	0.0065 mm (0.00025 in.)
Piston:	
Diameter	76.470 mm (3.01 in.)
Clearance to Bore	0.030 mm (0.0012 in.)
Piston Rings:	
Ring, End Gap:	
Top Compression	0.3 mm (0.019 in.)
2nd Compression	0.3 mm (0.019 in.)
Groove Clearance:	
Top Impression	0.02 mm (0.0008 in)
2nd Impression	0.02 mm (0.0008 in.)
Piston Pin:	
Diameter	18.000 mm (0.708 in.)
Pin Off-Set	0.5X 0.7 mm (0.019X 0.027 in.)
Camshaft:	
Lift Intake:	
1.3 SOHC	5.61 mm (0.220 in.)
1.5 SOHC	6.12 mm (0.240 in.)
Lift Exhaust	6.12 mm (0.240 in.)
End Play	0.09X 0.21 mm (0.0035X 0.0082 in.)
Journal OD:	
No. 1	39.445 mm (1.552 in.)
No. 2	39.700 mm (1.562 in.)
No. 3	39.945 mm (1.572 in.)
No. 4	40.200 mm (1.582 in.)
No. 5	40.445 mm (1.592 in.)

ENGINE SPECIFICATIONS (Cont'd)

Application	Description (Manual and Automatic)
Bearing OD:	
No. 1	39.500 mm (1.555 in.)
No. 2	39.750 mm (1.564 in.)
No. 3	40.000 mm (1.574 in.)
No. 4	40.250 mm (1.584 in.)
No. 5	40.500 mm (1.594 in.)
Crankshaft:	
Main Journal:	
Diameter (All)	54.982X 54.994 mm (2.164X 2.165 in.)
Taper (Maximum)	0.005 mm (0.0001 in.)
Out of Round (Maximum)	0.004 mm (0.0001 in.)
Main Bearing Clearance (All)	0.005 mm (0.0001 in.)
Crankshaft End Play	0.1 mm (0.003 in.)
Connecting Rod Journal:	
Diameter (All)	42.971X 42.987 mm (1.691X 1.692 in.)
Taper (Maximum)	0.005 mm (0.0001 in.)
Out of Round (Maximum)	0.004 mm (0.0001 in.)
Rod Bearing Clearance (All)	0.019X 0.070 mm (0.0007X 0.0027 in.)
Rod Side Clearance	0.070X 0.242 mm (0.0027X 0.009 in.)
Valve System:	
Valve Lash Compensators	Hydraulic
Face Angle (All)	46°
Seat Angle (All)	46°
Seat Runout (Maximum, All)	0.03 mm (0.019 in.)
Face Runout (Maximum, All)	0.03 mm (0.019 in.)
Seat Width:	
Intake	1.3X 1.5 mm (0.051X 0.059 in.)
Exhaust	1.6X 1.8 mm (0.063X 0.071 in.)
Valve Guide Inside Diameter (All)	7.030X 7.050 mm (0.276X 0.277 in.)
Valve Stem Diameter (All)	7 mm (0.275 in.)
Valve Diameter (All):	
Intake	38.0" 0.15 mm (1.49" 0.0059 in.)
Exhaust	31.0" 0.15 mm (1.22" 0.0059 in.)
Valve Spring Loads:	
Valve Open	625" 25 N (461" 18 lbs) @ 21.5 mm (0.846 in.)
Valve Closed	275" 15 N (202" 11 lbs) @ 31.5 mm (1.240 in.)
Oil Pump:	
Gap Between Oil Pump Body and Out Rotor	0.400X 0.484 mm (0.0157X 0.0191 in.)
Out Rotor Side Clearance	0.045X 0.100 mm (0.0018X 0.0039 in.)
Inner Rotor Side Clearance	0.035X 0.085 mm (0.0014X 0.0033 in.)
Relief Valve Spring Free Length	81 mm (3.2 in.)

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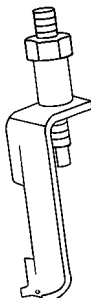
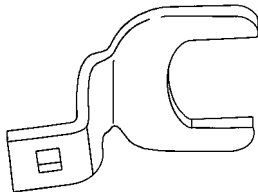
FASTENER TIGHTENING SPECIFICATIONS

Application	NSm	Lb-Ft	Lb-In
A/C Compressor Hose Assembly Retaining Bolt	33	24	-
A/C Compressor Mounting Bolts	27	20	-
A/C Compressor Mounting Bracket Bolts	50	36	-
Air Filter Housing Bolts	12	-	106
Alternator Adjusting Bolt	20	15	-
Alternator Adjusting Bracket Retaining Bolt	20	15	-
Camshaft Gear Bolt	45	33	-
Camshaft Pressure Plate Bolts	10	-	89
Connecting Rod Bearing Cap Bolts	25 + 30_ + 15_	18 + 30_ + 15_	-
Coolant Pump Retaining Bolts	10	-	89
Coolant Temperature Sensor	20	15	-
Crankshaft Bearing Cap Bolts	50 + 45_ + 15_	37 + 45_ + 15_	-
Crankshaft Pulley Bolt	95 + 30_ + 15_	70 + 30_ + 15_	-
Crankshaft Position Sensor Retaining Bolt	10	-	89
Cylinder Head Bolts (Camshaft Support Housing & Cylinder Head Mounting Bolts)	25 + 60_ + 60_ + 60_ + 10_	18 + 60_ + 60_ + 60_ + 10_	-
DIS Ignition Coil Mounting Bolts	10	-	89
DIS Ignition Coil Mounting Plate Bolts	10	-	89
Engine Lift Bracket Bolt	25	18	-
Engine Mount Attaching Nuts	40	30	-
Engine Mount Bracket Retaining Bolts	60	44	-
Engine Mount Bracket-to-Engine Mount Retaining Bolts	60	44	-
Exhaust Flex Pipe Bracket Bolts	40	30	-
Exhaust Flex Pipe-to-Catalytic Converter or Connecting Pipe Retaining Nuts	30	22	-
Exhaust Flex Pipe-to-Exhaust Manifold Retaining Nuts	40	30	-
Exhaust Manifold Heat Shield Bolts	15	11	-
Exhaust Manifold Nuts	25	18	-
Flexible Plate Bolts	60	44	-
Flexible Plate Inspection Cover Bolts	10	-	89
Flywheel Bolts	35 + 30_ + 15_	25 + 30_ + 15_	-
Flywheel Inspection Cover Bolts	12	-	106
Fuel Rail Retaining Bolts	25	18	-
Intake Manifold Retaining Nuts	25	18	-
Intake Manifold Support Bracket Retaining Bolts	22	16	-
Lower Timing Belt Cover Bolts	10	-	89

FASTENER TIGHTENING SPECIFICATIONS (Cont'd)

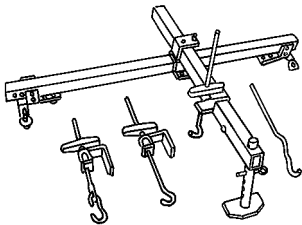
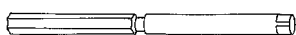
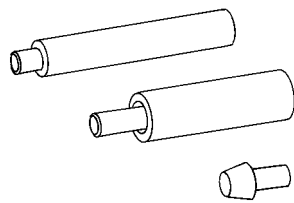
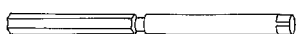
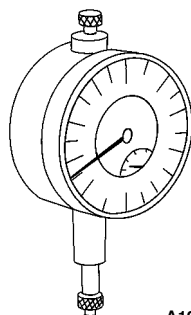
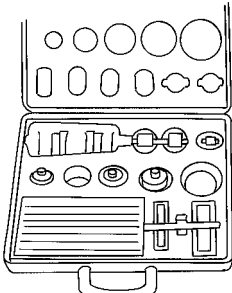
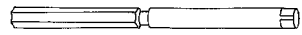
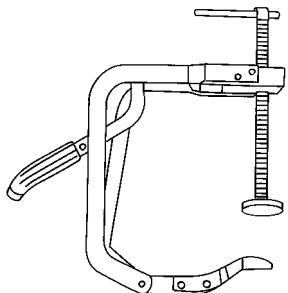
Application	NSm	Lb-Ft	Lb-In
Oil Pan Retaining Bolts	10	-	89
Oil Pan Drain Plug	55	41	-
Oil Pressure Switch	40	30	-
Oil Pump Retaining Bolts	10	-	89
Oil Pump/Pickup Tube and Support Bracket Bolts	10	-	89
Oil Pump Safety Relief Valve	30	22	-
Oil Pump Rear Cover Bolts	6	-	53
Power Steering Pump Mounting Bolts	25	18	-
Power Steering Pump Pulley Bolts	25	18	-
Rear Timing Belt Cover Bolts	10	-	89
Right Transaxle Brace Bolts	60	45	-
Spark Plugs	25	18	-
Thermostat Housing Mounting Bolts	20	15	-
Throttle Cable Bracket Bolts	8	-	71
Timing Belt Automatic Tensioner Bolt	20	15	-
Transaxle Bell Housing Bolts	75	55	-
Transaxle Torque Converter Bolts	45	33	-
Upper Timing Belt Cover Bolts	10	-	89
Valve Cover Bolts	10	-	89

SPECIAL TOOLS**SPECIAL TOOLS TABLE**

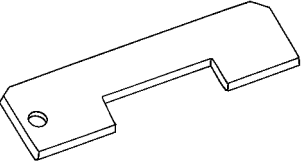
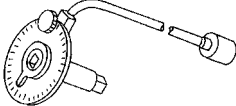
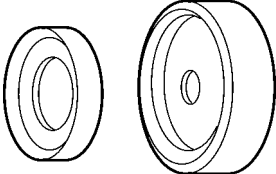
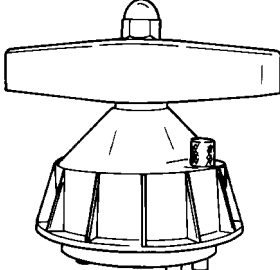
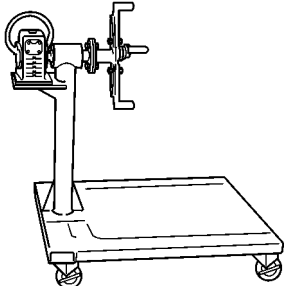
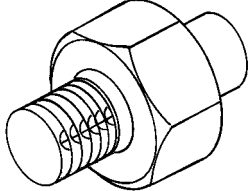
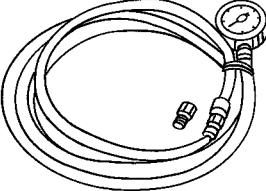
 <p>A102B150</p>	<p>KM-565-A Valve Spring Compressor</p>	 <p>A102B151</p>	<p>J-42492 Timing Belt Adjuster</p>
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SPECIAL TOOLS TABLE (Cont'd)

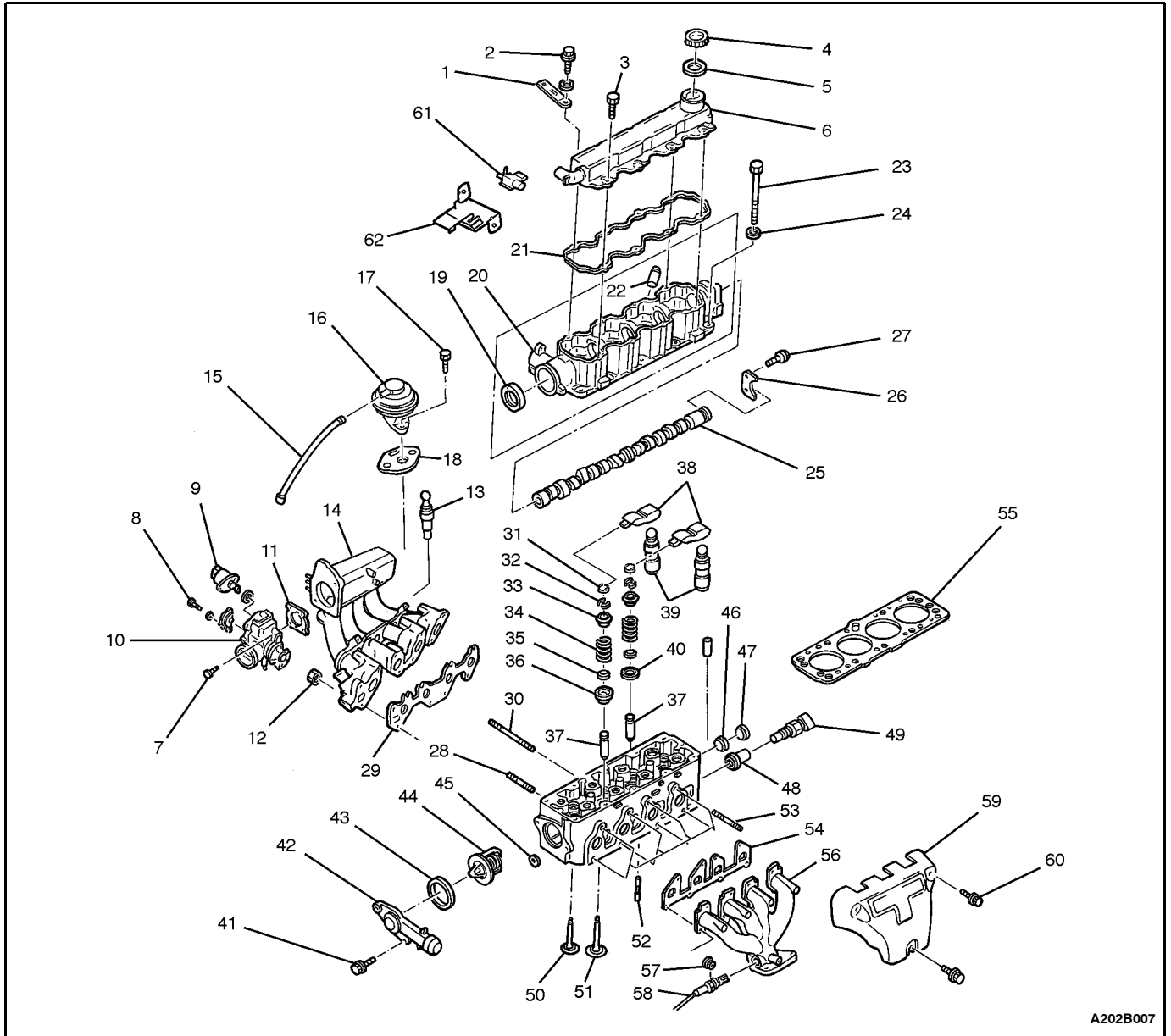
 <p>A102B152</p>	<p>J-28467-B Engine Assembly Support Fixture</p>	 <p>A102B155</p>	<p>KM-254 Valve Guide Reamer</p>
 <p>A102B153</p>	<p>KM-427 Piston Pin Service Set</p>	 <p>A102B155</p>	<p>KM-255 Valve Guide Reamer</p>
 <p>A102B154</p>	<p>MKM-571-B Gauge</p>	 <p>A102B156</p>	<p>KM-340-0 Cutter Set Includes: KM-340-7 KM-340-13 KM-340-26</p>
 <p>A102B155</p>	<p>KM-253 Valve Guide Reamer</p>	 <p>A102B157</p>	<p>KM-348 Valve Spring Compressor</p>

SPECIAL TOOLS TABLE (Cont'd)

 <p>A102B158</p>	<p>KM-419 Distance Gauge</p>	 <p>A102B161</p>	<p>KM-470-B Angular Torque Gauge</p>
 <p>A102B160</p>	<p>KM-635 Crankshaft Rear Oil Seal Installer</p>	 <p>A102C155</p>	<p>J-36972 Crankshaft Rear Oil Seal Installer</p>
 <p>A102B159</p>	<p>MKM-412 Engine Overhaul Stand</p>	 <p>B102C044</p>	<p>KM-135 Adapter</p>
 <p>A202B005</p>	<p>KM-498-B Pressure Gauge</p>		

COMPONENT LOCATOR

UPPER END

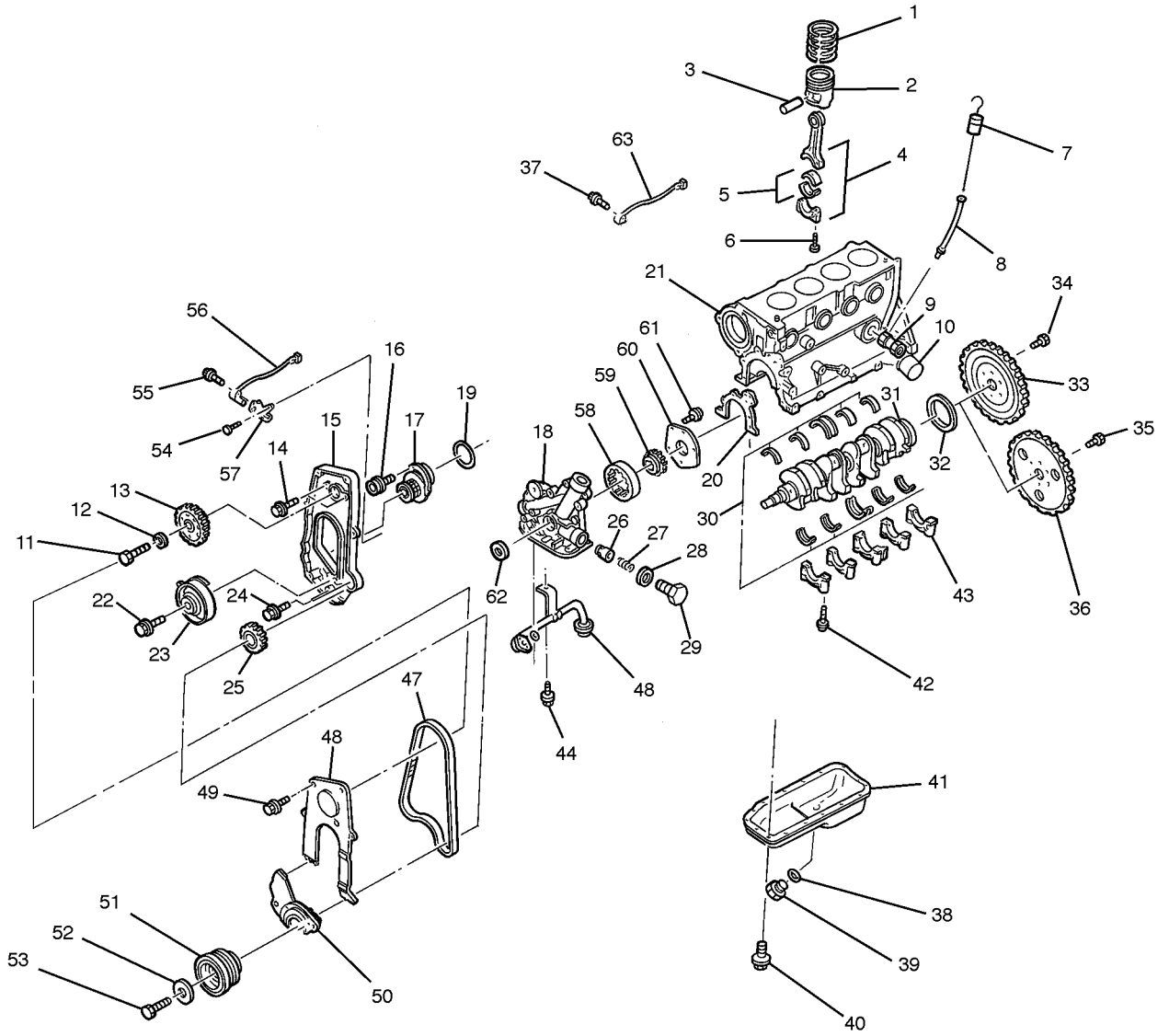


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|--------------------------------------|----------------------------------|
| 1 Wiring Bracket | 32 Valve Key |
| 2 Bolt | 33 Valve Spring Plate |
| 3 Bolt | 34 Valve Spring |
| 4 Cap, Bayonet Joint | 35 Valve Stem Seal |
| 5 Seal, Bayonet Cap | 36 Exhaust Valve Spring Seat |
| 6 Valve Cover | 37 Valve Guide |
| 7 Bolt | 38 Cam Follower |
| 8 Throttle Position Sensor | 39 Cam Follower Lifter |
| 9 Idle Air Control Valve | 40 Intake Valve Spring Seat |
| 10 Throttle Body | 41 Bolt |
| 11 Throttle Body Gasket | 42 Thermostat Housing |
| 12 Nut | 43 Thermostat Housing Seal Ring |
| 13 Engine Coolant Temperature Sensor | 44 Thermostat |
| 14 Intake Manifold | 45 Screw Plug |
| 15 Vacuum Tube | 46 Oil Duct Cap |
| 16 EGR Valve | 47 Oil Duct Cap |
| 17 Bolt | 48 Adapter |
| 18 EGR Gasket | 49 Coolant Temperature Sensor |
| 19 Shaft Seal Ring | 50 Exhaust Valve |
| 20 Camshaft Support | 51 Intake Valve |
| 21 Valve Cover Gasket | 52 Cylinder Head Oil Duct Sleeve |
| 22 Tube | 53 Bolt-Stud |
| 23 Cylinder Head Bolt | 54 Exhaust Manifold Gasket |
| 24 Washer | 55 Cylinder Head Gasket |
| 25 Camshaft | 56 Exhaust Manifold |
| 26 Camshaft Pressure Plate | 57 Nut |
| 27 Bolt | 58 Exhaust Oxygen Sensor |
| 28 Bolt-Stud | 59 Exhaust Manifold Heat Shield |
| 29 Intake Manifold Gasket | 60 Bolt |
| 30 Bolt-Stud | 61 EGR Solenoid |
| 31 Valve Thrust Piece | 62 Bracket |
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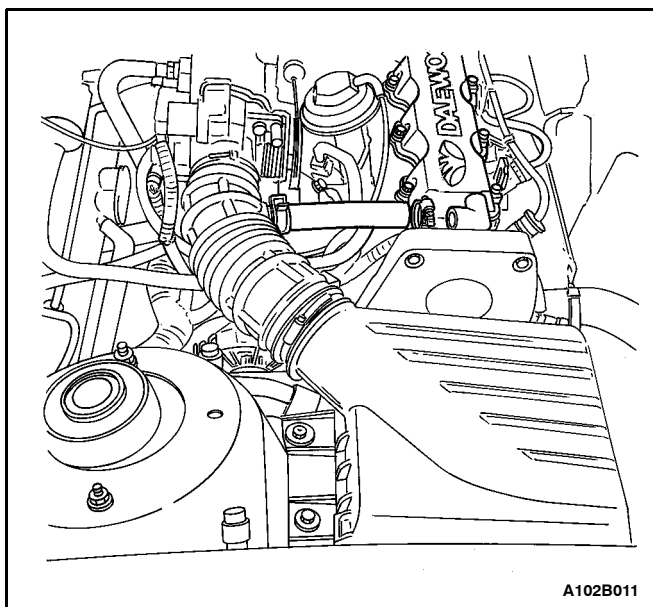
1B-10 SOHC ENGINE MECHANICAL

LOWER END



A202B006

- | | |
|----------------------------------|-------------------------------------|
| 1 Piston Ring Seat | 33 Flywheel (Manual Transaxle) |
| 2 Piston | 34 Bolt (Manual Transaxle) |
| 3 Piston Pin | 35 Bolt (Automatic Transaxle) |
| 4 Connecting Rod | 36 Flex Plate (Automatic Transaxle) |
| 5 Connecting Rod Bearing Set | 37 Bolt |
| 6 Connecting Rod Bolt | 38 Threaded Ring |
| 7 Oil Level Gauge Stick | 39 Drain Plug |
| 8 Gauge Stick Tube | 40 Bolt |
| 9 Connecting Piece | 41 Oil Pan |
| 10 Oil Filter | 42 Main Bearing Cap Bolt |
| 11 Camshaft Pulley Bolt | 43 Main Bearing |
| 12 Washer | 44 Bolt |
| 13 Camshaft Gear | 45 Bracket |
| 14 Rear Cover Bolt | 46 Oil Pickup Tube |
| 15 Rear Timing Belt Cover | 47 Timing Belt |
| 16 Bolt | 48 Upper Timing Belt Front Cover |
| 17 Coolant Pump | 49 Bolt |
| 18 Oil Pump | 50 Lower Timing Belt Front Cover |
| 19 Seal Ring | 51 Crankshaft Pulley |
| 20 Oil Pump Body Gasket | 52 Washer |
| 21 Engine Block | 53 Bolt |
| 22 Bolt | 54 Bolt |
| 23 Auto Tensioner | 55 Bolt |
| 24 Bolt | 56 Crankshaft Position Sensor |
| 25 Crankshaft Gear | 57 Bracket |
| 26 Pressure Relief Valve Plunger | 58 Gear |
| 27 Spring | 59 Gear |
| 28 Oil Pump Seal Ring | 60 Cover |
| 29 Bolt Plug | 61 Bolt |
| 30 Crankshaft Bearing Set | 62 Seal |
| 31 Crankshaft | 63 Knock Sensor |
| 32 Shaft Seal Ring | |
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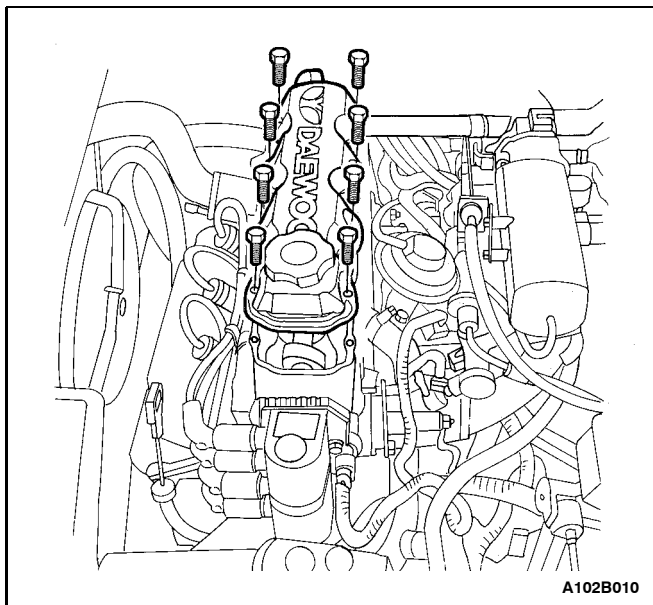
MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

VALVE COVER

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the breather tube from the valve cover.



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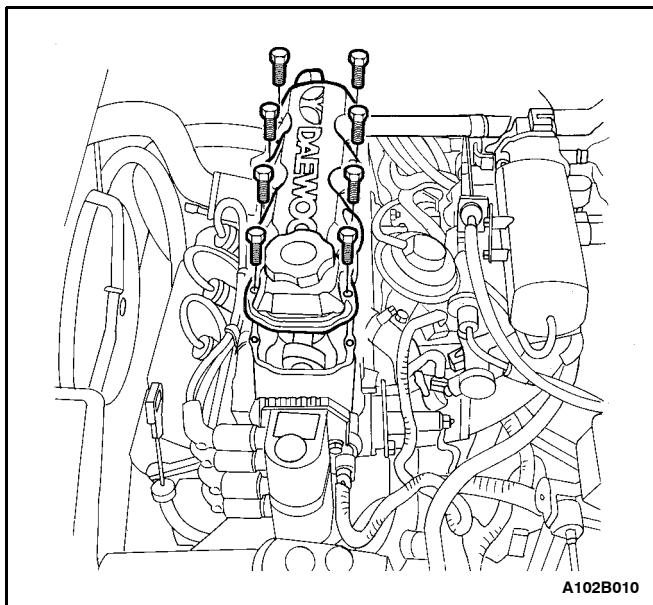
3. Remove the eight bolts from the valve cover.
4. Remove the valve cover.
5. Remove the valve cover gasket.
6. Clean the sealing surfaces of the valve cover and the camshaft housing.

Installation Procedure

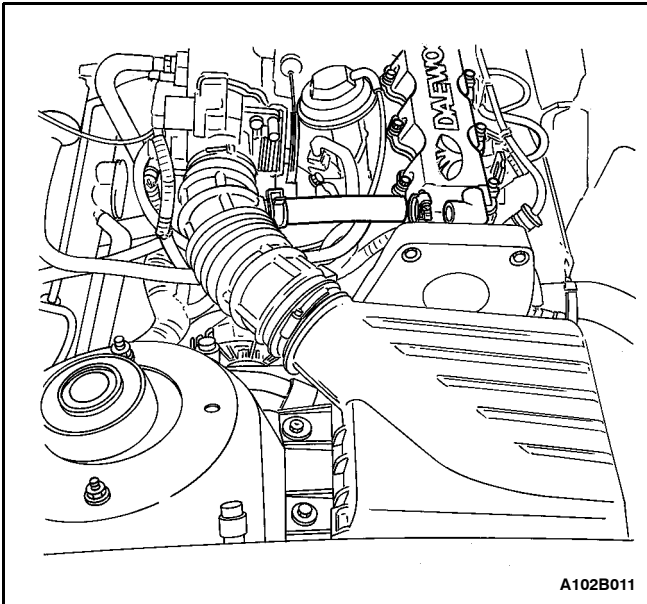
1. Install the new valve cover gasket and the valve cover.
2. Install the eight bolts to the valve cover.

Tighten

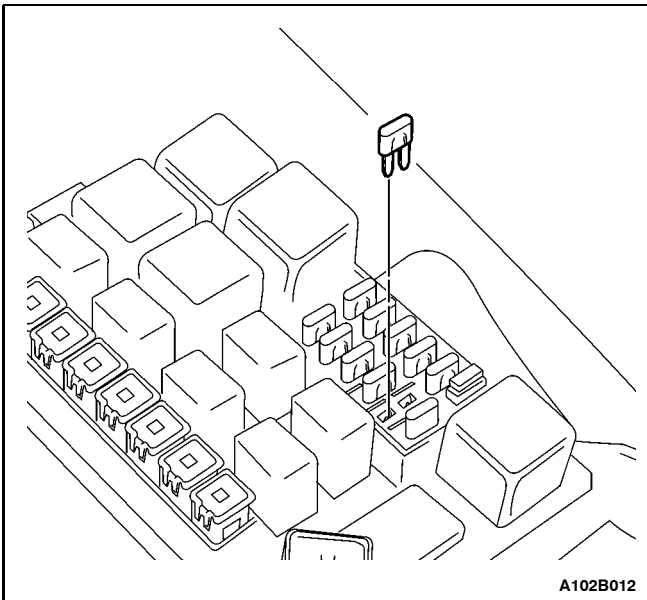
Tighten the valve cover bolts to 10 NSm (89 lb-in).



A102B010



3. Connect the breather tube to the valve cover.
4. Connect the negative battery cable.



CYLINDER HEAD AND GASKET

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

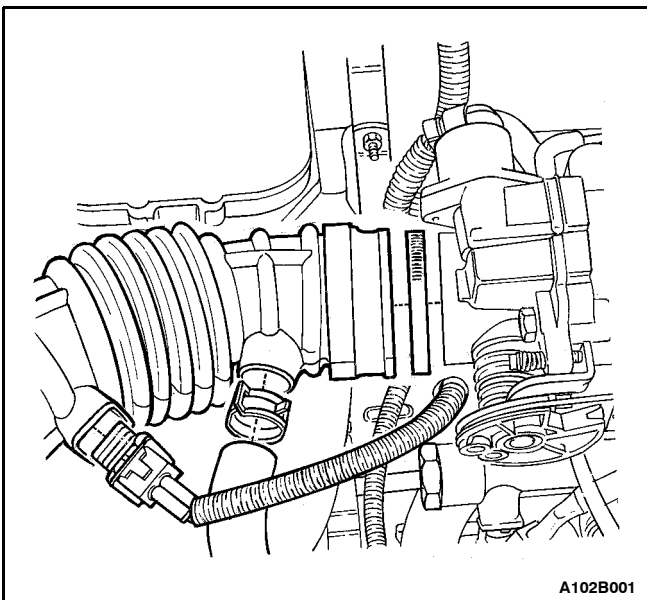
Tools Required

J-42492 Timing Belt Adjuster

KM-470-B Angular Torque Gauge

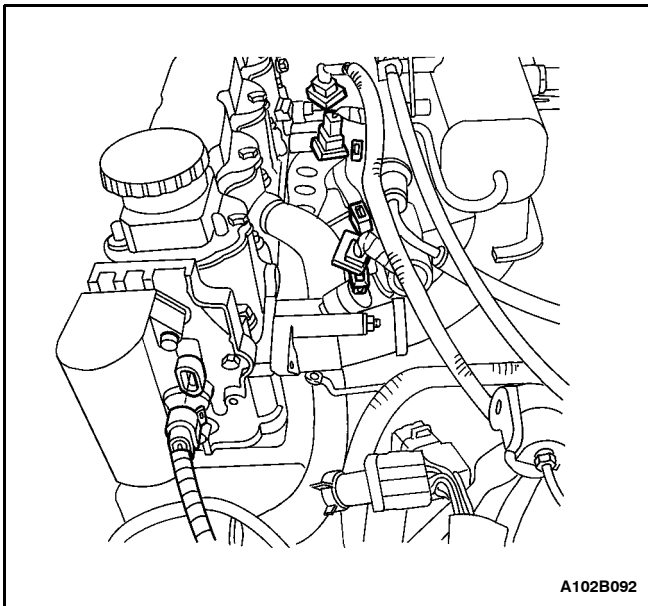
Removal Procedure

1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine for 10 seconds to rid the fuel system of fuel pressure.
3. Disconnect the negative battery cable.
4. Disconnect the electronic control module (ECM) ground terminal from the intake manifold.

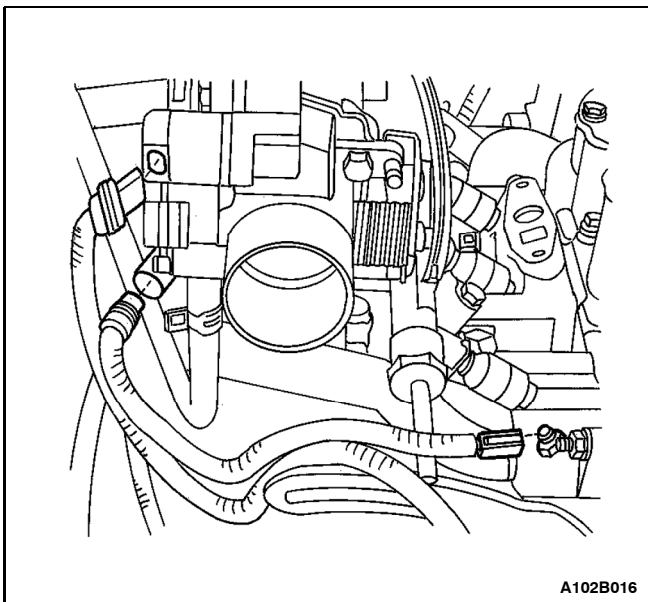


5. Drain the engine coolant. Refer to Section 1D, Engine Cooling.
6. Disconnect the manifold air temperature sensor connector.
7. Disconnect the breather tube from the valve cover.
8. Disconnect the air intake tube from the throttle body.

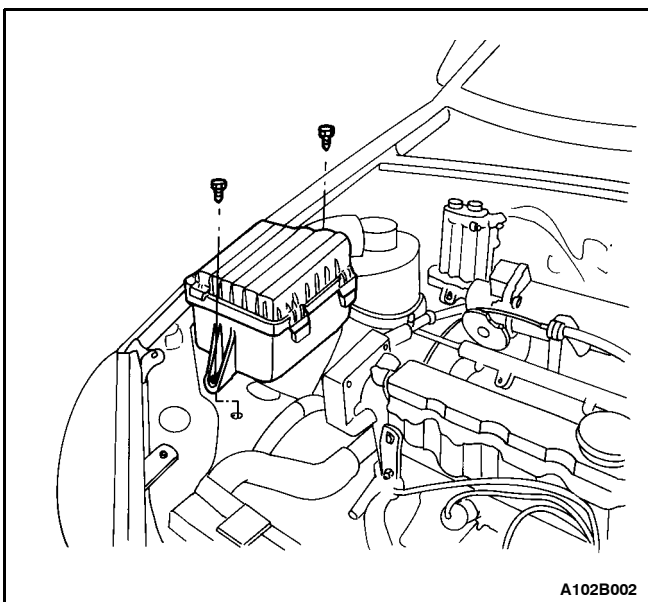
1B - 14 SOHC ENGINE MECHANICAL



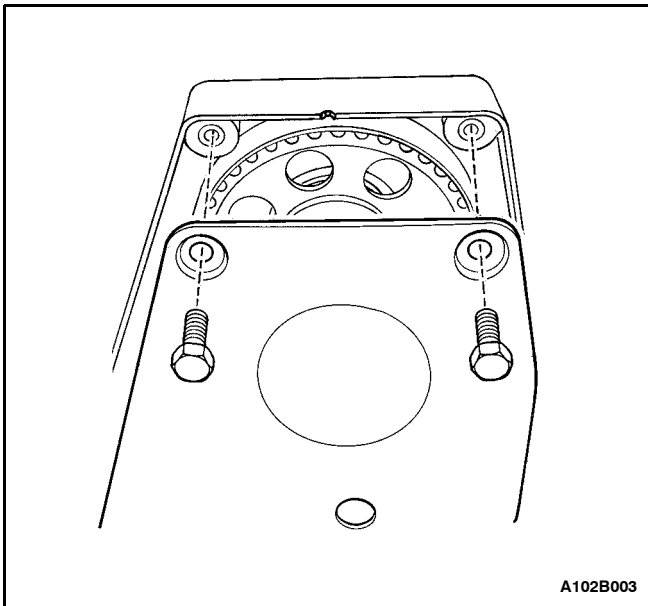
9. Disconnect the direct ignition system (DIS) ignition coil connector.
10. Disconnect the oxygen sensor connector.
11. Disconnect the fuel injector harness connectors.



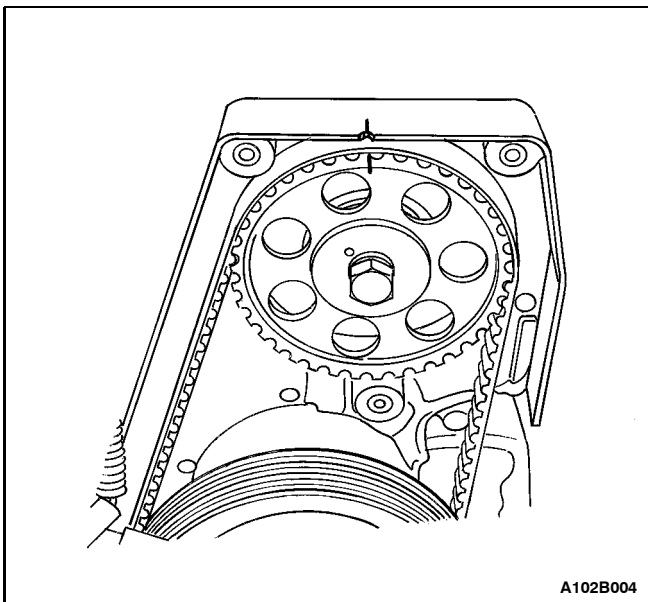
12. Disconnect the idle air control valve connector.
13. Disconnect the throttle position sensor connector.
14. Disconnect the engine coolant temperature sensor connector.
15. Disconnect the coolant temperature sensor connector.



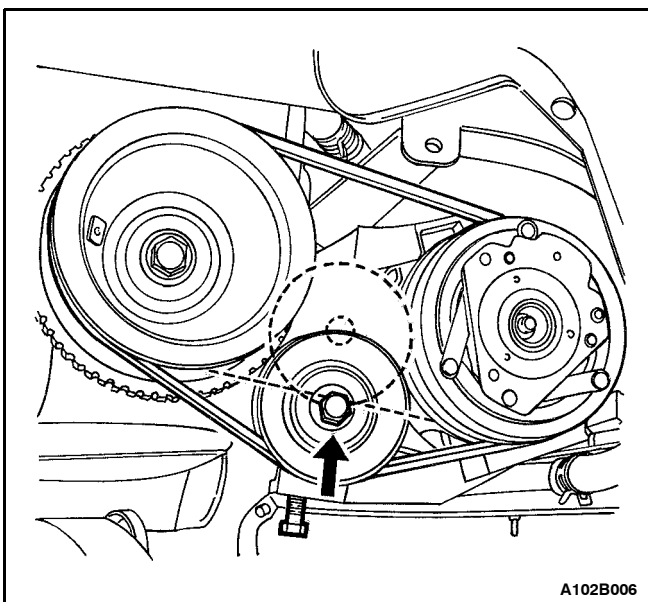
16. Remove the air cleaner housing bolts.
17. Remove the air cleaner housing.



18. Remove the upper timing belt cover bolts.
19. Remove the upper timing belt cover.

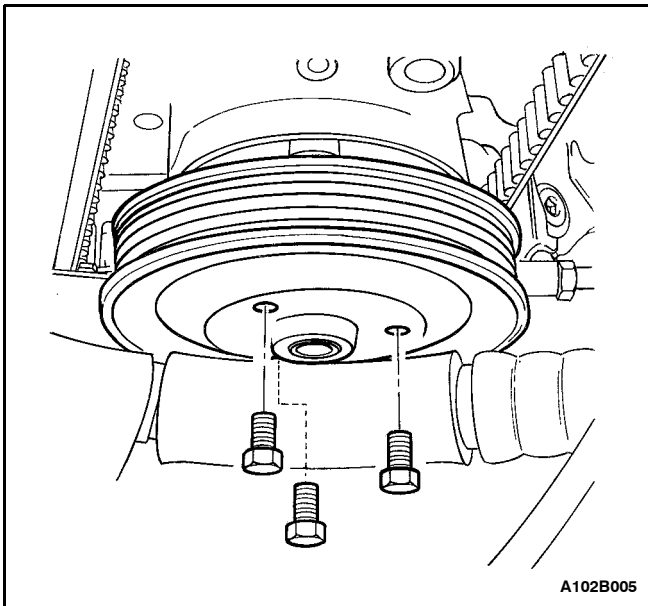


20. Align the camshaft gear timing mark to the notch in the rear timing belt cover.

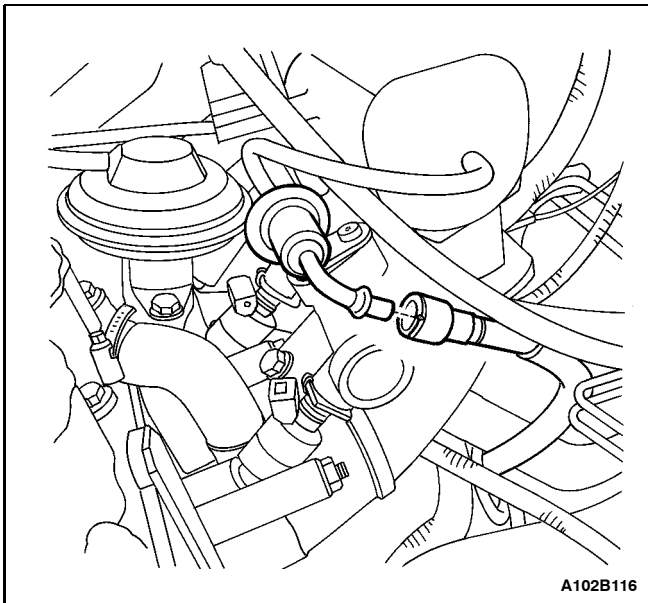


21. Remove the right front wheel. Refer to Section 2E, Tires and Wheels.
22. Remove the right front wheel well splash shield.
23. Remove the A/C compressor drive belt, if equipped.

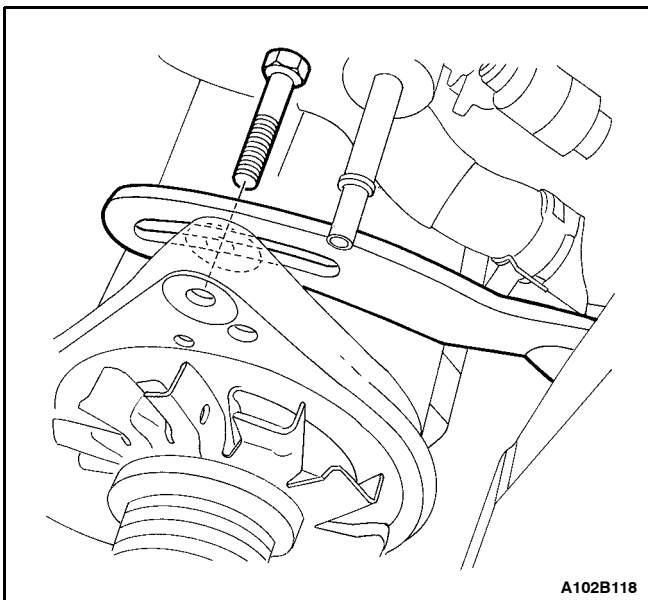
1B - 16 SOHC ENGINE MECHANICAL



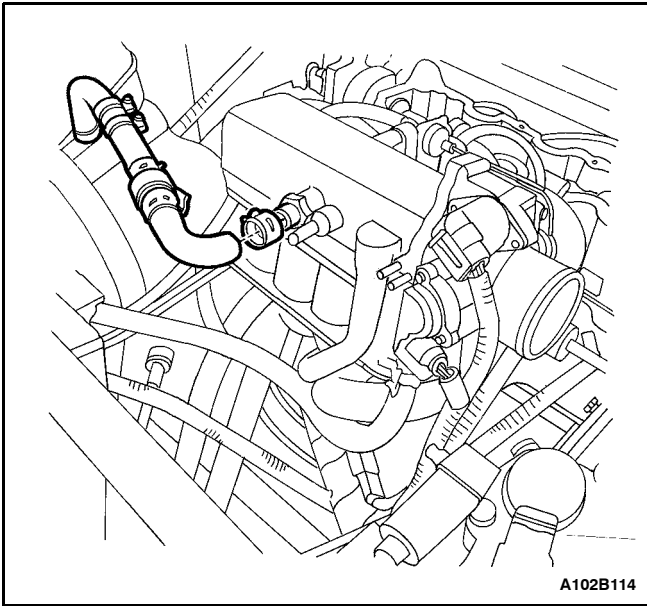
- 24. Remove the alternator drive belt.
- 25. Remove the power steering pump pulley bolts, if equipped.
- 26. Remove the power steering pump pulley, if equipped.



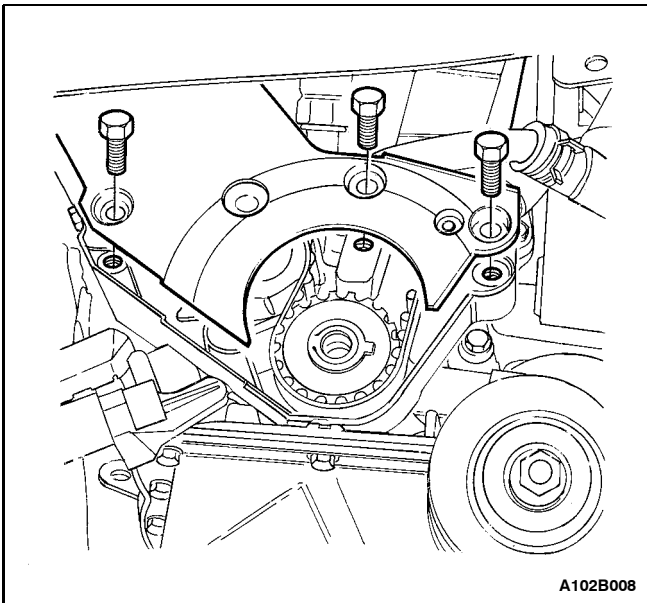
- 27. Disconnect the fuel return line at the fuel pressure regulator.
- 28. Disconnect the fuel feed line at the fuel rail.



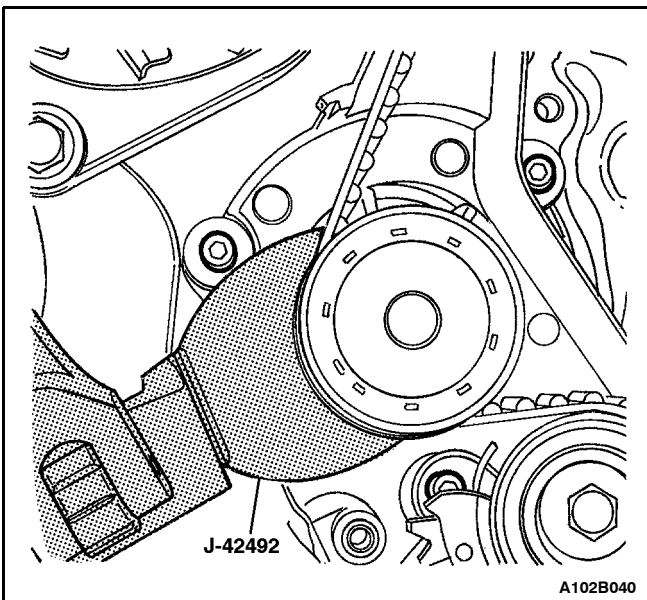
- 29. Remove the alternator adjusting bolt.
- 30. Remove the alternator adjusting bracket retaining bolt.
- 31. Remove the alternator adjusting bracket.



- 32. Disconnect the upper radiator hose at the thermostat housing.
- 33. Disconnect the brake booster vacuum hose at the intake manifold.
- 34. Disconnect all of the necessary vacuum hoses.

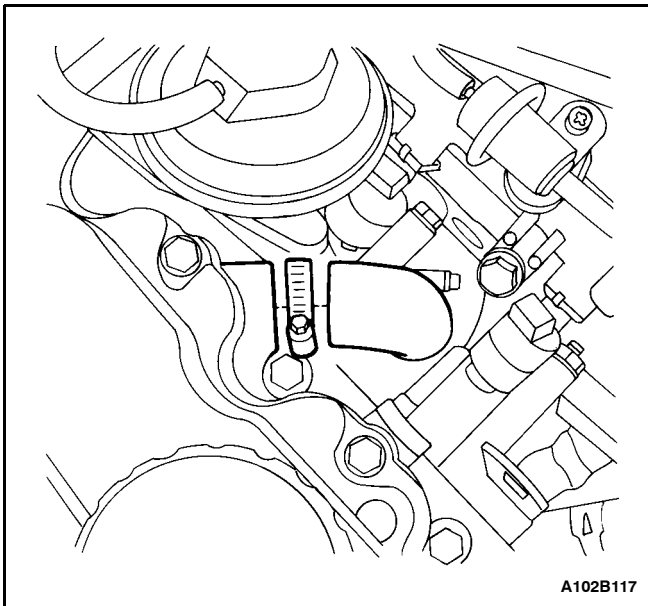


- 35. Remove the crankshaft pulley bolt.
- 36. Remove the crankshaft pulley.
- 37. Remove the power steering pump, if equipped. Refer to Section 6B, Power Steering Pump.
- 38. Install the engine mount bracket-to-engine mount retaining bolts and tighten the bolts to secure the engine, if the power steering pump was removed.
- 39. Remove the lower timing belt cover bolts.
- 40. Remove the lower timing belt cover.

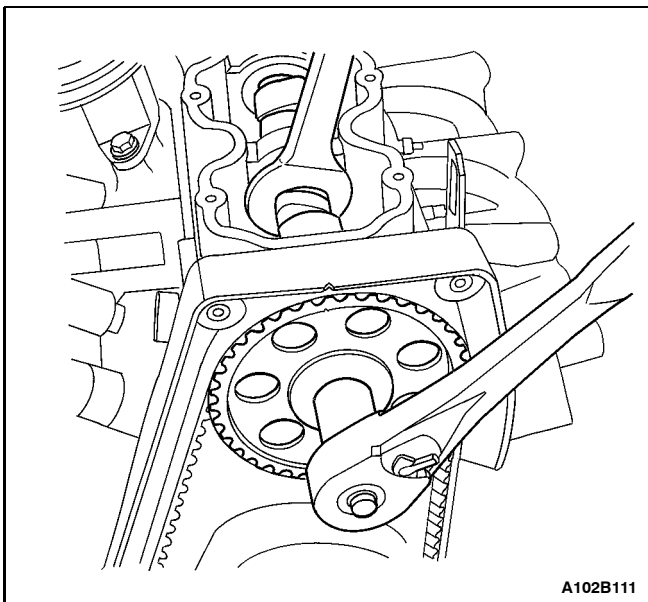


- 41. Slightly loosen the coolant pump retaining bolts.
- 42. Rotate the coolant pump counterclockwise using the timing belt adjuster J-42492 to relieve the timing belt tension.
- 43. Remove the timing belt. Refer to "Timing Belt" in this section.

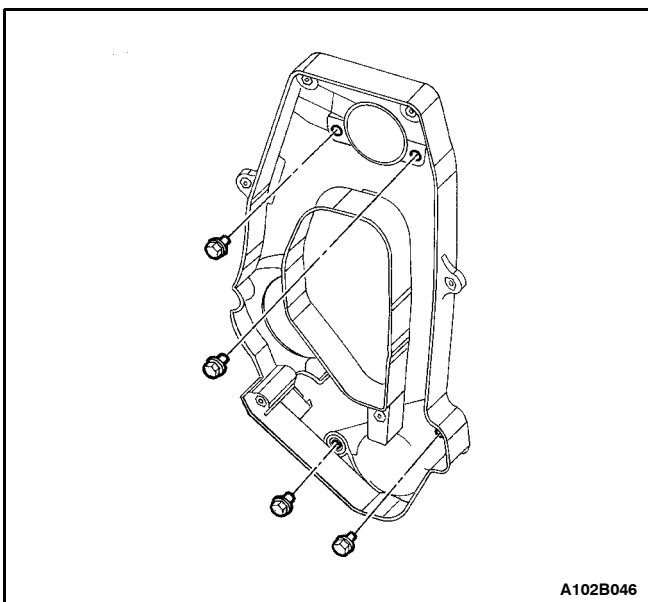
1B - 18 SOHC ENGINE MECHANICAL



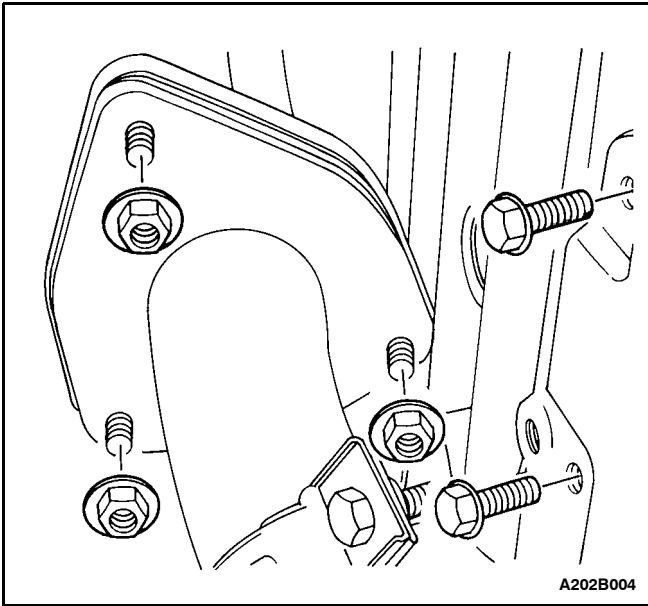
44. Disconnect the crankcase ventilation tube at the camshaft housing and the electrical connector at the exhaust gas recirculation (EGR) solenoid.



45. Remove the valve cover bolts.
46. Remove the valve cover and the valve cover gasket.
Notice: Take care to prevent any scratches, nicks or damage to the camshaft.
47. While holding the camshaft firmly in place, remove the camshaft gear bolt.
48. Remove the camshaft gear.

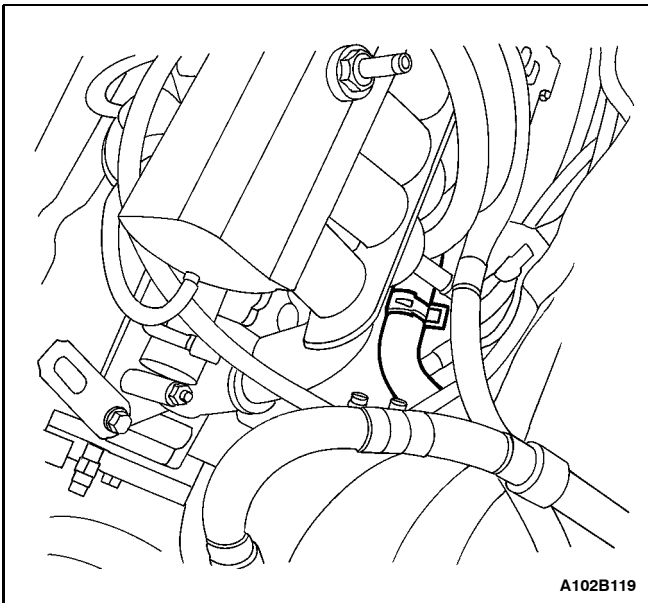


49. Remove the timing belt automatic tensioner bolt.
50. Remove the timing belt automatic tensioner.
51. Remove the rear timing belt cover bolts.
52. Remove the rear timing belt cover.



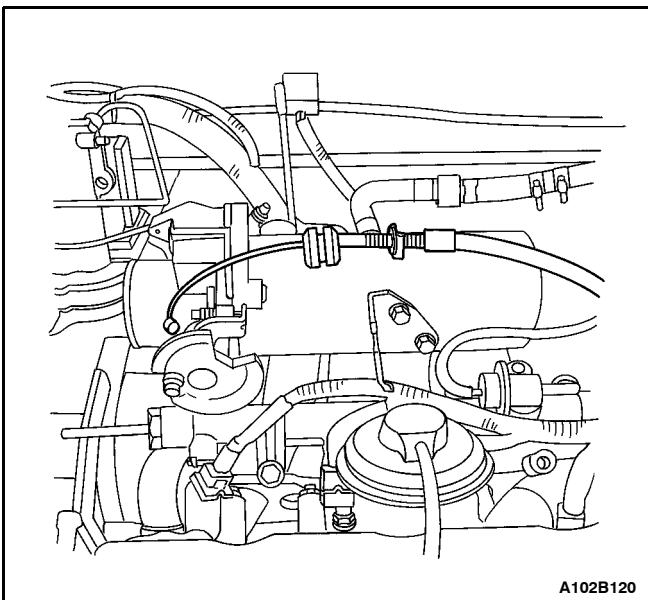
53. Disconnect the ignition wires at the spark plugs.

54. Remove the retaining nuts from the exhaust flex pipe at the exhaust manifold flange and the bolts at the bracket.



55. Disconnect the heater inlet hose at the coolant distributor.

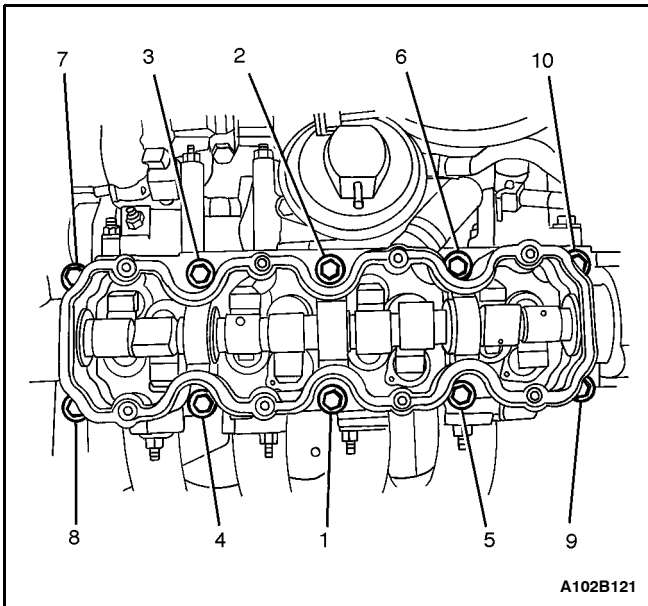
56. Disconnect the surge tank coolant hose at the throttle body.



57. Remove the intake manifold support bracket retaining bolts from the coolant distributor.

58. Disconnect the throttle cable at the throttle body and the intake manifold.

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59. Gradually loosen all of the cylinder head bolts in the sequence shown.

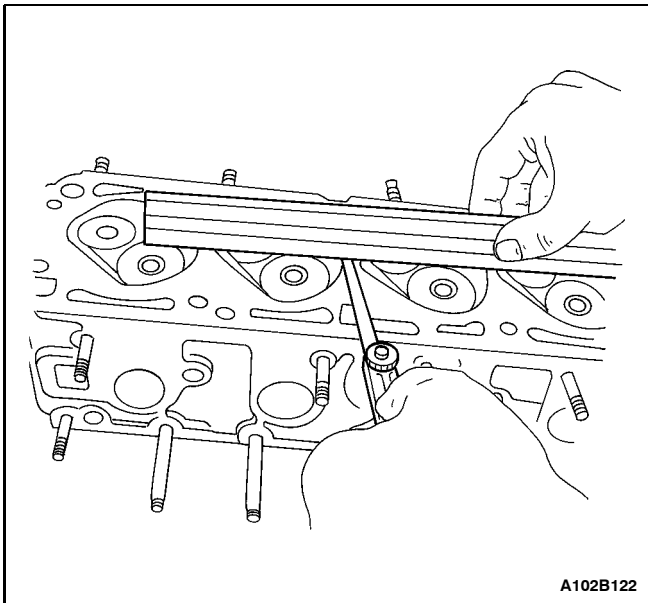
60. Remove the cylinder head bolts.

61. Remove the camshaft carrier assembly.

Notice: Prevent any engine oil or coolant from entering the cylinders when removing the cylinder head. Damage to the engine could result.

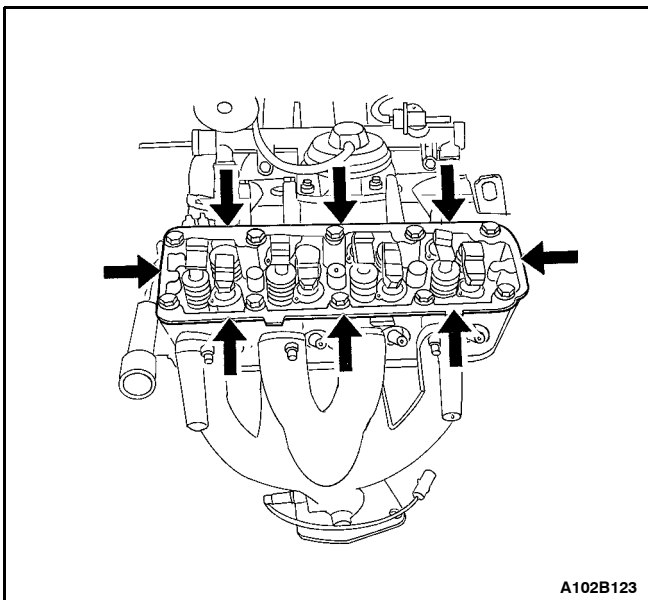
62. Remove the cylinder head with the intake manifold and the exhaust manifold attached.

63. Remove the cylinder head gasket.



Cleaning Procedure

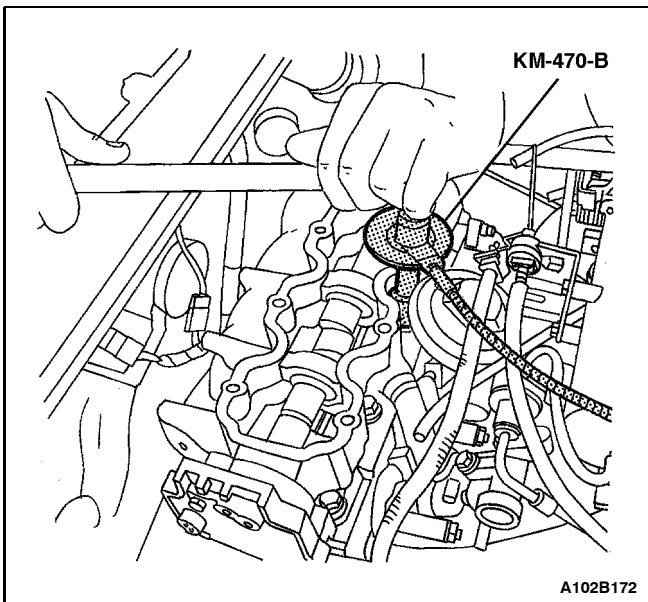
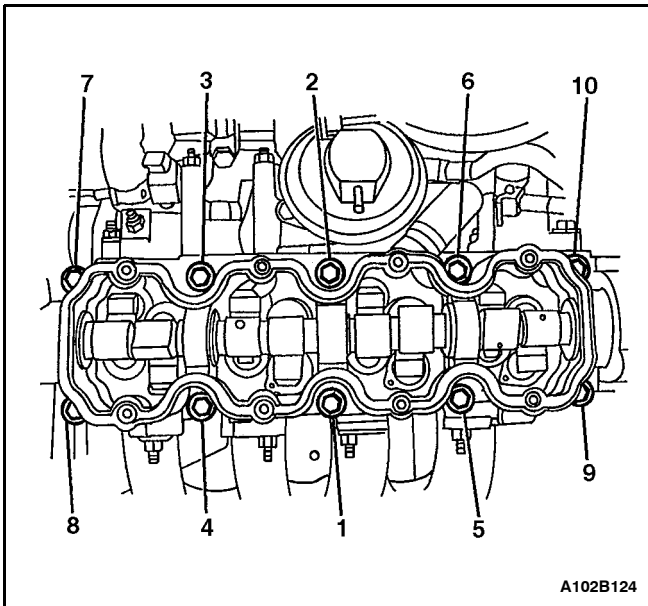
1. Clean the gasket surfaces of the cylinder head and the engine block.
2. Make sure the gasket surfaces of the cylinder head and the engine block are free of nicks and heavy scratches.
3. Clean the cylinder head bolts.
4. Inspect the cylinder head for warpage. Refer to "Cylinder Head and Valve Train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



Installation Procedure

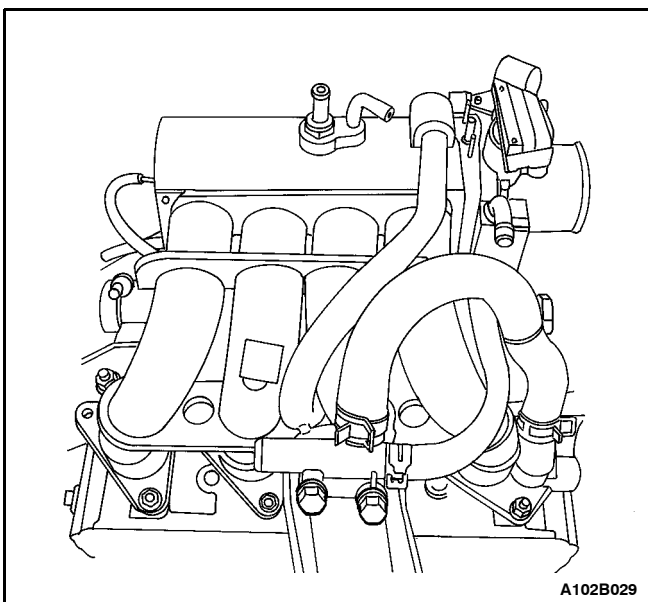
1. Apply a continuous 3 mm (0.12 inch) bead of gasket maker to the sealing surface of the camshaft carrier.
2. Install the cylinder head gasket.
3. Install the cylinder head with the intake manifold and the exhaust manifold attached.
4. Install the camshaft carrier assembly.

5. Install the cylinder head bolts in the sequence shown.



Tighten

Tighten the cylinder head bolts in the sequence previously shown to 25 Nsm (18 lb-ft) using a torque wrench. Use the angular torque gauge KM-470-B to tighten the cylinder head bolts another 60 degrees plus 60 degrees plus 60 degrees plus 10 degrees.

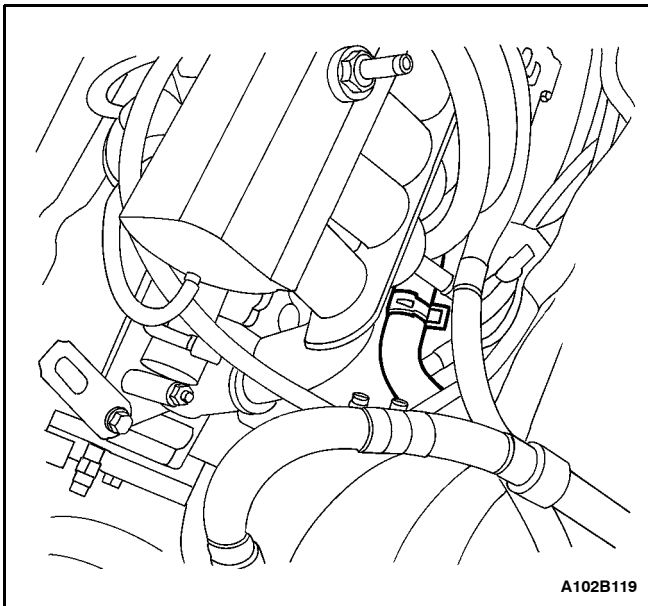


6. Connect the throttle cable at the throttle body and at the intake manifold.
7. Install the intake manifold support bracket retaining bolt to the coolant distributor.

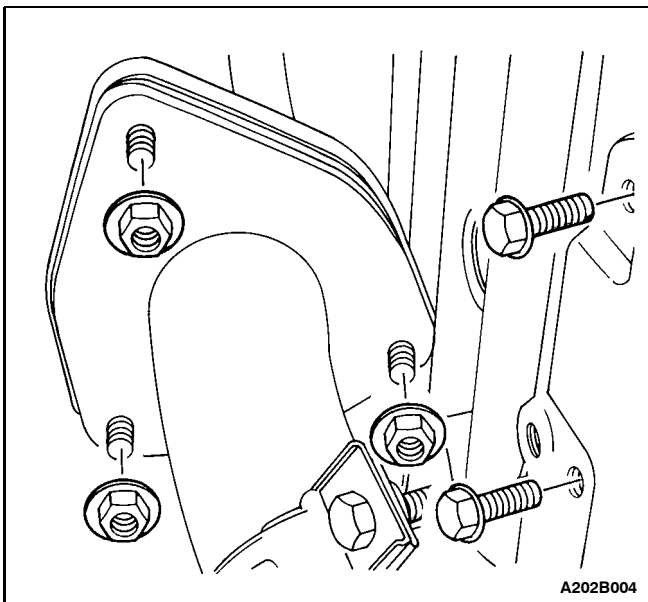
Tighten

Tighten the intake manifold support bracket retaining bolts to 22 Nsm (16 lb-ft).

1B - 22 SOHC ENGINE MECHANICAL



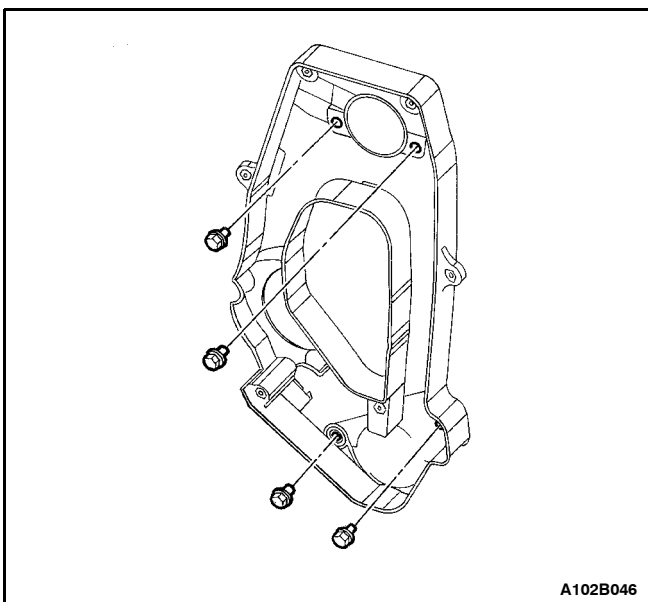
8. Connect the surge tank coolant hose at the throttle body.
9. Connect the heater inlet hose to the coolant distributor.



10. Install the exhaust flex pipe retaining nuts at the exhaust manifold flange and the bolts to the bracket.

Tighten

Tighten the exhaust flex pipe-to-exhaust manifold retaining nuts and bracket bolts to 40 N \cdot m (30 lb-ft).



11. Connect the ignition wires at the spark plugs.
12. Install the rear timing belt cover.
13. Install the rear timing belt cover bolts.

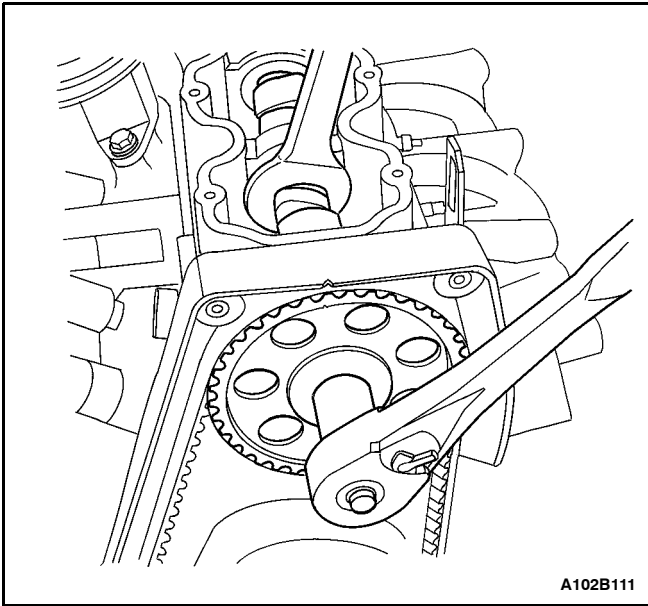
Tighten

Tighten the rear timing belt cover bolts to 10 N \cdot m (89 lb-in).

14. Install the timing belt automatic tensioner.
15. Install the timing belt automatic tensioner bolt.

Tighten

Tighten the timing belt automatic tensioner bolt to 20 N \cdot m (15 lb-ft).



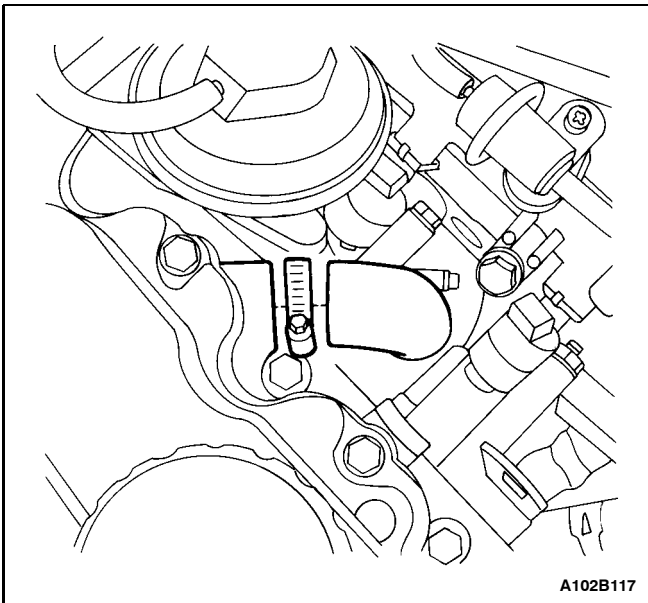
Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshaft. Such damage can impair vehicle operation.

16. Install the camshaft gear.

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

Tighten

Tighten the camshaft gear bolt to 45 N \cdot m (33 lb-ft).



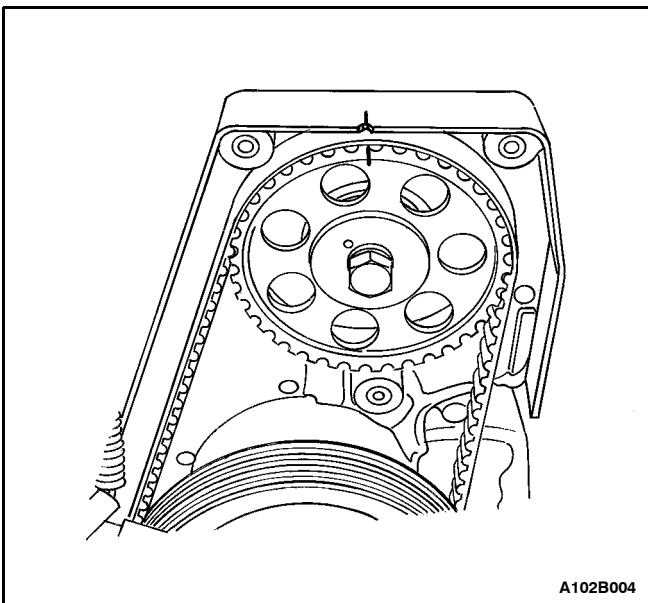
18. Install the valve cover and the valve cover gasket.

19. Install the valve cover bolts.

Tighten

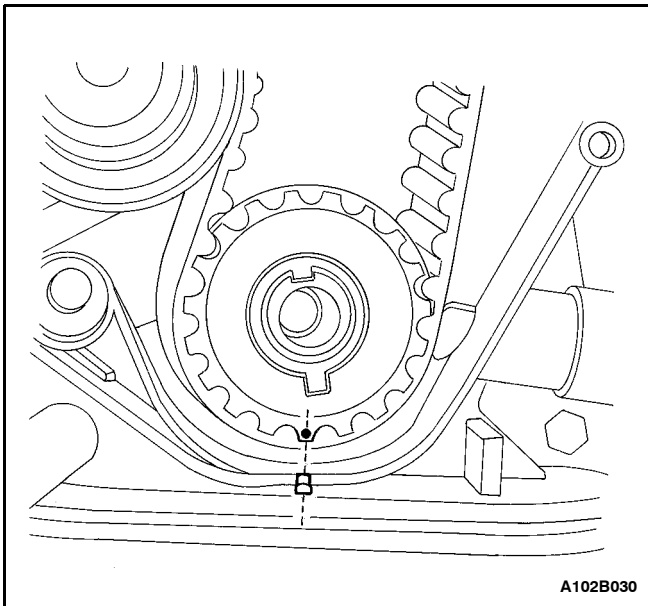
Tighten the valve cover bolts to 10 N \cdot m (89 lb-in).

20. Connect the crankcase ventilation tube to the camshaft housing and connect the EGR solenoid connector.

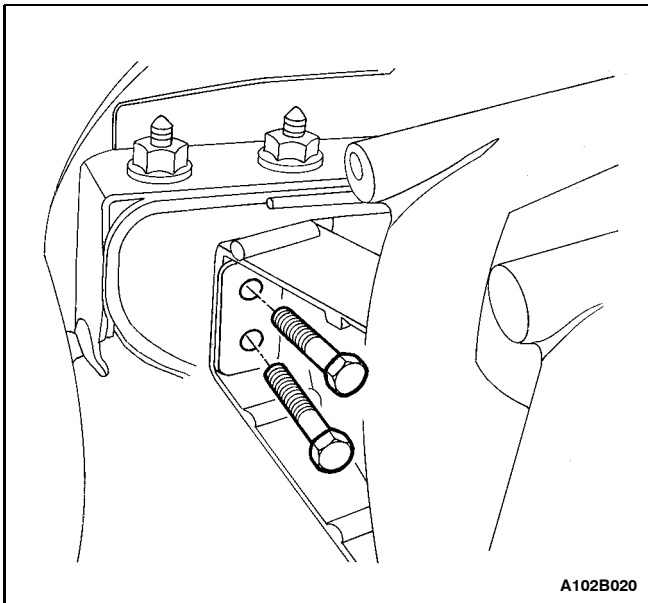


21. Align the mark on the camshaft gear to the notch at the top of the rear timing belt cover.

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22. Align the mark on the crankshaft gear to the notch at the bottom of the rear timing belt cover.



23. Install the timing belt. Refer to "Timing Belt" in this section.
24. Check the timing belt tension. Refer to "Timing Belt Check and Adjust" in this section.
25. Install the lower timing belt cover.
26. Install the lower timing belt cover bolts.

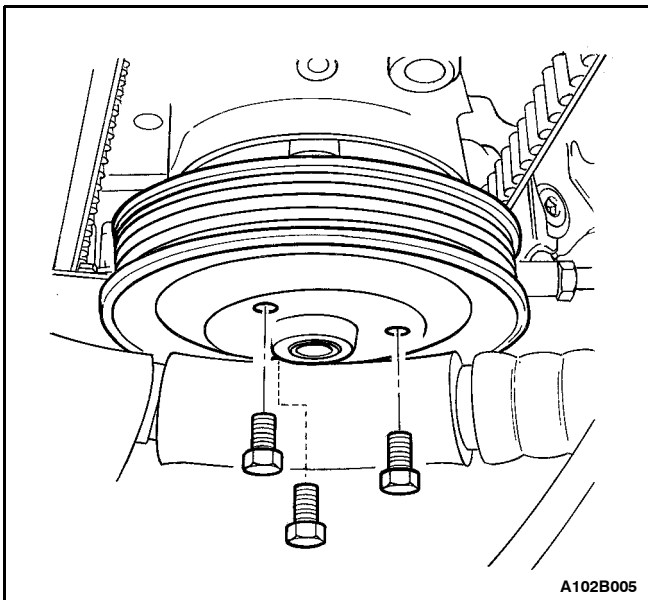
Tighten

Tighten the lower timing belt cover bolts to 10 NSm (89 lb-in).

27. Install the power steering pump and the bolts, if equipped. Refer to Section 6B, Power Steering Pump.
28. Install the engine mount bracket-to-engine mount retaining bolts if the power steering pump was installed.

Tighten

Tighten the engine mount bracket-to-engine mount retaining bolts to 60 NSm (44 lb-ft).



29. Install the crankshaft pulley.
30. Install the crankshaft pulley bolt.

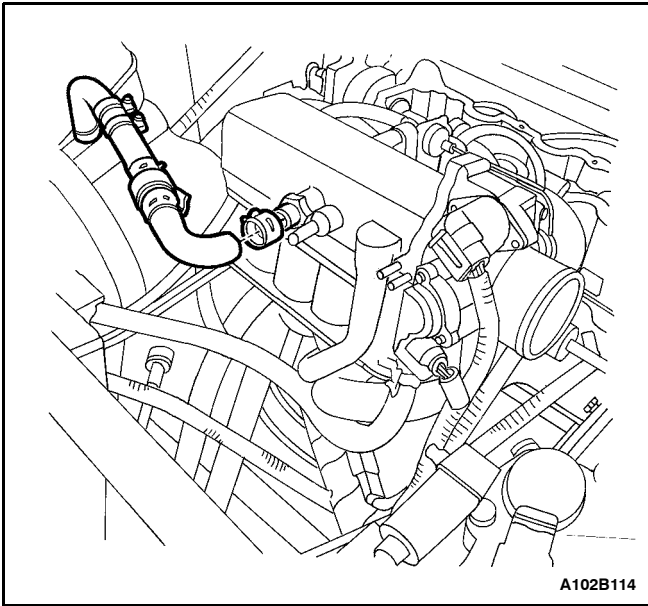
Tighten

Tighten the crankshaft pulley bolt to 95 NSm (70 lb-ft) using a torque wrench. Use the angular torque gauge KM-470-B to tighten the crankshaft pulley bolt another 30 degrees plus 15 degrees.

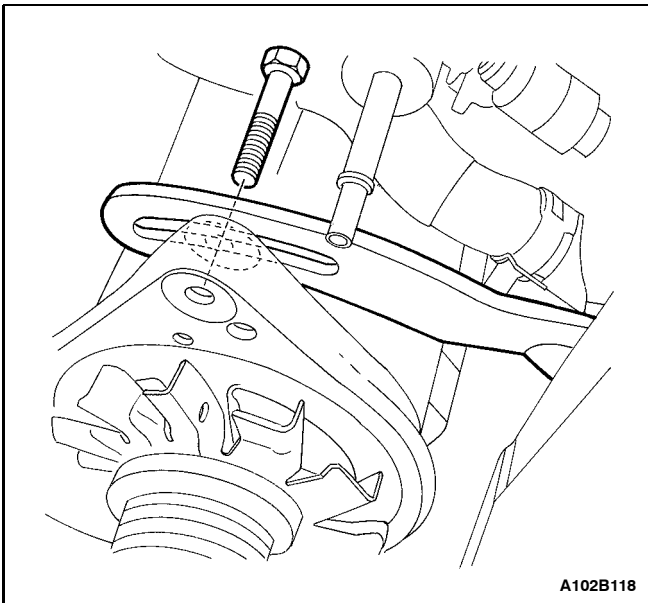
31. Install the power steering pump pulley, if equipped.
32. Install the power steering pump pulley bolts, if equipped.

Tighten

Tighten the power steering pump pulley bolts to 25 NSm (18 lb-ft).



- 33. Connect all of the vacuum hoses.
- 34. Connect the brake booster hose at the intake manifold.
- 35. Connect the upper radiator hose at the thermostat housing.

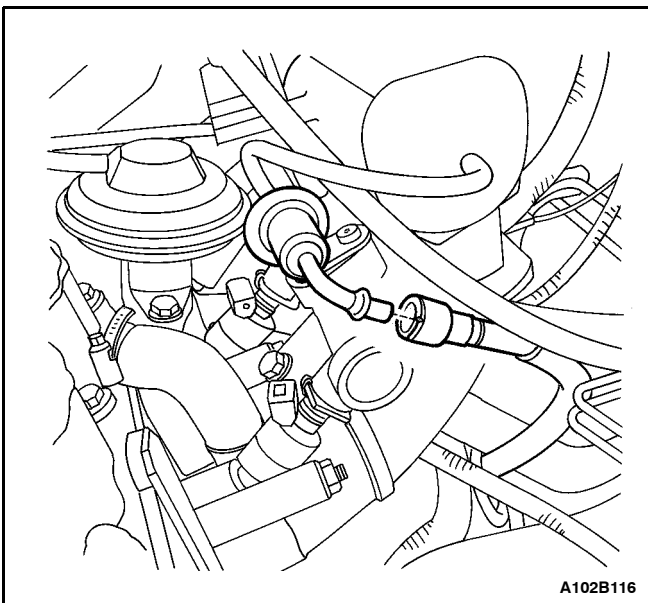


- 36. Install the alternator adjusting bracket.
- 37. Install the alternator adjusting bracket retaining bolt.

Tighten

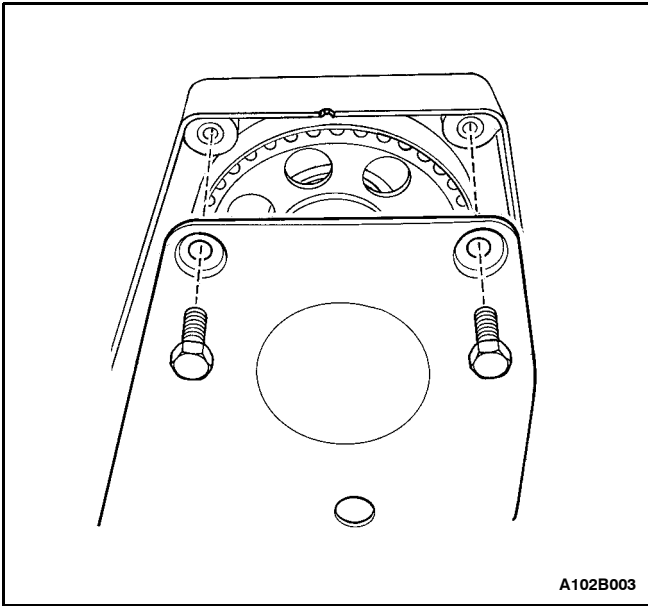
Tighten the alternator adjusting bracket retaining bolt to 20 N \cdot m (15 lb-ft).

- 38. Install the alternator adjusting bolt. Do not tighten.



- 39. Connect the fuel feed line at the fuel rail.
- 40. Connect the fuel return line at the fuel pressure regulator.

1B - 26 SOHC ENGINE MECHANICAL



A102B003

41. Install the alternator drive belt.

Tighten

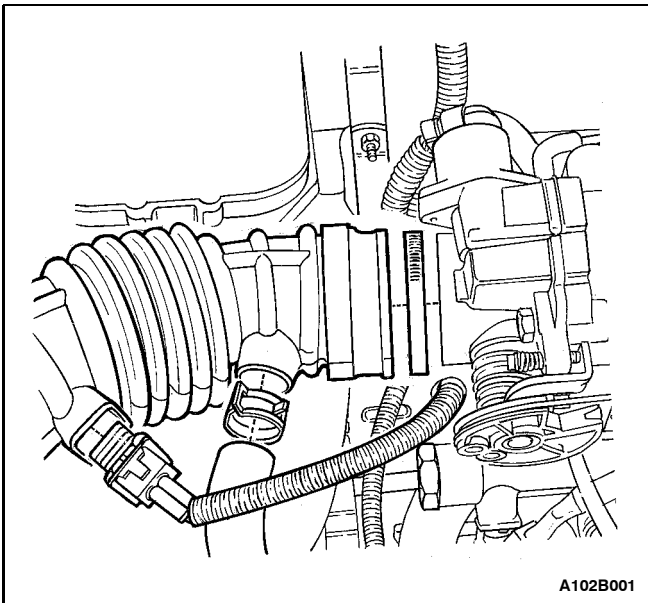
Tighten the alternator adjusting bolt to 20 N·m (15 lb-ft).

42. Install the upper timing belt cover.
43. Install the upper timing belt cover bolts.

Tighten

Tighten the upper timing belt cover bolts to 10 N·m (89 lb-in).

44. Install the A/C compressor drive belt, as necessary.
45. Install the right front wheel well splash shield.
46. Install the right front wheel. Refer to Section 2E, Tires and Wheels.



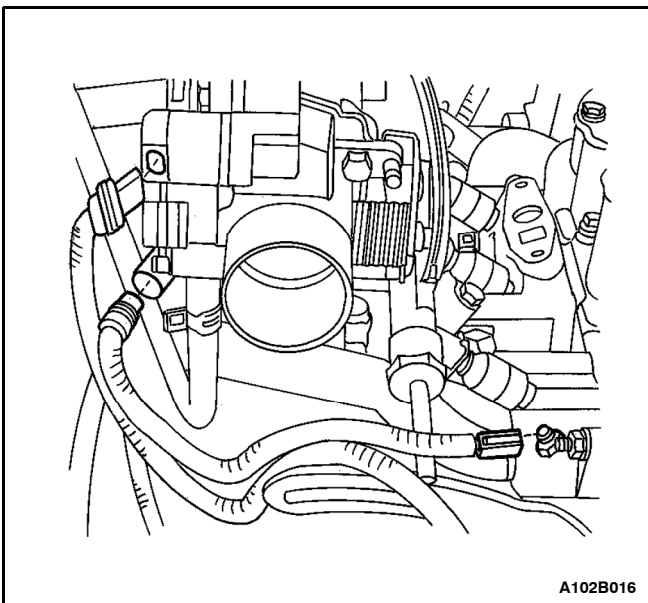
A102B001

47. Install the air filter housing.
48. Install the air filter housing bolts.

Tighten

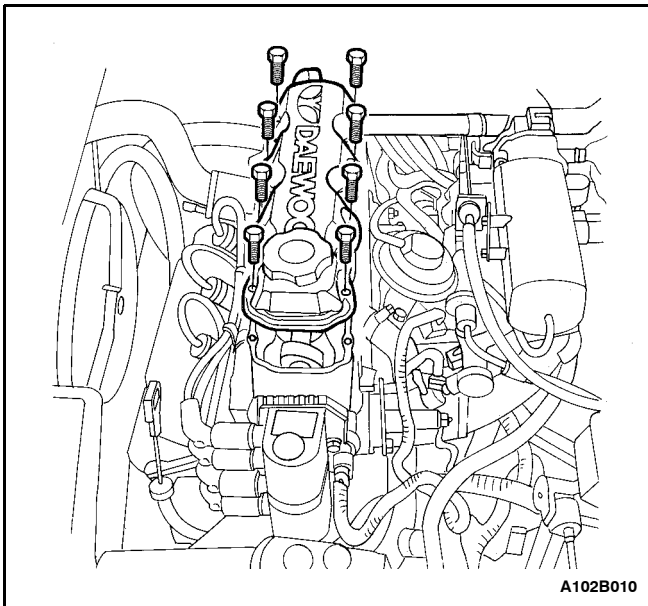
Tighten the air filter housing bolts to 12 N·m (106 lb-in).

49. Connect the air intake tube to the throttle body.
50. Connect the breather tube to the valve cover.
51. Connect the manifold air temperature sensor connector.



A102B016

52. Connect the coolant temperature sensor connector.
53. Connect the engine coolant temperature sensor connector.
54. Connect the idle air control valve connector.
55. Connect the throttle position sensor connector.
56. Connect the DIS ignition coil connector.
57. Connect the fuel injector harness connectors.
58. Connect the oxygen sensor connector.
59. Connect the ECM ground terminal at the intake manifold.
60. Connect the negative battery cable.
61. Install the fuel pump fuse.
62. Refill the engine cooling system. Refer to Section 1D, Engine Cooling.



CAMSHAFT

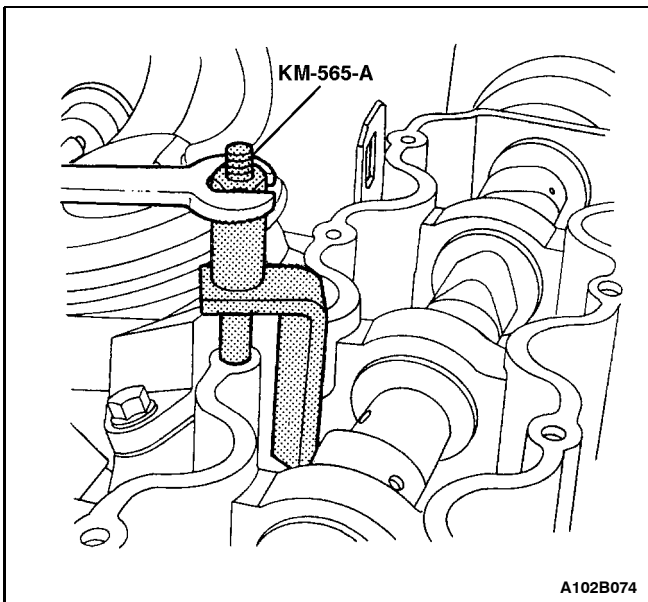
(Left-Hand Drive Shown, Right Hand Drive Similar)

Tools Required

KM-565-A Valve Spring Compressor

Removal Procedure

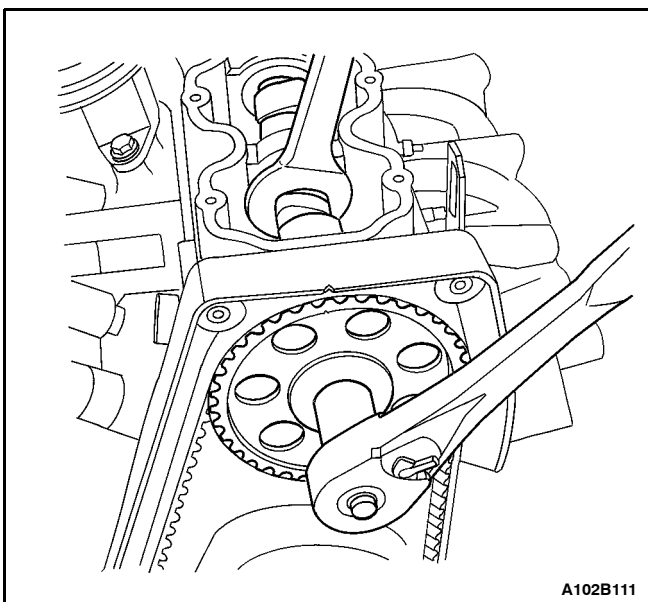
1. Remove the timing belt. Refer to "Timing Belt" in this section.
2. Disconnect the air breather tube at the valve cover.
3. Remove the valve cover bolts.
4. Remove the valve cover.
5. Remove the valve cover gasket.



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

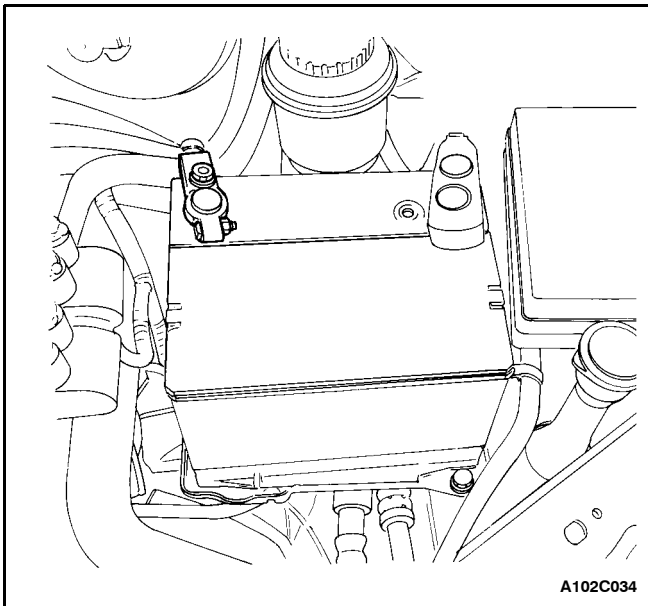
Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshaft. Such damage can impair vehicle operation.

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

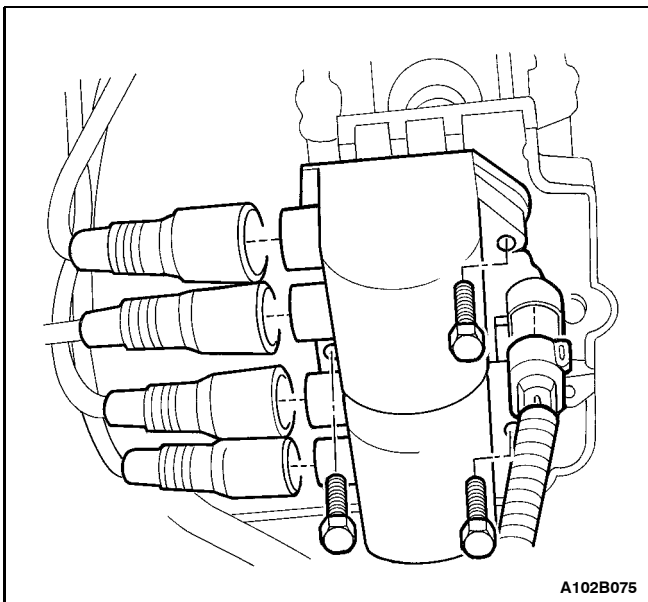


8. While holding the camshaft firmly in place, remove the camshaft gear bolt.
9. Remove the camshaft gear.

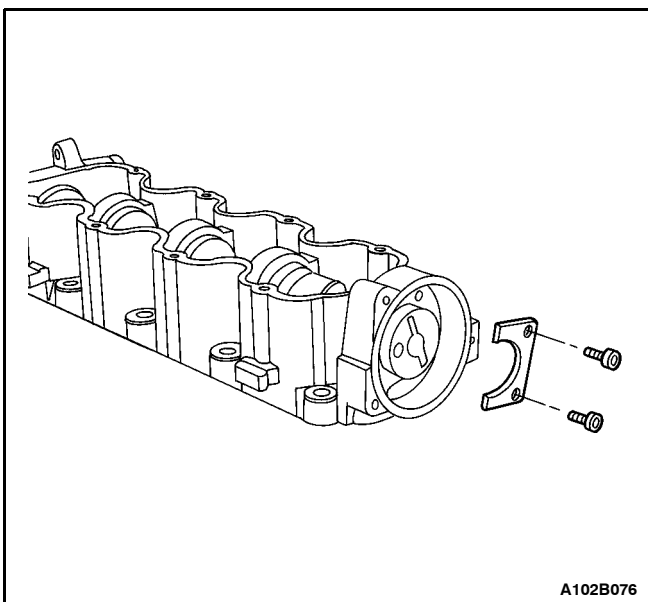
1B - 28 SOHC ENGINE MECHANICAL



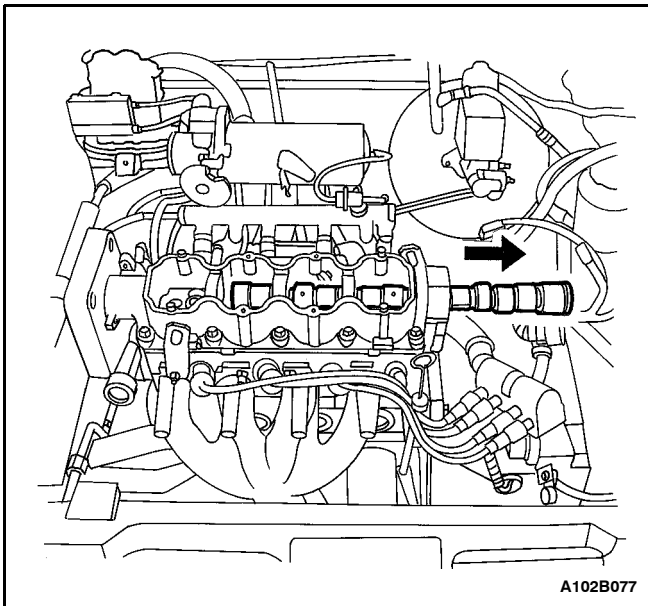
10. Disconnect the positive battery cable from the battery.
11. Remove the battery and the battery tray. Refer to Section 1E, Engine Electrical.



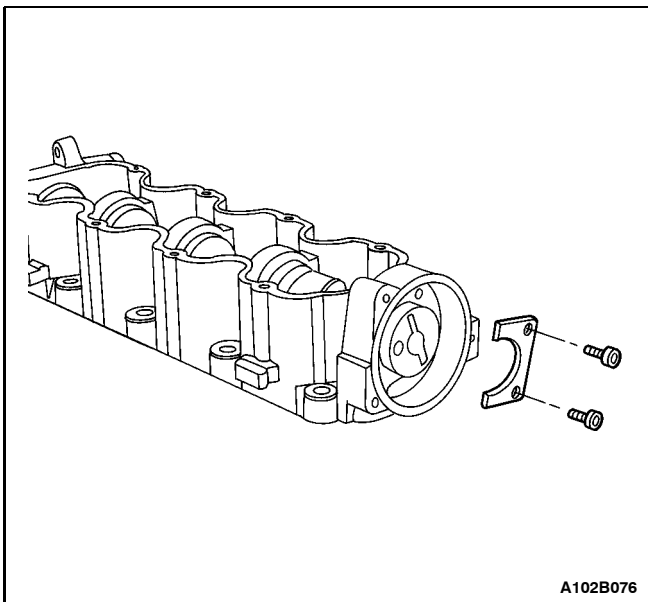
12. Disconnect the direct ignition system (DIS) ignition coil connector.
13. Disconnect the DIS ignition wires at the ignition coil.
14. Remove the DIS ignition coil mounting bolts.
15. Remove the DIS ignition coil.



16. Remove the DIS ignition coil mounting plate bolts.
17. Remove the DIS ignition coil mounting plate.
18. Remove the camshaft pressure plate bolts.
19. Remove the camshaft pressure plate.



20. Remove the camshaft.

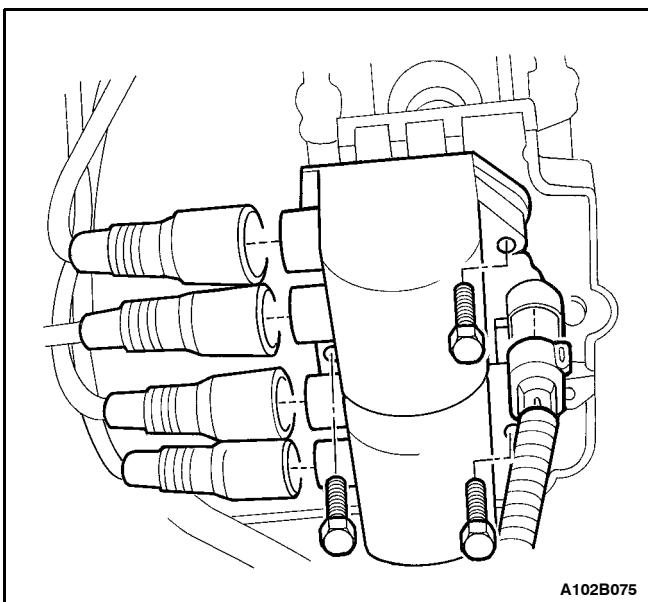


Installation Procedure

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

Tighten

Tighten the camshaft pressure plate bolts to 10 NSm (89 lb-in).



4. Measure camshaft end play. Camshaft end play should be 0.04 to 0.16 mm (.016 to 0.64 inch).
5. Install the DIS ignition coil mounting plate.
6. Install the DIS ignition coil mounting plate bolts.

Tighten

Tighten the DIS ignition coil mounting plate bolts to 10 NSm (89 lb-in).

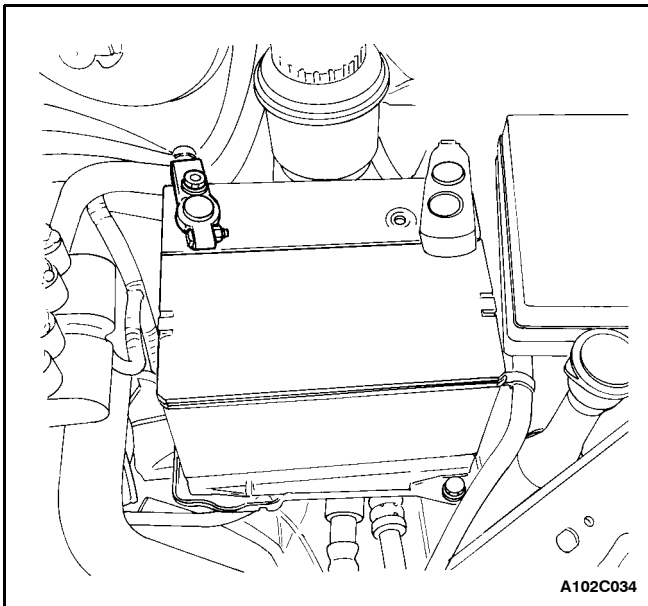
7. Install the DIS ignition coil.
8. Install the DIS ignition coil mounting bolts.

Tighten

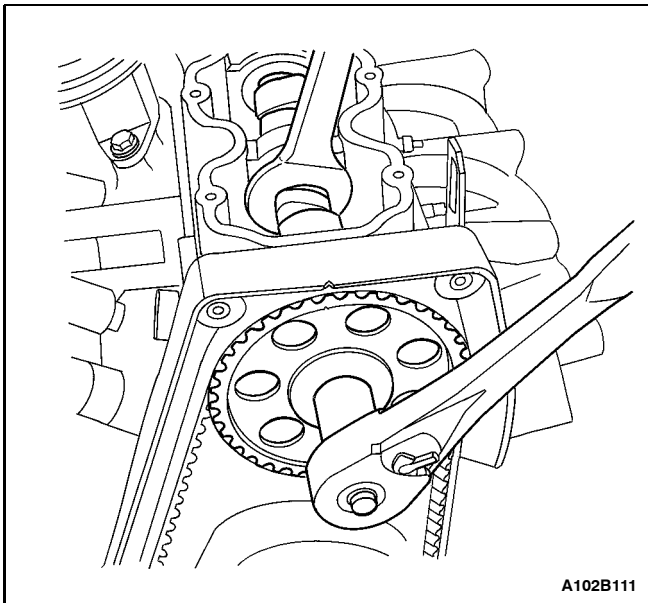
Tighten the DIS ignition coil mounting bolts to 10 NSm (89 lb-in).

9. Connect the ignition wires at the DIS ignition coil.
10. Connect the DIS ignition coil connector.

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11. Install the battery and the battery tray. Refer to Section 1E, Engine Electrical.
12. Connect the positive battery cable to the battery.

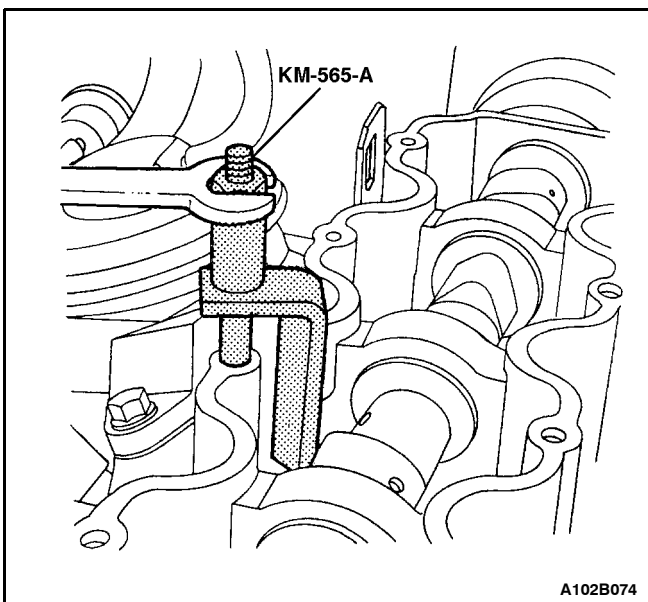


Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshaft. Such damage can impair vehicle operation.

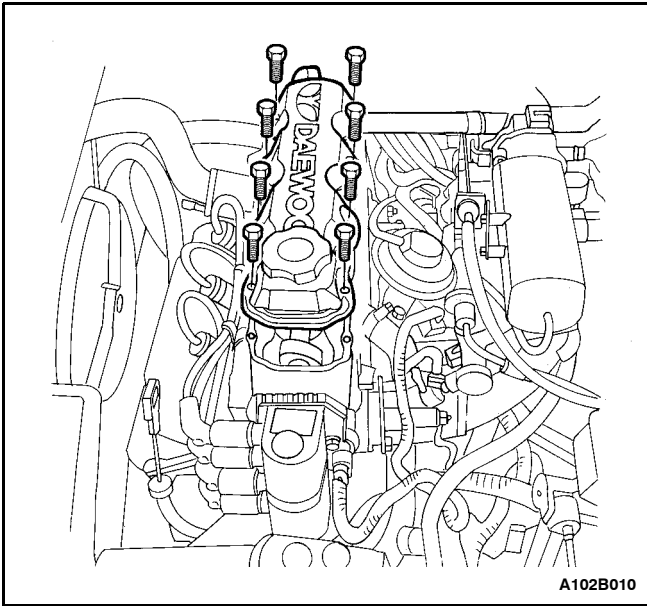
13. Install the camshaft gear.
14. While holding the camshaft firmly in place, install the camshaft gear bolt.

Tighten

Tighten the camshaft gear bolt to 45 N·m (33 lb-ft).



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



17. Install the valve cover gasket.

18. Install the valve cover.

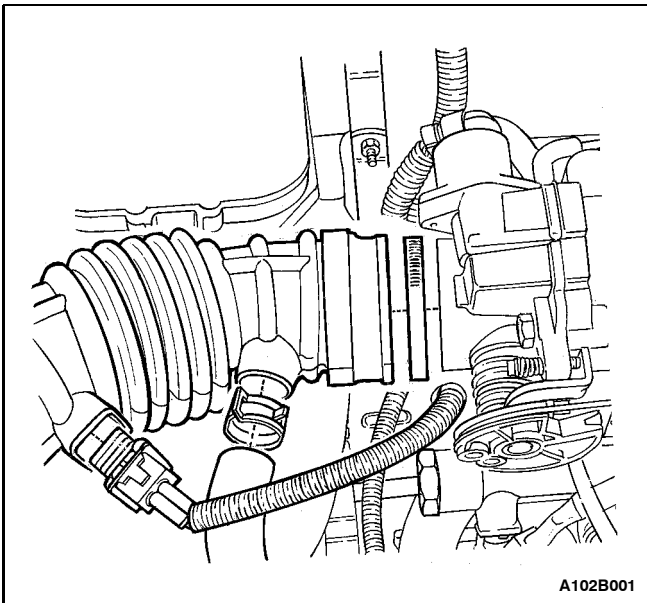
19. Install the valve cover bolts.

Tighten

Tighten the valve cover bolts to 10 N·m (89 lb-in).

20. Connect the air breather tube to the valve cover.

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



TIMING BELT CHECK AND ADJUST

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

Tools Required

J-42492 Timing Belt Adjuster

KM-470-B Angular Torque Gauge

Adjustment Procedure

1. Disconnect the negative battery cable.

2. Disconnect the manifold air temperature sensor connector.

3. Disconnect the air intake tube from the throttle body.

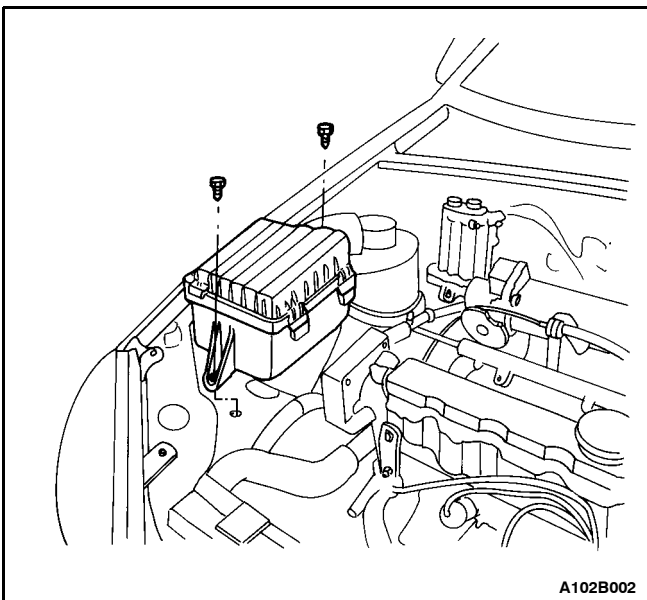
4. Disconnect the breather tube from the valve cover.

5. Remove the air cleaner housing bolts.

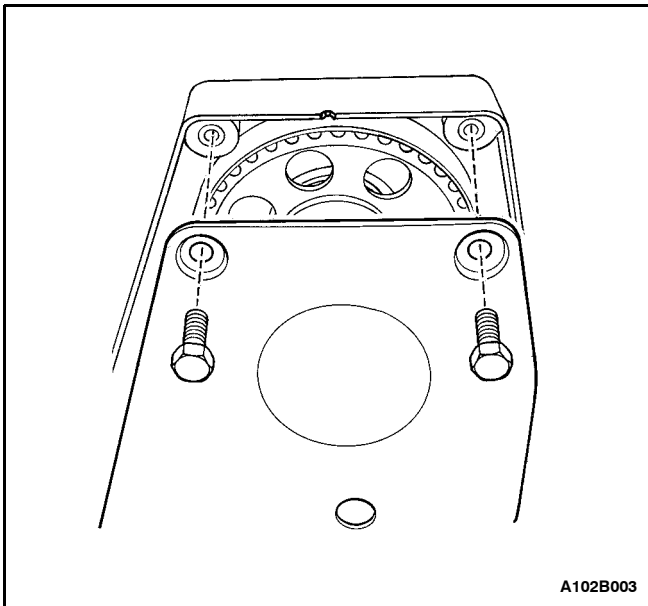
6. Remove the air cleaner housing.

7. Remove the right front wheel. Refer to Section 2E, Tires and Wheels.

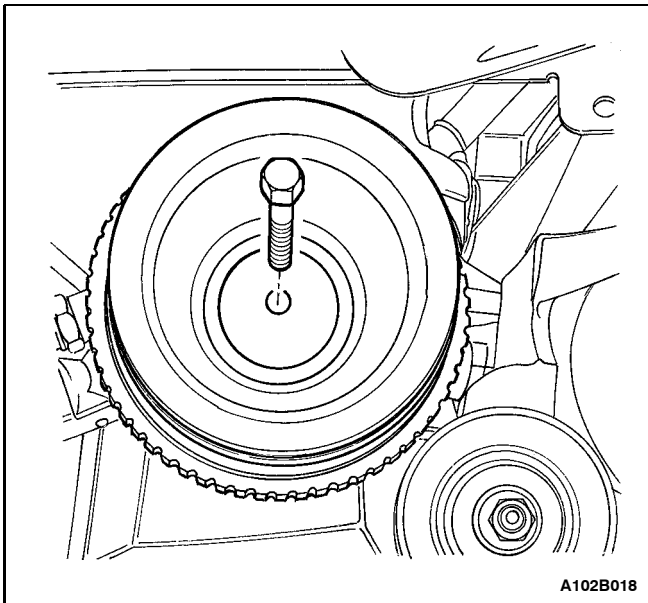
8. Remove the right front wheel well splash shield.



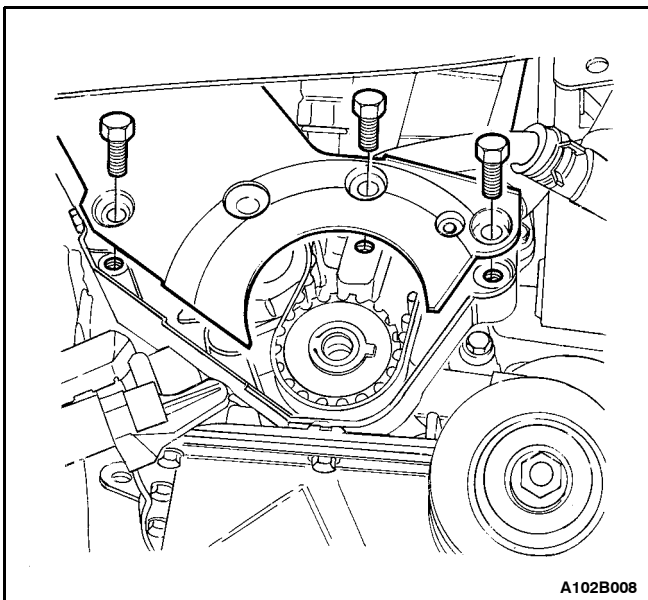
1B - 32 SOHC ENGINE MECHANICAL



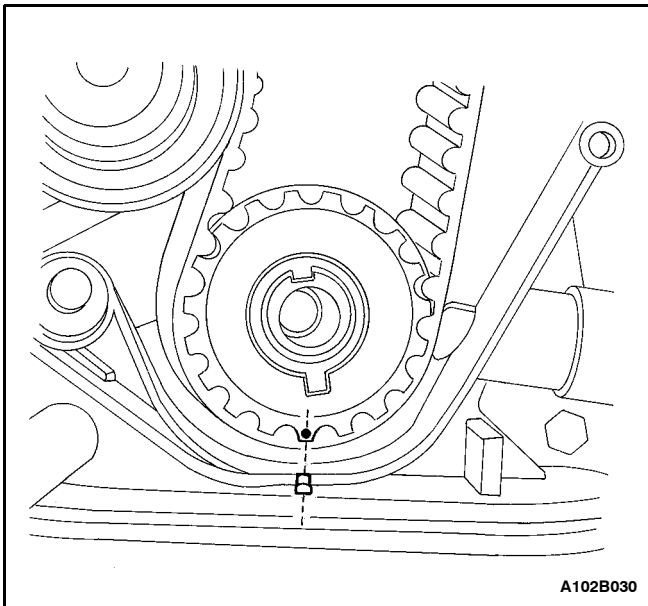
9. Remove the A/C compressor drive belt, if equipped.
10. Remove the alternator drive belt.
11. Remove the power steering pump pulley bolts, if equipped.
12. Remove the power steering pump pulley, if equipped.
13. Remove the power steering pump mounting bolts, if equipped.
14. Remove the upper timing belt cover bolts.
15. Remove the upper timing belt cover.



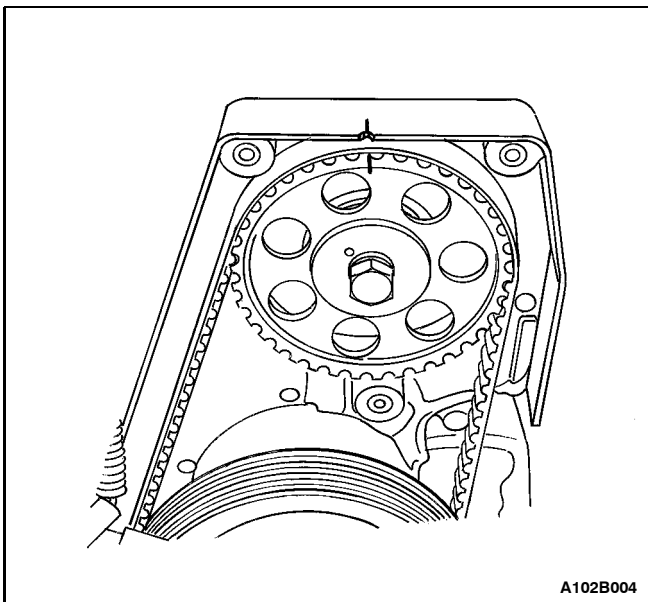
16. Remove the crankshaft pulley bolt.
17. Remove the crankshaft pulley.



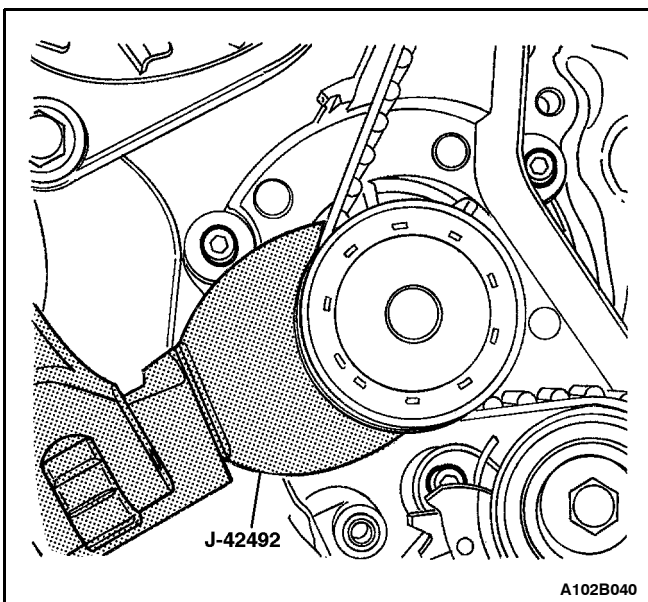
18. Remove the lower timing belt cover bolts.
19. Remove the lower timing belt cover.



20. Install the crankshaft pulley bolt.
21. Rotate the crankshaft at least one full turn clockwise using the crankshaft pulley bolt.
22. Align the dot on the crankshaft gear to the notch at the bottom of the rear timing belt cover.

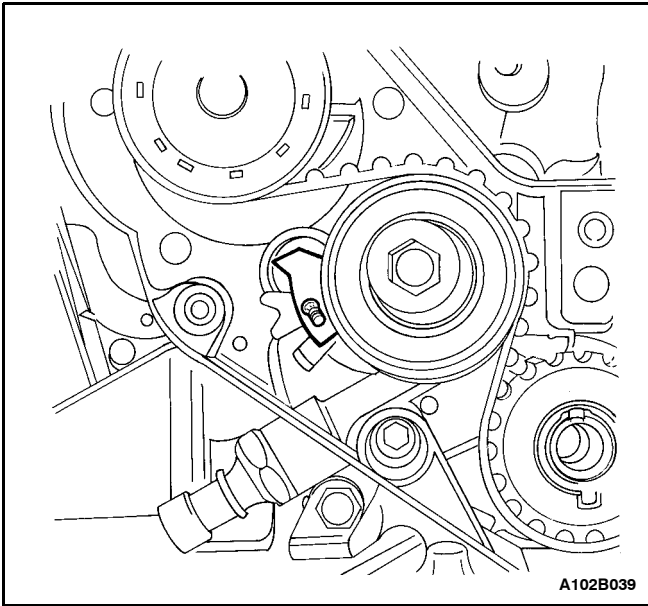


23. Align the camshaft gear timing mark to the notch at the top of the rear timing belt cover.

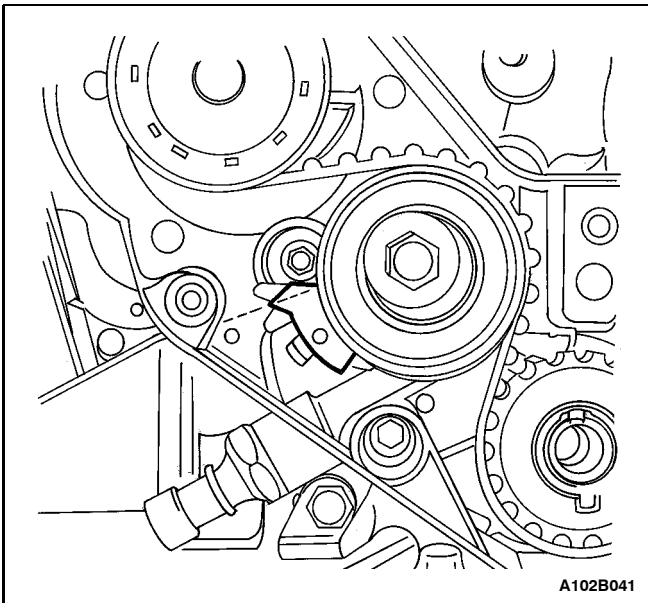


24. Slightly loosen the three coolant pump retaining bolts.
25. Using the timing belt adjuster J-42492, rotate the coolant pump clockwise to add the highest tension to the timing belt.
26. Tighten the coolant pump retaining bolts.

1B - 34 SOHC ENGINE MECHANICAL



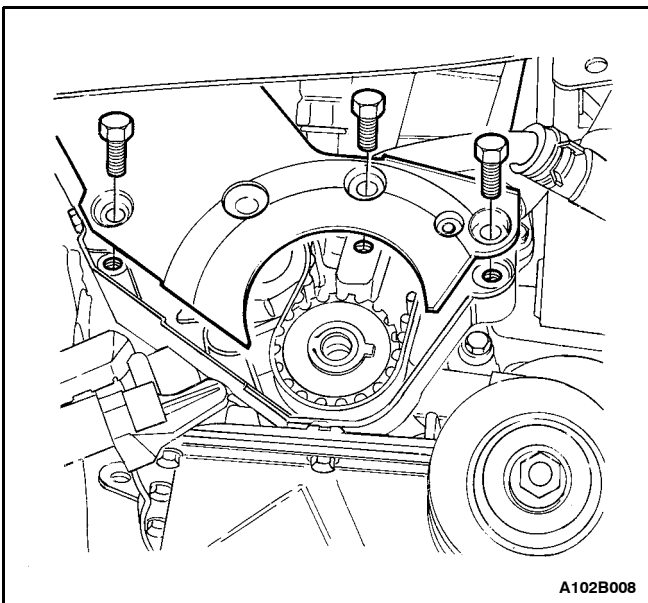
27. Align the adjust arm hole of the timing belt automatic tensioner to the hole in the timing belt automatic tensioner bracket.
28. Insert a 4.5 mm driver through the adjust arm hole and the tensioner bracket hole.
29. Rotate the crankshaft two full turns clockwise using the crankshaft pulley bolt.
30. Rotate the crankshaft at least one full turn clockwise using the crankshaft pulley bolt.
31. Remove the driver from the timing belt automatic tensioner.
32. Loosen the coolant pump retaining bolts.



33. Rotate the coolant pump until the adjust arm pointer of the timing belt automatic tensioner is aligned with the notch in the timing belt automatic tensioner bracket.
34. Tighten the coolant pump retaining bolts.

Tighten

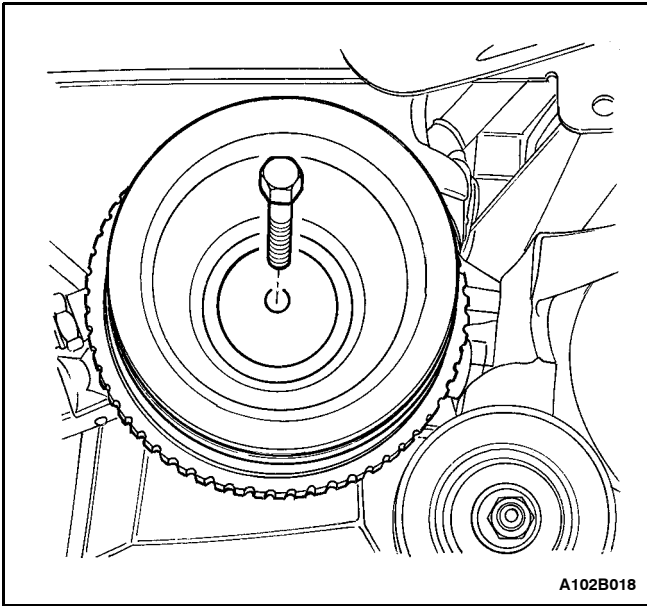
Tighten the coolant pump retaining bolts to 10 N·m (89 lb-in).



35. Remove the crankshaft pulley bolt.
36. Install the lower timing belt cover.
37. Install the lower timing belt cover bolts.

Tighten

Tighten the lower timing belt cover bolts to 10 N·m (89 lb-in).

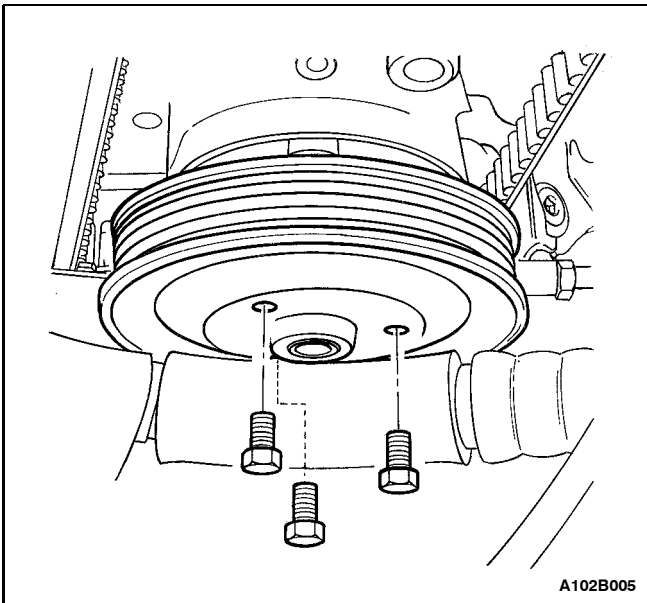


38. Install the crankshaft pulley.

39. Install the crankshaft pulley bolt.

Tighten

Tighten the crankshaft pulley bolt to 95 N·m (70 lb-ft) using a torque wrench. Use the angular torque gauge KM-470-B to tighten the crankshaft pulley bolt another 30 degrees plus 15 degrees.



40. Install the upper timing belt cover.

41. Install the upper timing belt cover bolts.

Tighten

Tighten the upper timing belt cover bolts to 10 N·m (89 lb-in).

42. Install the power steering pump mounting bolts, if equipped.

Tighten

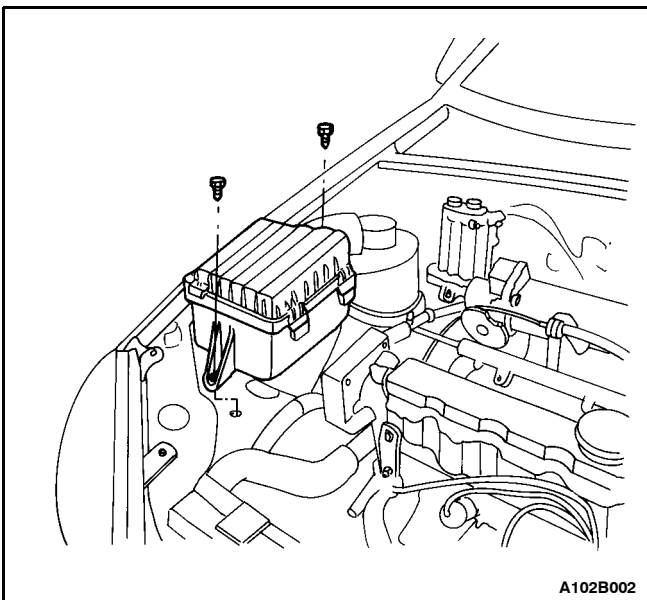
Tighten the power steering pump mounting bolts to 25 N·m (18 lb-ft).

43. Install the power steering pump pulley, if equipped.

44. Install the power steering pump pulley bolts, if equipped.

Tighten

Tighten the power steering pump pulley bolts to 25 N·m (18 lb-ft).



45. Install the alternator drive belt.

Tighten

Tighten the alternator adjusting bolt to 20 N·m (15 lb-ft).

46. Install the A/C compressor drive belt, if equipped.

47. Install the right front wheel well splash shield.

48. Install the right front wheel. Refer to Section 2E, Tires and Wheels.

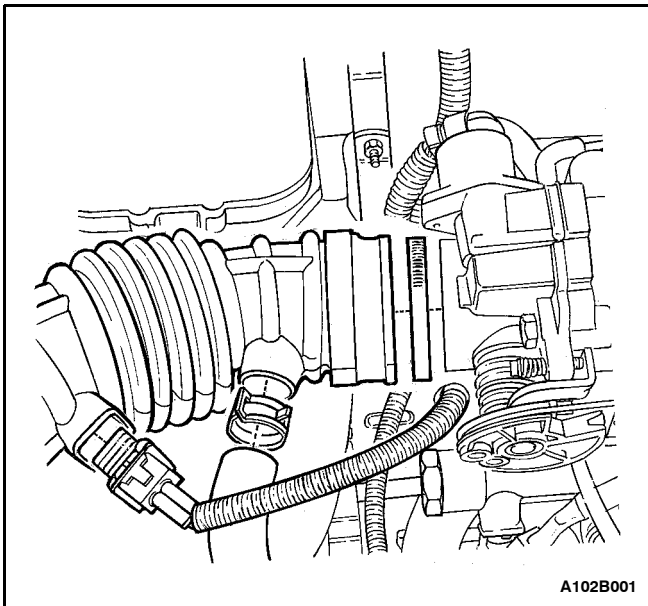
49. Install the air cleaner housing.

50. Install the air cleaner housing bolts.

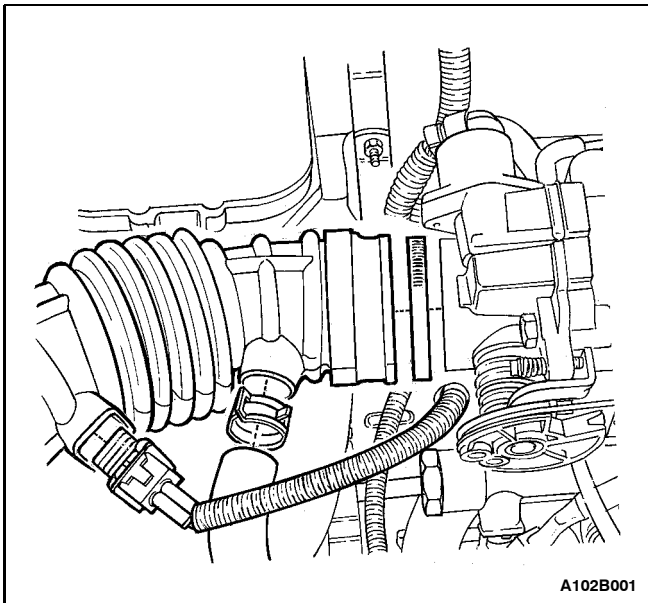
Tighten

Tighten the air filter housing bolts to 12 N·m (106 lb-in).

1B - 36 SOHC ENGINE MECHANICAL



51. Connect the air intake tube to the throttle body.
52. Connect the breather tube to the valve cover.
53. Connect the manifold air temperature sensor connector.
54. Connect the negative battery cable.



TIMING BELT

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

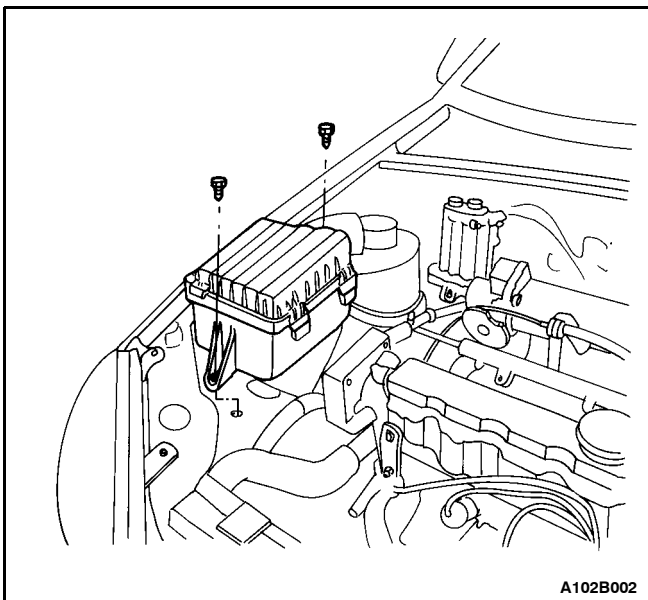
Tools Required

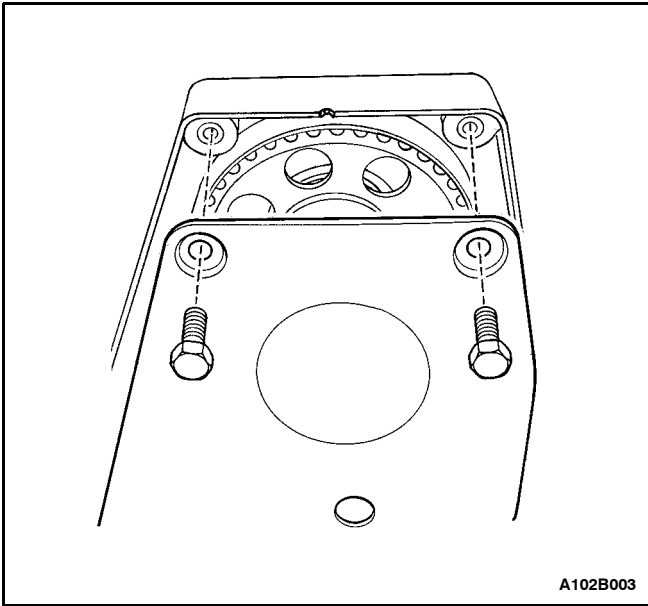
J-42492 Timing Belt Adjuster

KM-470-B Angular Torque Gauge

Removal Procedure

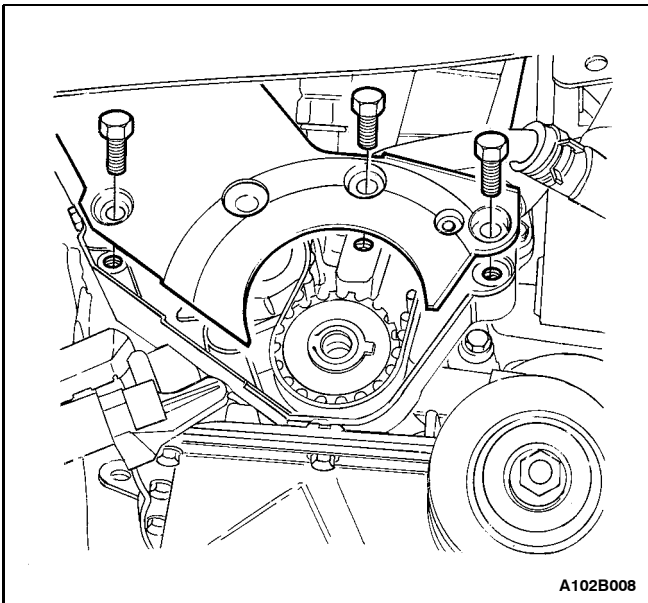
1. Disconnect the negative battery cable.
2. Disconnect the manifold air temperature sensor connector.
3. Disconnect the air intake tube from the throttle body.
4. Disconnect the breather tube from the valve cover.
5. Remove the air cleaner housing bolts.
6. Remove the air cleaner housing.
7. Remove the right front wheel. Refer to Section 2E, Tires and Wheels.
8. Remove the right front wheel well splash shield.





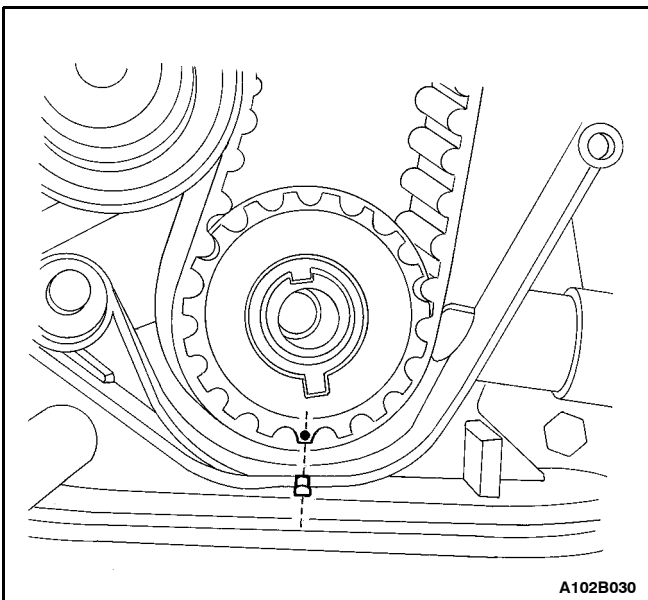
A102B003

9. Remove the A/C compressor drive belt, if equipped.
10. Remove the alternator drive belt.
11. Remove the power steering pump, if equipped. Refer to Section 6B, Power Steering Pump.
12. Remove the upper timing belt cover bolts.
13. Remove the upper timing belt cover.



A102B008

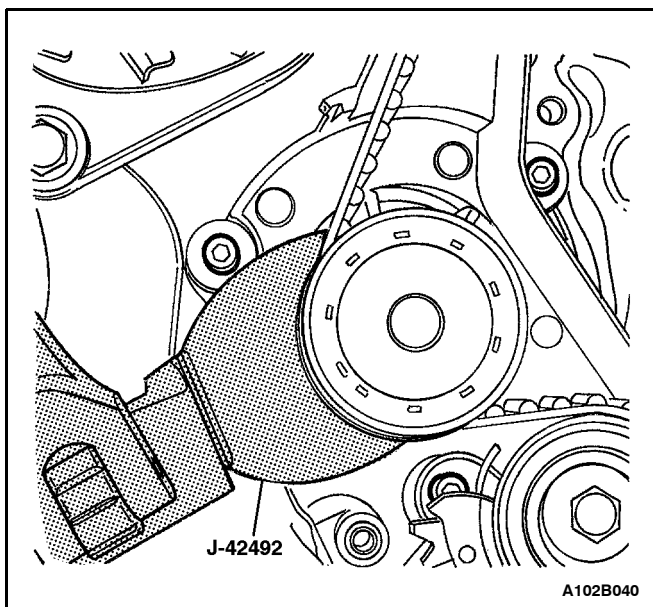
14. Remove the crankshaft pulley bolt.
15. Remove the crankshaft pulley.
16. Remove the lower timing belt cover bolts.
17. Remove the lower timing belt cover.



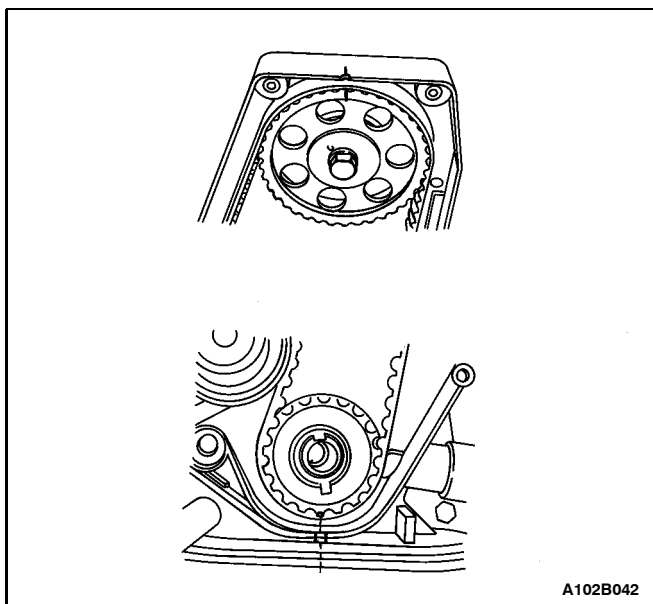
A102B030

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

1B - 38 SOHC ENGINE MECHANICAL

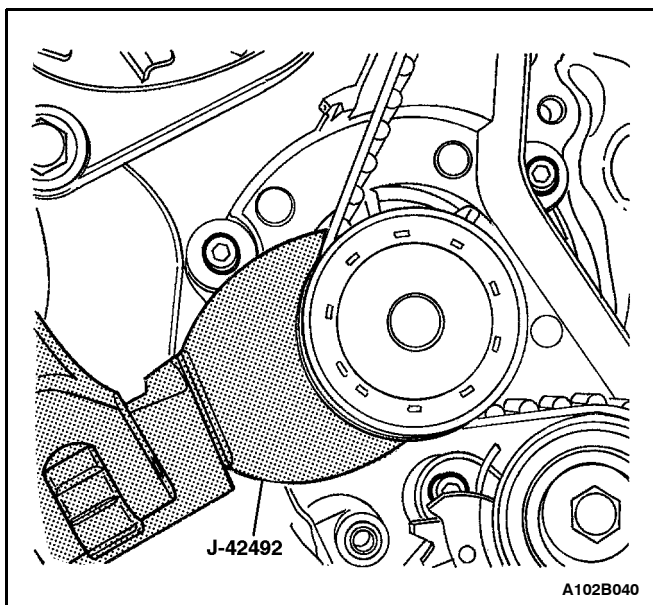


20. Slightly loosen the coolant pump retaining bolts.
21. Using the timing belt adjuster J-42492, rotate the coolant pump counterclockwise to release the tension on the timing belt.
22. Remove the timing belt.

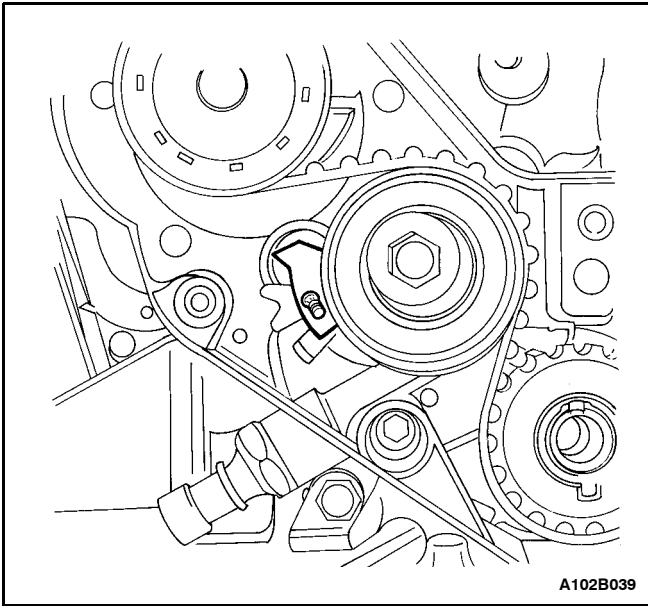


Installation Procedure

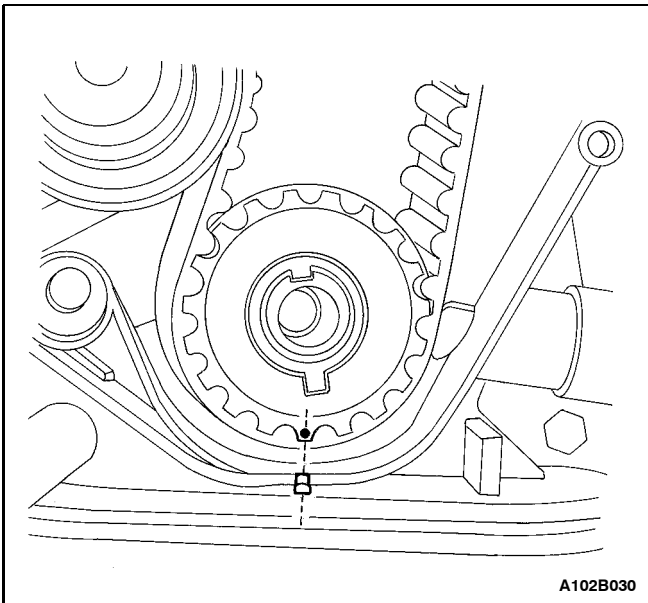
1. Align the mark on the crankshaft gear to the notch on the bottom of the rear timing belt cover.
2. Align the mark on the camshaft gear to the notch on the top of the rear timing belt cover.
3. Install the timing belt.



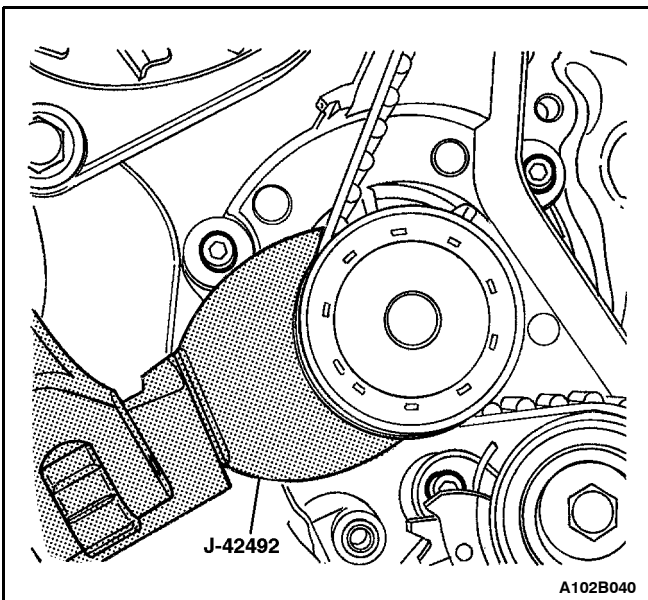
4. Using the timing belt adjuster J-42492, rotate the coolant pump clockwise to add the highest tension to the timing belt.
5. Tighten the coolant pump retaining bolts.



6. Align the adjust arm hole of the timing belt automatic tensioner to the hole in the timing belt automatic tensioner bracket.
7. Insert a 4.5 mm driver through the adjust arm hole and the tensioner bracket hole.

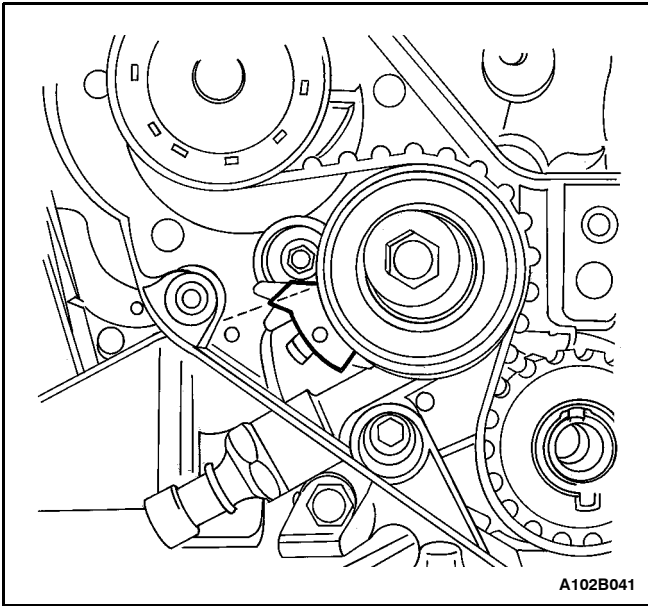


8. Rotate the crankshaft two full turns clockwise using the crankshaft pulley bolt.
9. Align the mark on the crankshaft gear to the notch at the bottom of the rear timing belt cover.



10. Remove the driver from the timing belt automatic tensioner.
11. Slightly loosen the three coolant pump retaining bolts.
12. Using the timing belt adjuster J-42492, rotate the coolant pump.

1B - 40 SOHC ENGINE MECHANICAL

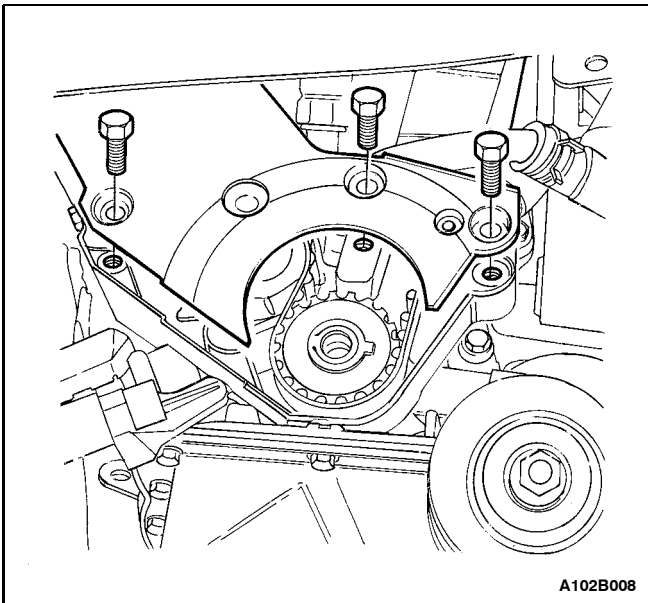


13. Rotate the coolant pump until the adjust arm pointer of the timing belt automatic tensioner is aligned with the notch in the timing belt automatic tensioner bracket.

14. Tighten the coolant pump retaining bolts.

Tighten

Tighten the coolant pump retaining bolts to 10 NSm (89 lb-in).



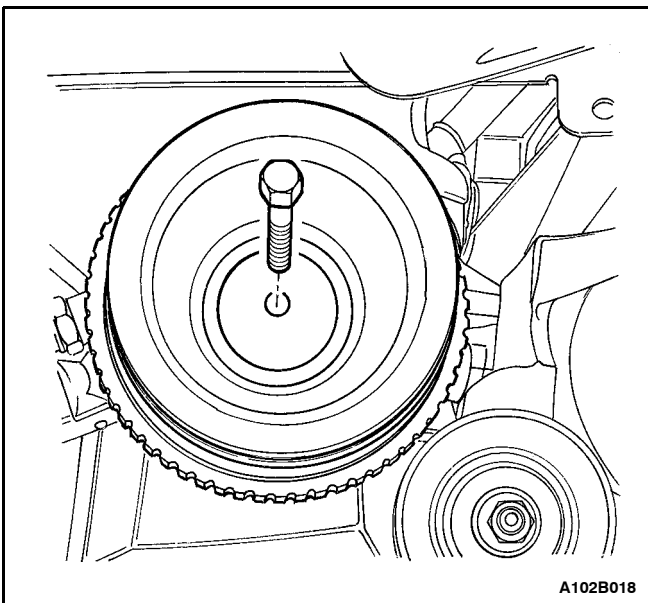
15. Remove the crankshaft pulley bolt.

16. Install the lower timing belt cover.

17. Install the lower timing belt cover bolts.

Tighten

Tighten the lower timing belt cover bolts to 10 NSm (89 lb-in).

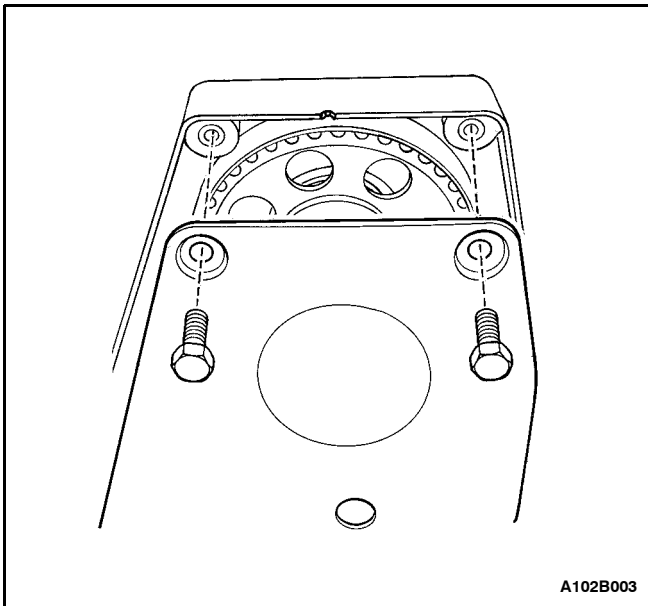


18. Install the crankshaft pulley.

19. Install the crankshaft pulley bolt.

Tighten

Tighten the crankshaft pulley bolt to 95 NSm (70 lb-ft) using a torque wrench. Using the angular torque gauge KM-470-B, tighten the crankshaft pulley bolt another 30 degrees plus 15 degrees.

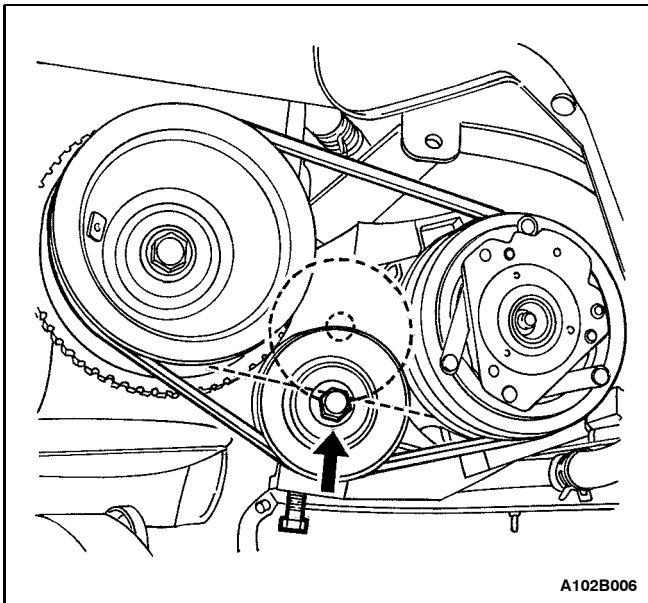


20. Install the upper timing belt cover.

21. Install the upper timing belt cover bolts.

Tighten

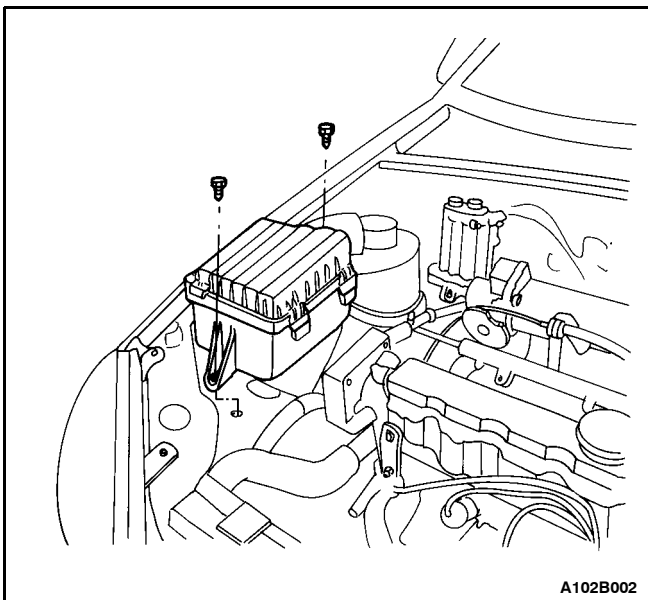
Tighten the upper timing belt cover bolts to 10 N·m (89 lb-in).



22. Install the power steering pump, if equipped. Refer to Section 6B, Power Steering Pump.

23. Install the alternator drive belt.

24. Install the A/C compressor drive belt, if equipped.



25. Install the right front wheel well splash shield.

26. Install the right front wheel. Refer to Section 2E, Tires and Wheels.

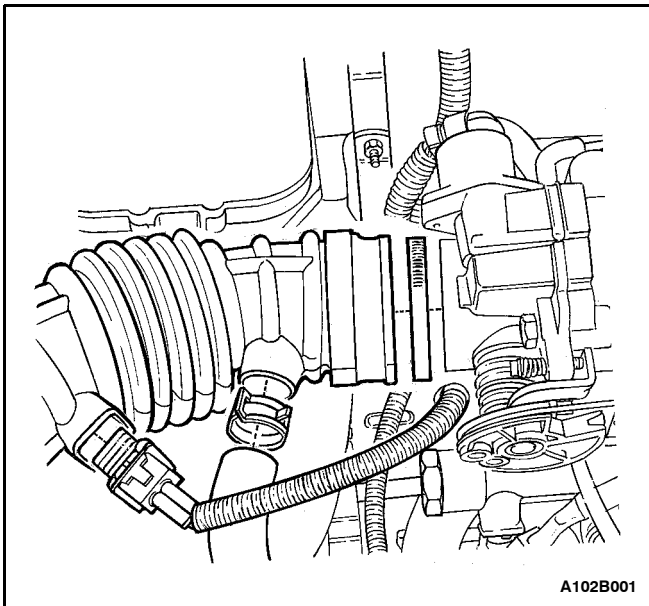
27. Install the air filter housing.

28. Install the air filter housing bolts.

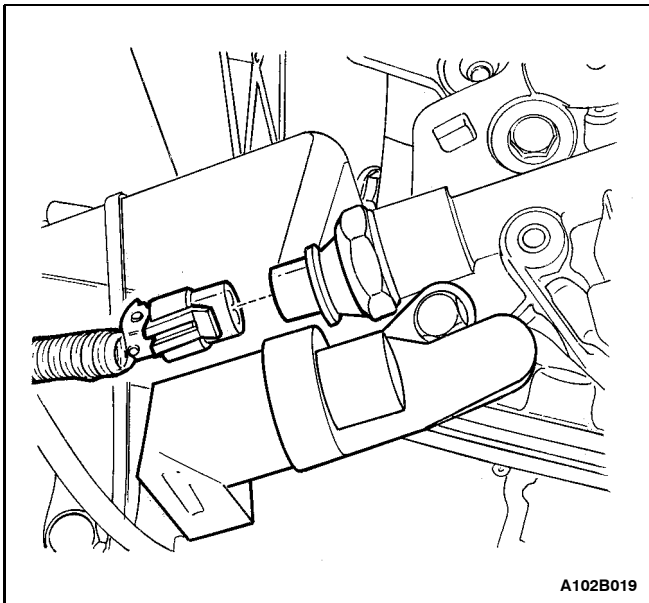
Tighten

Tighten the air filter housing bolts to 12 N·m (106 lb-in).

1B - 42 SOHC ENGINE MECHANICAL



29. Connect the air intake tube to the throttle body.
30. Connect the breather tube to the valve cover.
31. Connect the manifold air temperature sensor connector.
32. Connect the negative battery cable.



OIL PUMP

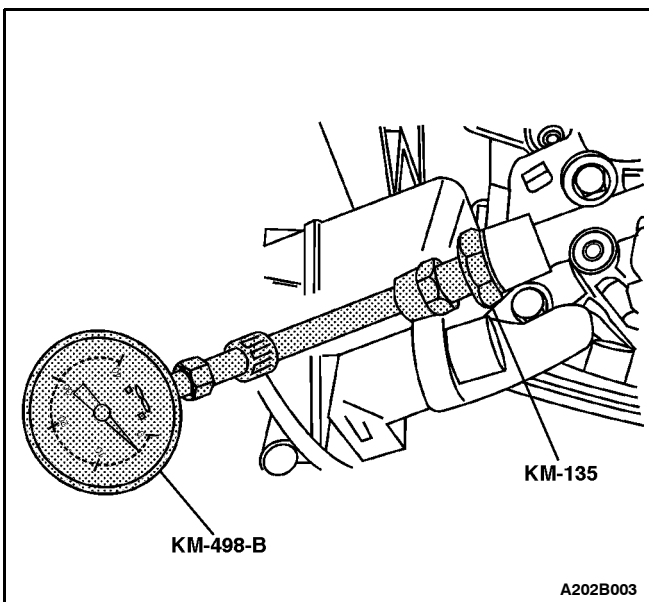
Tools Required

KM-498-B Pressure Gauge

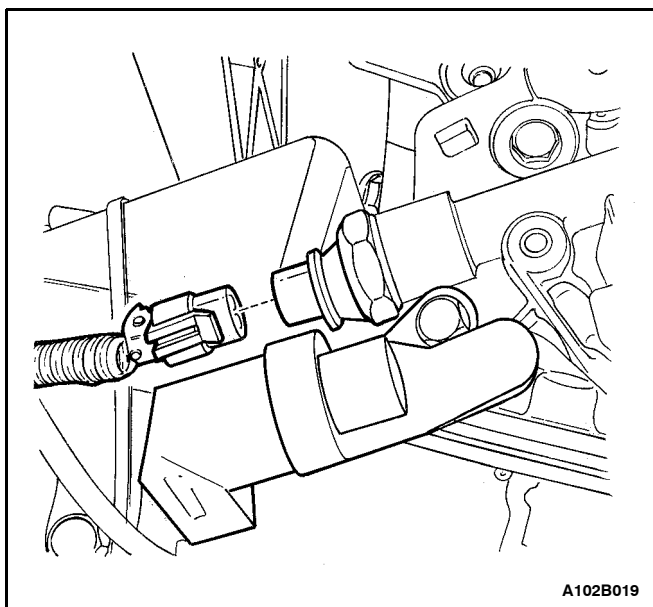
KM-135 Adapter

Engine Oil Pressure Inspection Procedure

1. Remove the right-hand (RH) wheel well splash shield.
2. Remove the oil pressure switch connector.



3. Install the adapter KM-135 in place of the oil pressure switch.
 4. Connect the pressure gauge KM-498-B to the adapter.
 5. Start the engine and check the oil pressure at idle speed and an engine temperature of 80_C (176_F).
- Important:** The minimum oil pressure should be 30 kPa (8.88 psi).
6. Stop the engine and remove the oil pressure gauge and the adapter.



7. Install the oil pressure switch.

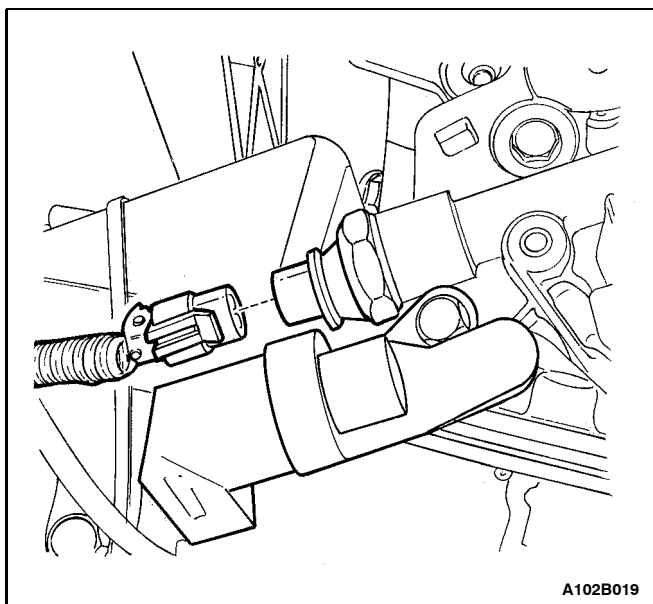
Tighten

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 RH wheel well splash shield.

10. Check the oil level and fill the oil to the FULL mark.



Removal Procedure

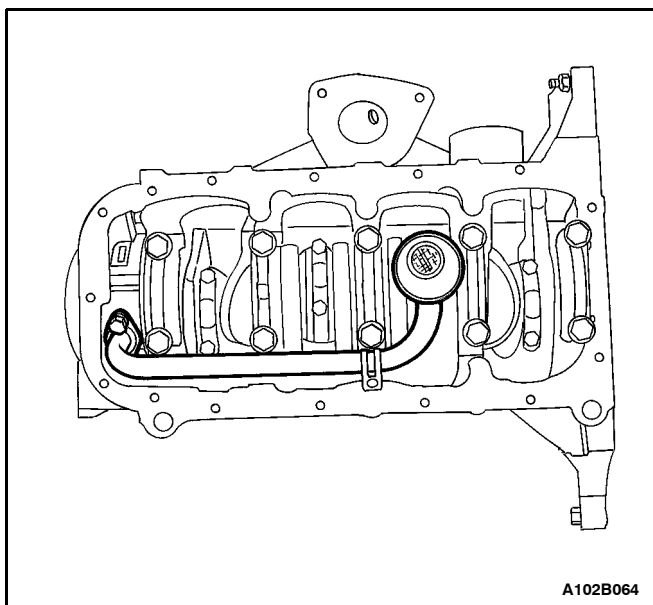
1. Disconnect the negative battery cable.

2. Remove the power steering pump, if equipped. Refer to Section 6A, Power Steering System.

3. Remove the timing belt. Refer to "Timing Belt" in this section.

4. Remove the rear timing belt cover. Refer to "Rear Timing Belt Cover" in this section.

5. Disconnect the oil pressure switch connector.



6. Remove the crankshaft position sensor bolt.

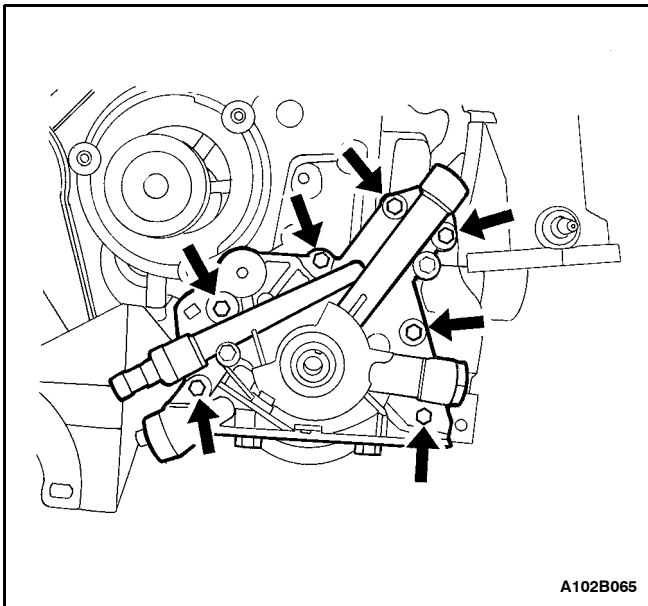
7. Remove the crankshaft position sensor.

8. Remove the oil pan. Refer to "Oil Pan" in this section.

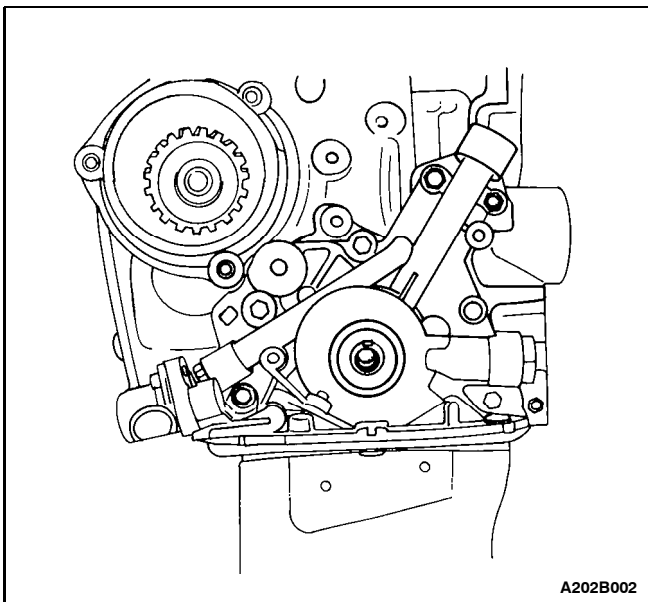
9. Remove the oil pump pickup tube and the support bracket bolts.

10. Remove the oil pump pickup tube.

1B - 44 SOHC ENGINE MECHANICAL

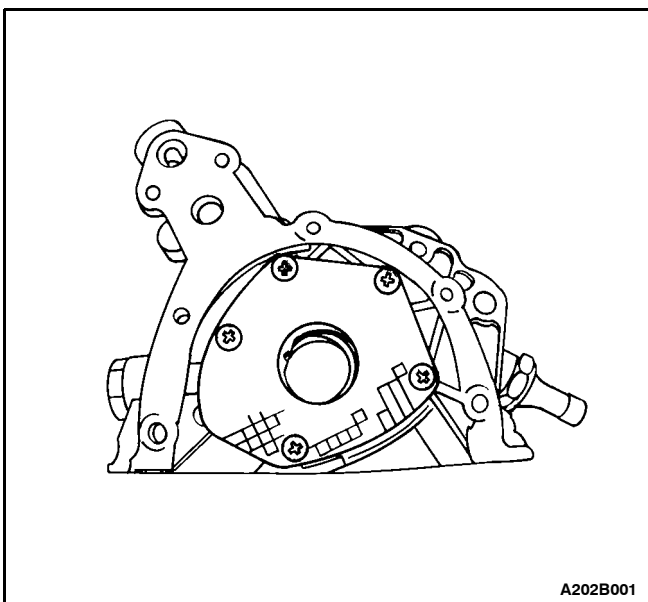


11. Remove the oil pump retaining bolts.
12. Carefully separate the oil pump and the gasket from the engine block and the oil pan.
13. Remove the oil pump.

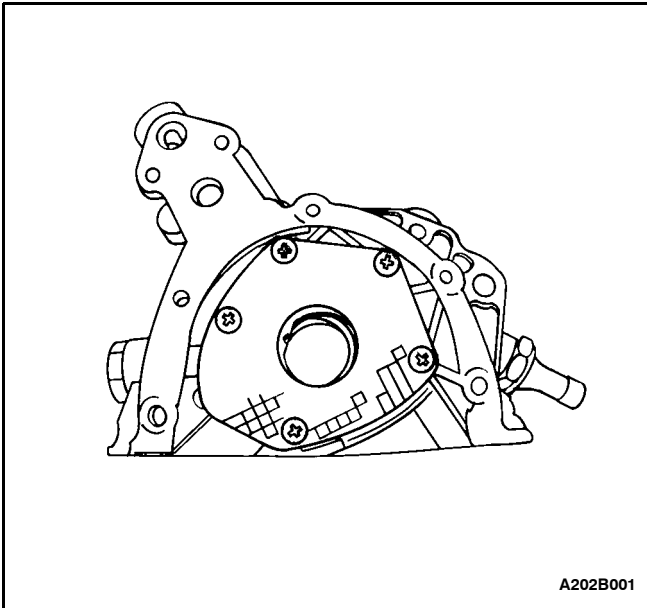


Inspection Procedure

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



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



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

Notice: Pack the oil pump gear cavity with petroleum jelly to ensure an oil pump prime. Failure to do this can damage the engine.

11. Install the oil pump rear cover and the bolts.

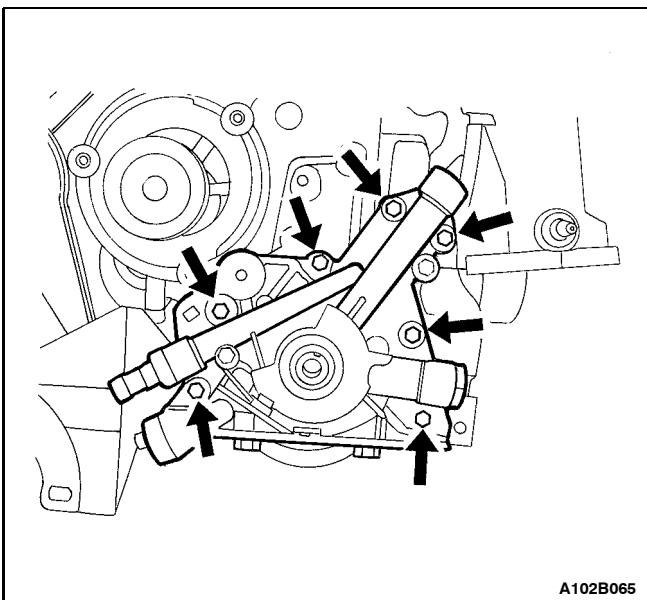
Tighten

Tighten the oil pump rear cover bolts to 6 NSm (53 lb-in).

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

Tighten

Tighten the oil pump safety relief valve bolt to 30 NSm (22 lb-ft).



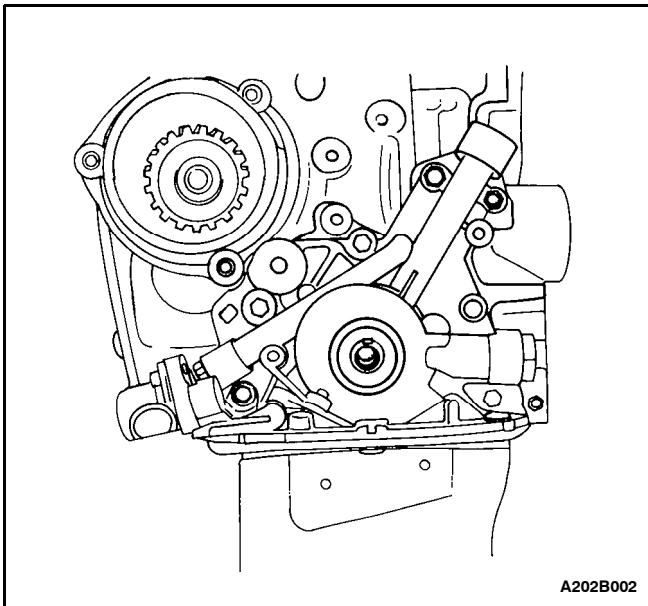
Installation Procedure

1. Apply a bead of room temperature vulcanizing (RTV) sealer to the oil pump gasket.
2. Install a new oil pump gasket to the oil pump.
3. Coat the threads of the oil pump bolts with Loctite[®] 573.
4. Install the oil pump to the engine block with the bolts.

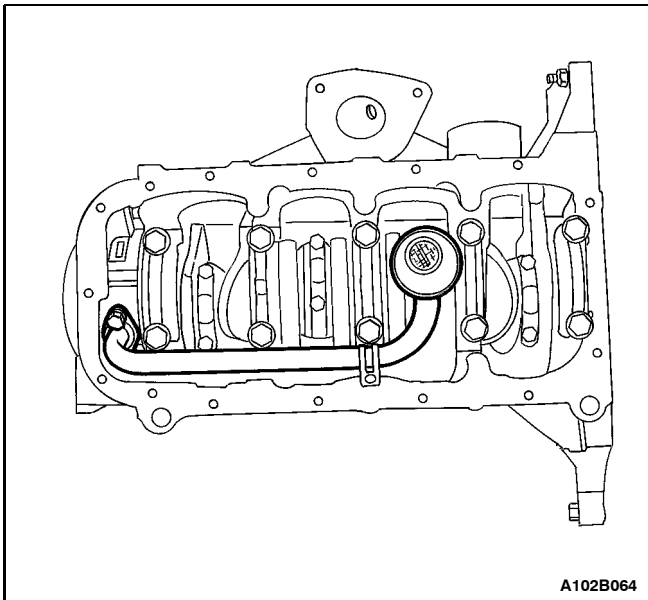
Tighten

Tighten the oil pump retaining bolts to 10 NSm (89 lb-in).

1B - 46 SOHC ENGINE MECHANICAL



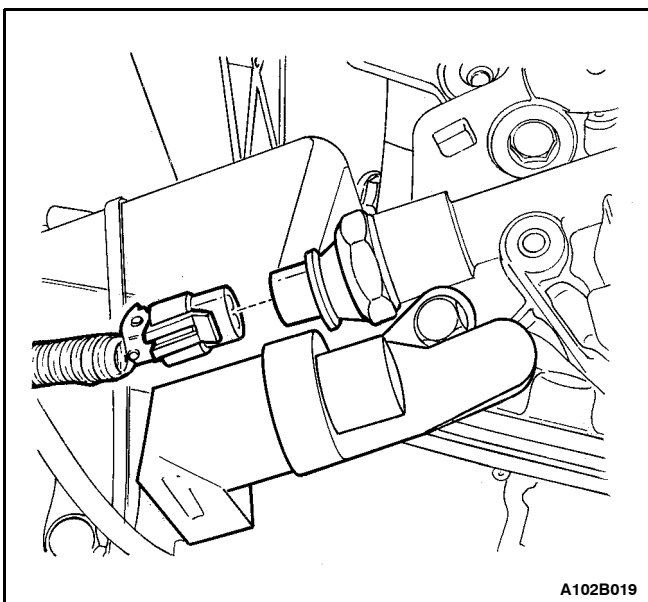
5. Install a new oil pump to the crankshaft shaft seal.
6. Coat the lip of the seal with a thin coat of grease.



7. Coat the threads of the oil pump pickup tube and the support bracket bolts with Loctite[®] 573.
8. Install the oil pump pickup tube and the bolts.

Tighten

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

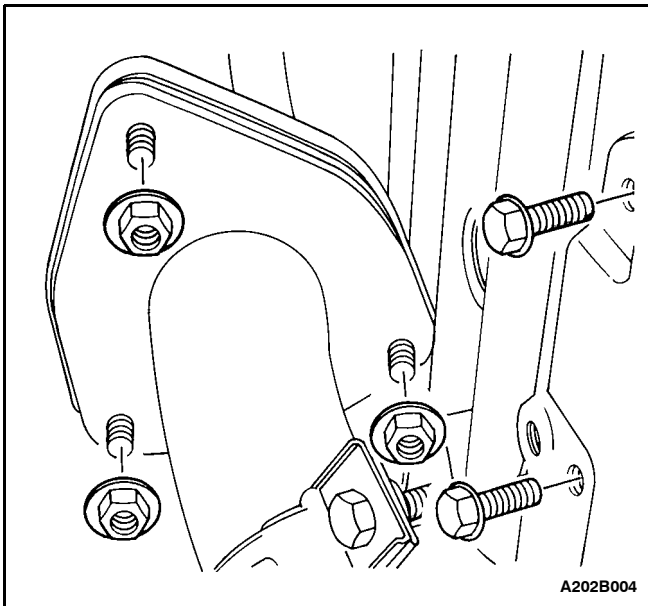


9. Install the oil pan. Refer to "Oil Pan" in this section.
10. Install the crankshaft position sensor and the bolt.

Tighten

Tighten the crankshaft position sensor retaining bolt to 10 N·m (89 lb-in).

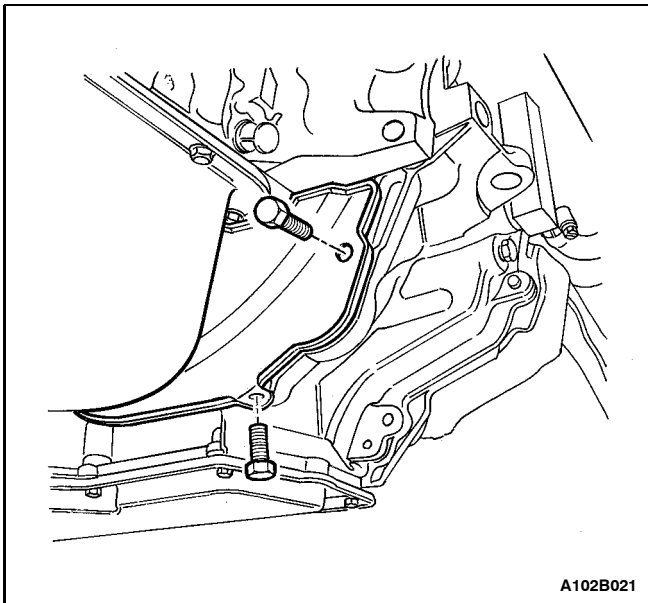
11. Connect the oil pressure switch connector.
12. Install the rear timing belt cover. Refer to "Rear Timing Belt Cover" in this section.
13. Install the timing belt. Refer to "Timing Belt" In this section.
14. Install the power steering pump, if equipped. Refer to Section 6A, Power Steering System.
15. Connect the negative battery cable.



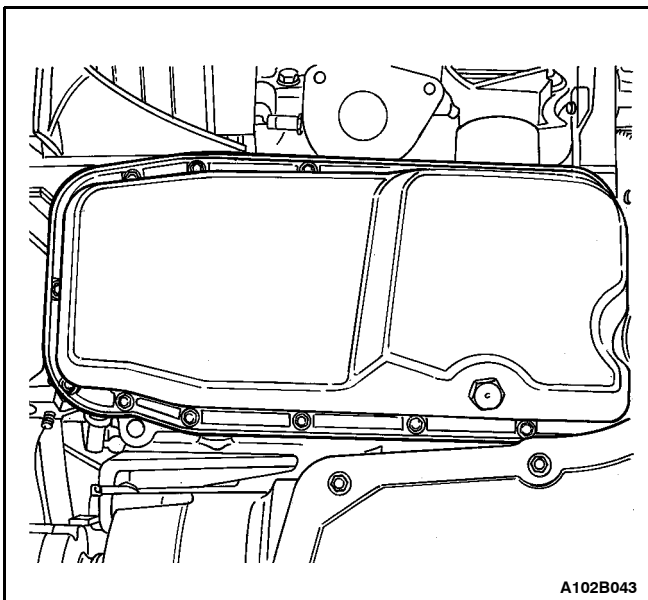
OIL PAN

Removal Procedure

1. Disconnect the negative battery cable.
2. Drain the engine oil from the engine crankcase.
3. Remove the exhaust flex pipe retaining nuts from the exhaust manifold and the bolts from the bracket.
4. Remove the exhaust flex pipe retaining nuts from the catalytic converter or connecting pipe.
5. Remove the exhaust flex pipe.

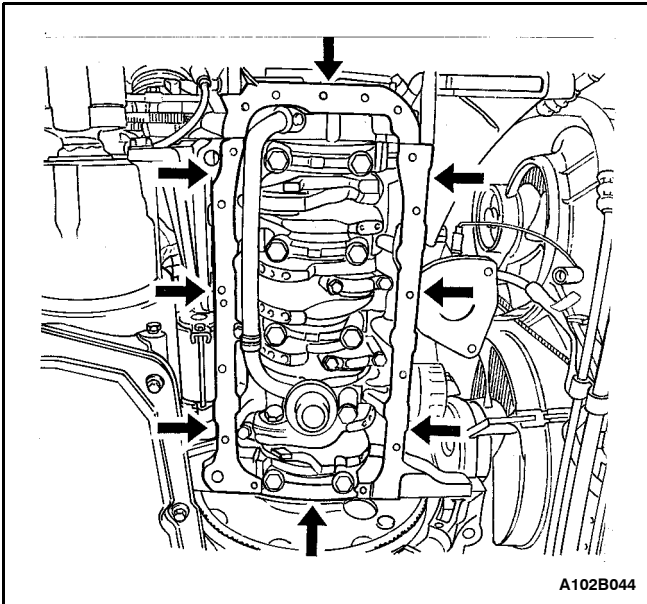


6. Remove the flywheel or flexible plate inspection cover bolts.
7. Remove the flywheel or flexible plate inspection cover.



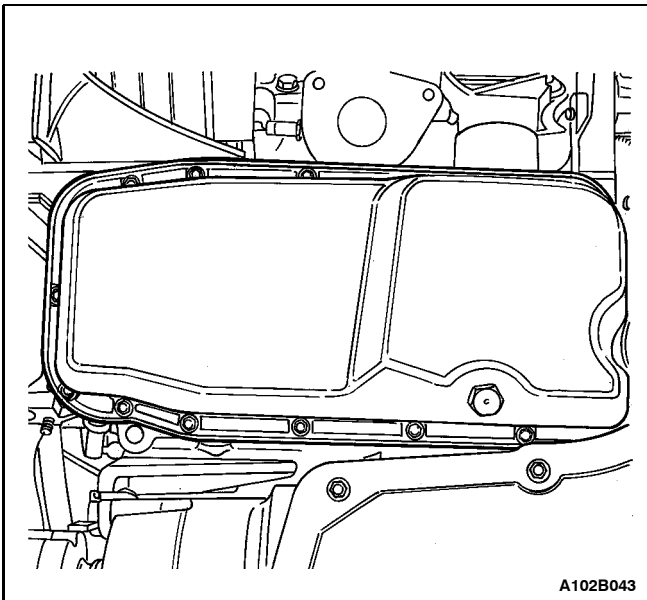
8. Remove the oil pan retaining bolts.
9. Remove the oil pan from the engine block.

1B - 48 SOHC ENGINE MECHANICAL



Cleaning Procedure

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



Installation Procedure

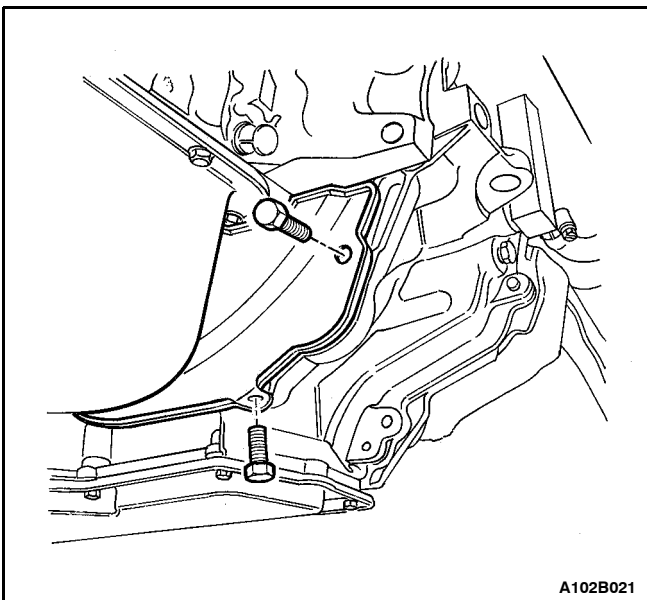
1. Install the oil pan gasket to the oil pan.
2. Install the oil pan to the engine block.

Important: Install the oil pan within 5 minutes after applying liquid gasket to the oil pan.

3. Install the oil pan retaining bolts.

Tighten

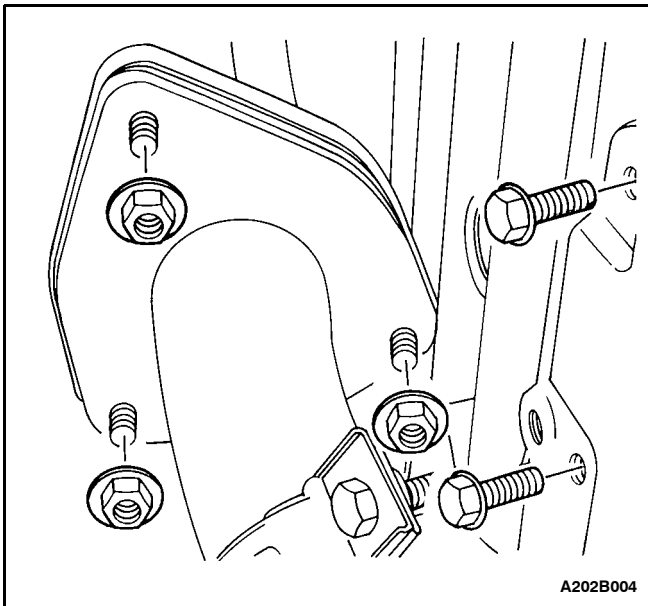
Tighten the oil pan retaining bolts to 10 NSm (89 lb-in).



4. Install the flywheel or flexible plate inspection cover.
5. Install the flywheel or flexible plate inspection cover bolts.

Tighten

Tighten the flywheel inspection cover bolts to 12 NSm (106 lb-in) or the flexible plate inspection cover bolts to 10 NSm (89 lb-in).



6. Install the exhaust flex pipe.

7. Install the exhaust flex pipe to the exhaust manifold retaining nuts and the bracket bolts.

Tighten

Tighten the exhaust flex pipe-to-exhaust manifold retaining nuts and bracket bolts to 40 N_m (30 lb-ft).

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

Tighten

Tighten the exhaust flex pipe-to-catalytic converter or connecting pipe retaining nuts to 30 N_m (22 lb-ft).

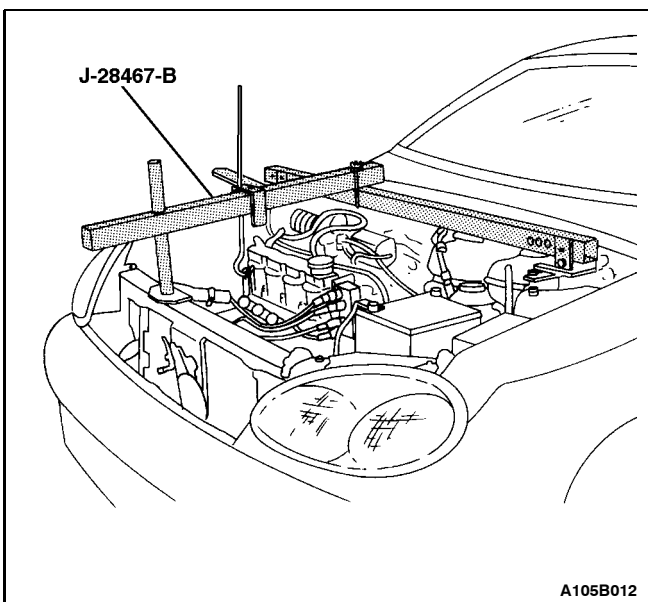
9. Connect the negative battery cable.

10. Install the oil pan drain plug.

Tighten

Tighten the oil pan drain plug to 55 N_m (41 lb-ft).

11. Refill the engine crankcase with engine oil.



ENGINE MOUNT

Tools Required

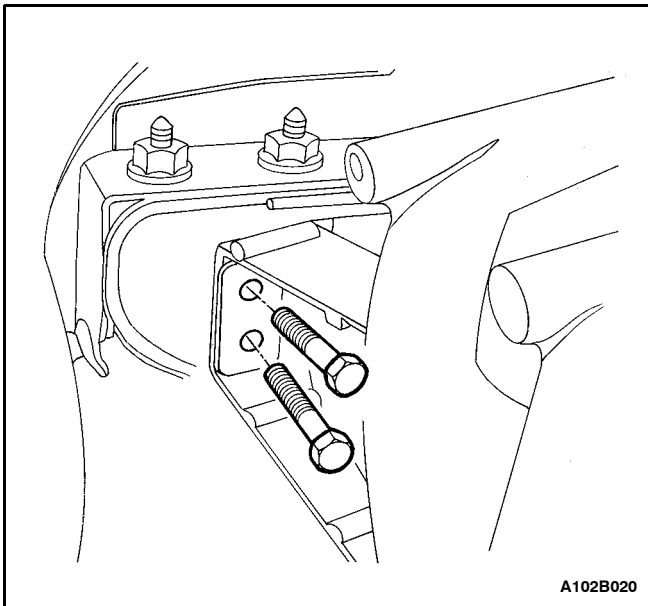
J-28467-B Engine Assembly Support Fixture

Removal Procedure

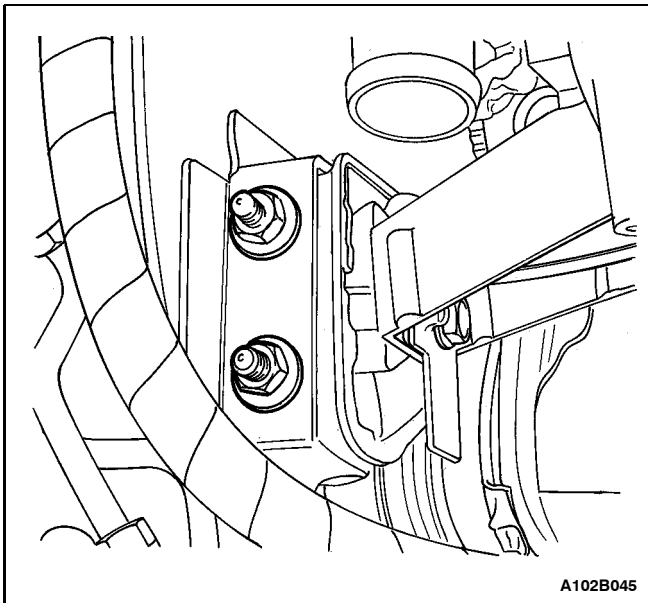
1. Disconnect the negative battery cable.

2. Support the engine assembly using the engine assembly support fixture J-28467-B.

1B - 50 SOHC ENGINE MECHANICAL

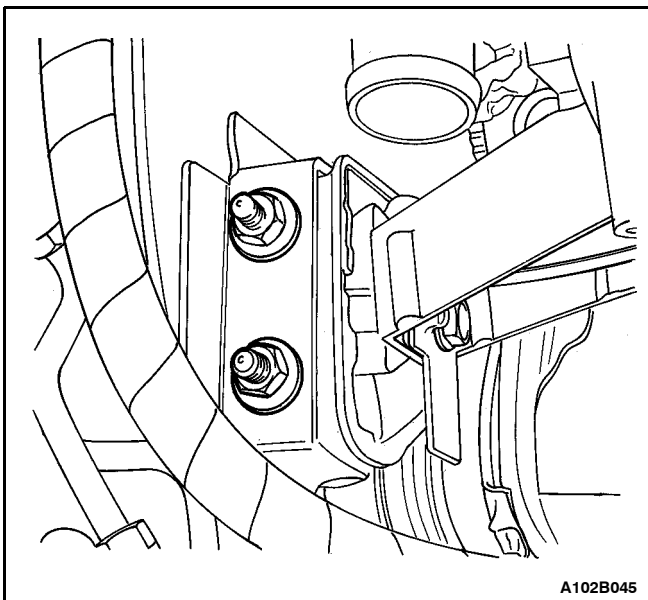


3. Remove the engine mount bracket retaining bolts.



4. Remove the engine mount attaching nuts.

5. Remove the engine mount.

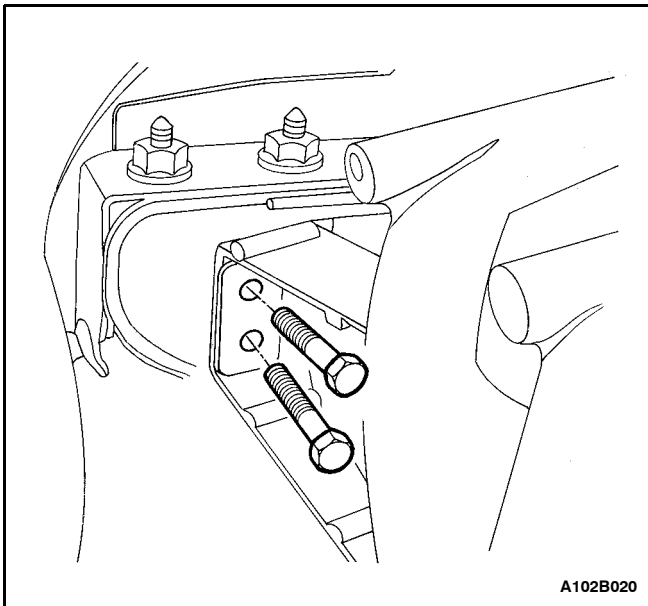


Installation Procedure

1. Install the engine mount.
2. Install the engine mount attaching nuts.

Tighten

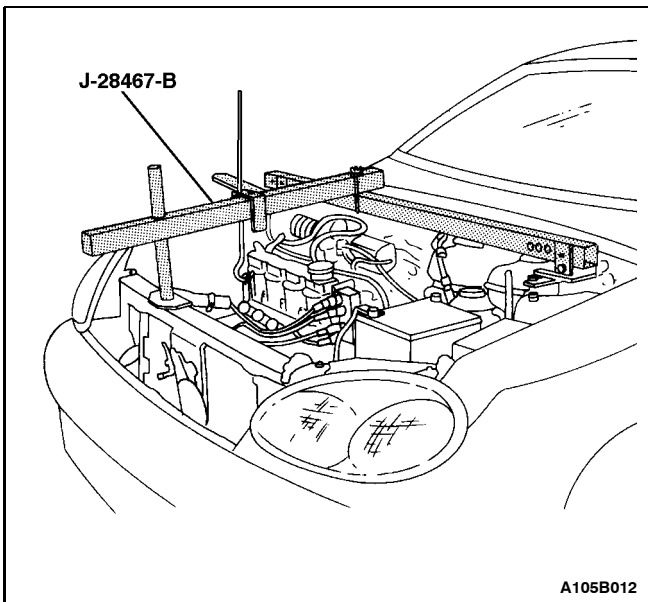
Tighten the engine mount attaching nuts to 40 NSm (30 lb-ft).



3. Install the engine mount bracket retaining bolts.

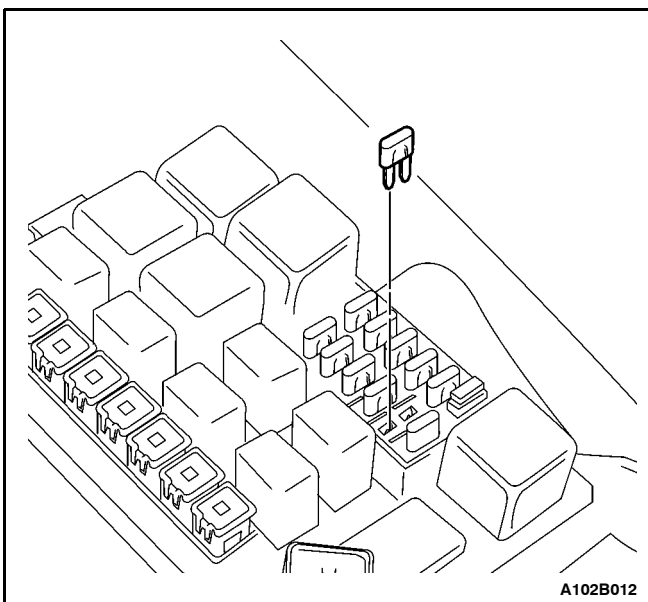
Tighten

Tighten the engine mount bracket retaining bolts to 60 Nsm (44 lb-ft).



4. Remove the engine assembly support fixture J-28467-B.

5. Connect the negative battery cable.



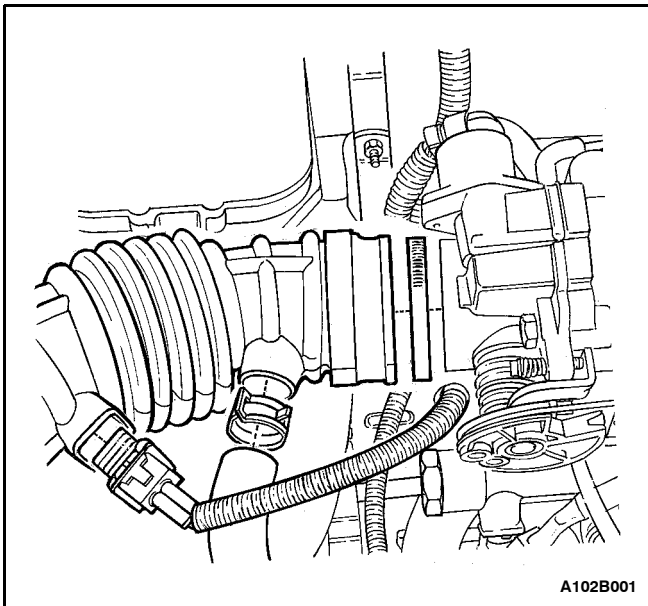
INTAKE MANIFOLD

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

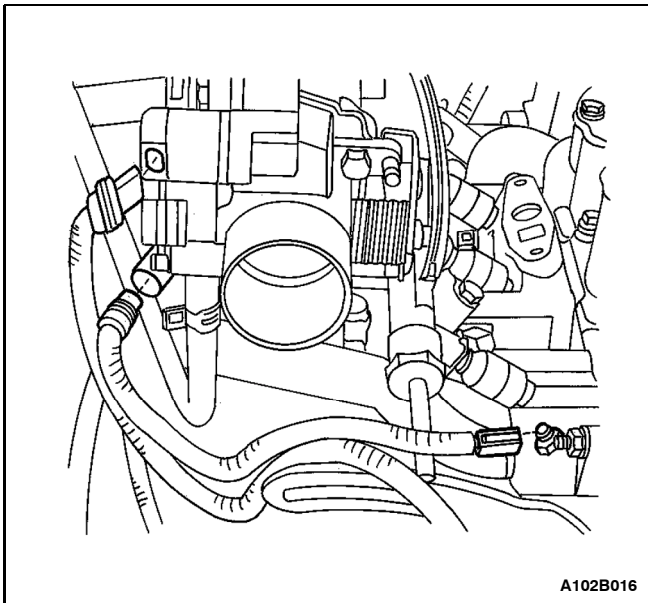
Removal Procedure

1. Remove the fuel pump fuse.
2. Start the engine. Crank the engine after it stalls for 10 seconds to rid the fuel system of fuel pressure.
3. Disconnect the negative battery cable.
4. Disconnect the electronic control module (ECM) ground terminal from the intake manifold.

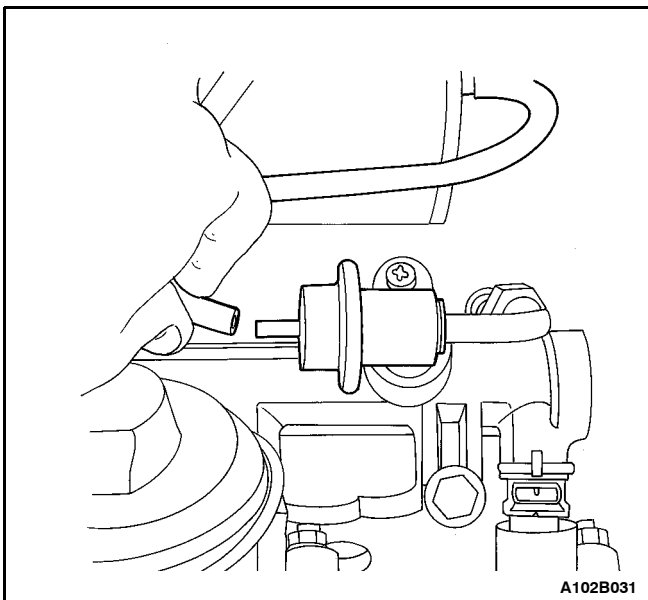
1B - 52 SOHC ENGINE MECHANICAL



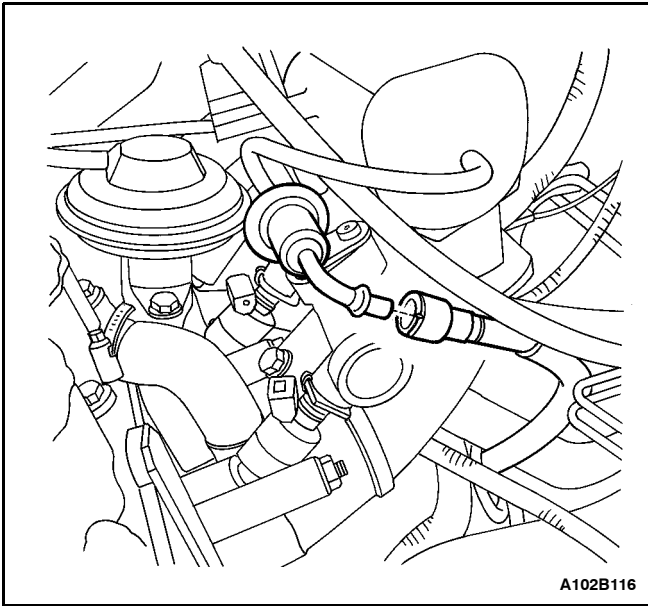
5. Drain the engine coolant. Refer to Section 1D, Engine Cooling.
6. Disconnect the manifold air temperature sensor connector.
7. Disconnect the air intake tube from the throttle body.



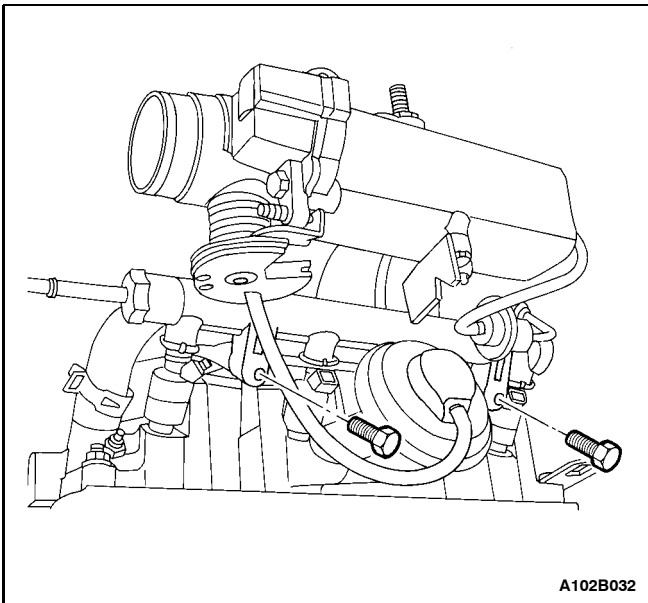
8. Disconnect the idle air control valve connector.
9. Disconnect the throttle position sensor connector.
10. Disconnect the engine coolant temperature sensor connector.



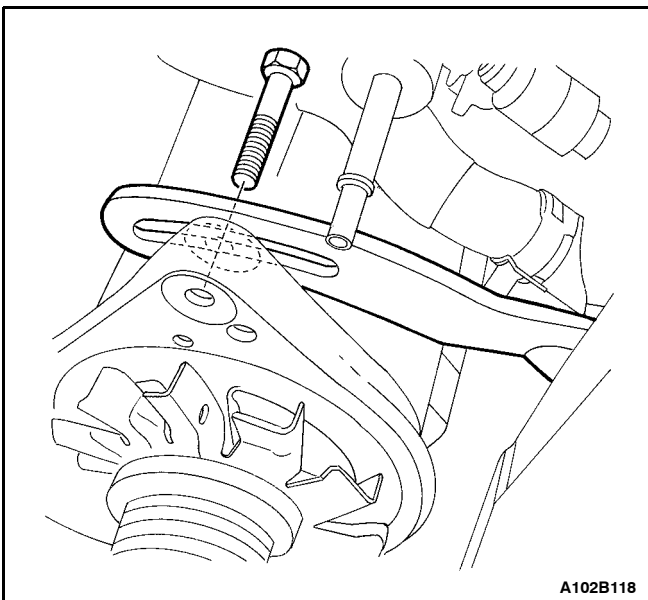
11. Disconnect the heater inlet hose from the coolant distributor beneath the intake manifold.
12. Disconnect the surge tank coolant hose at the throttle body.
13. Disconnect all of the necessary vacuum hoses, including the vacuum hose at the fuel pressure regulator and the brake booster vacuum hose at the intake manifold.



14. Disconnect the throttle cable from the throttle body and the intake manifold.
15. Remove the two throttle cable bracket bolts and the throttle cable bracket.
16. Disconnect the fuel return line from the fuel pressure regulator.
17. Disconnect the fuel feed line from the fuel rail.

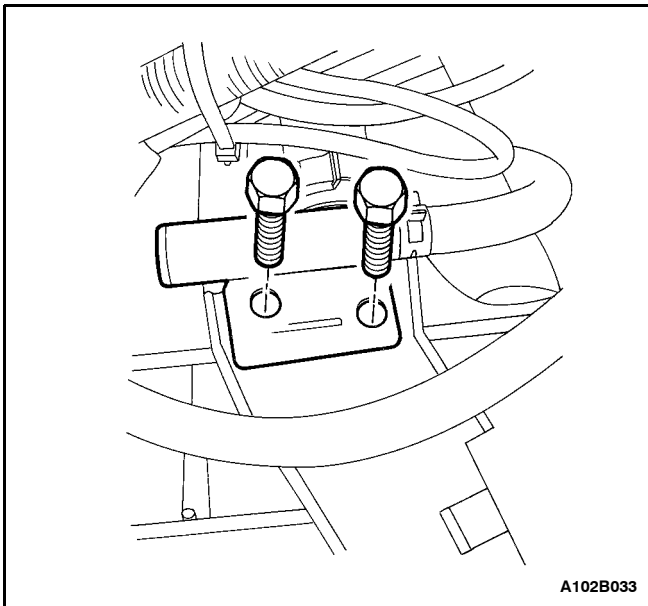


18. Disconnect the fuel injector connectors from the fuel injectors.
19. Remove the two retaining bolts from the fuel injector rail.
20. Remove the fuel injector rail and fuel injectors as an assembly. Refer to Section 1F, Engine Controls.



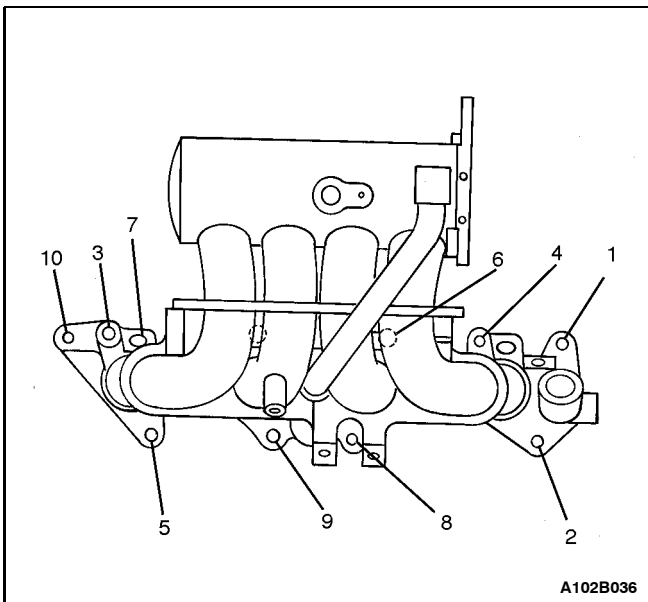
21. Remove the alternator drive belt.
22. Remove the alternator adjusting bracket and the bolts.

1B - 54 SOHC ENGINE MECHANICAL

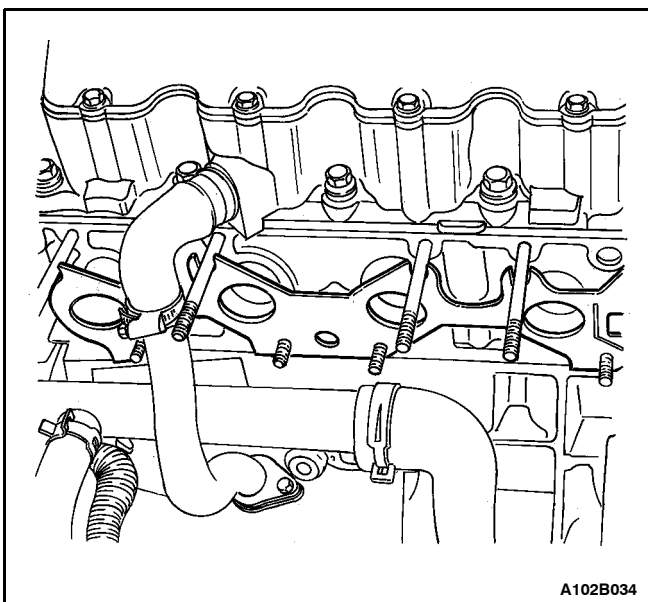


23. Remove the three intake manifold support bracket retaining bolts from the coolant distributor and the engine block.

24. Remove the intake manifold support bracket.



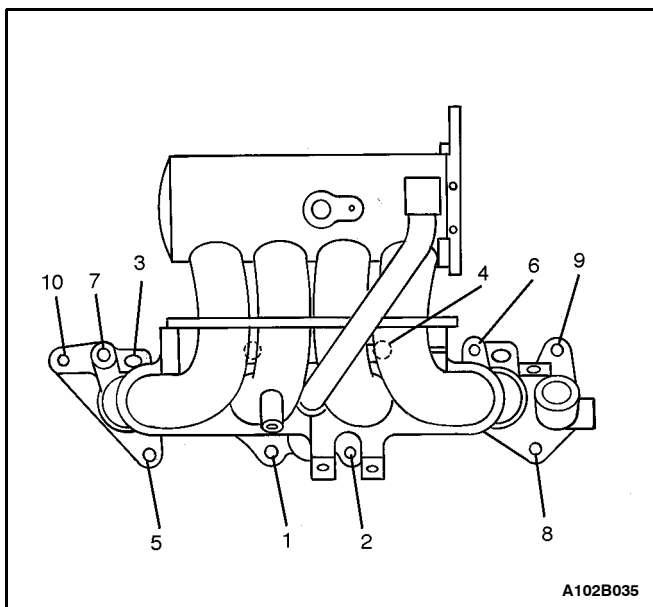
25. Remove the intake manifold retaining nuts and the engine lift bracket bolt in the sequence shown.



26. Remove the intake manifold.

27. Remove the intake manifold gasket.

28. Clean the sealing surfaces of the intake manifold and the cylinder head.



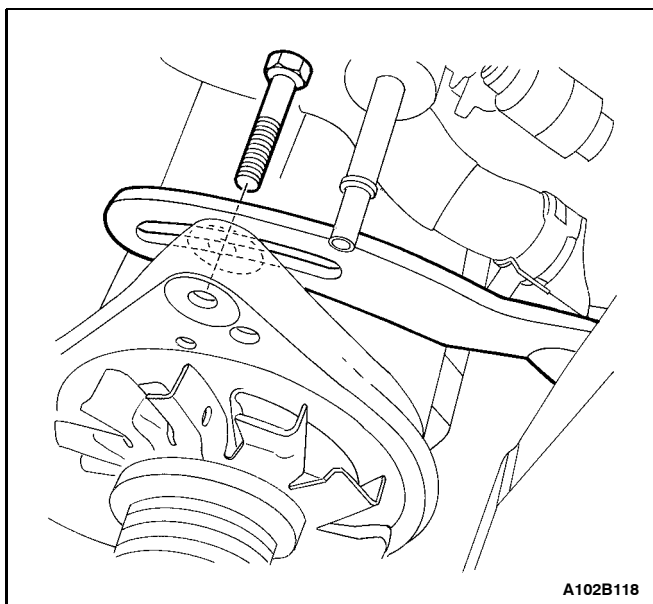
Installation Procedure

1. Install the intake manifold gasket.
2. Install the intake manifold.
3. Install the intake manifold retaining nuts and the engine lift bracket bolt in the sequence shown.

Tighten

Tighten the intake manifold retaining nuts in the sequence shown to 25 N \cdot m (18 lb-ft).

Tighten the engine lift bracket bolt to 25 N \cdot m (18 lb-ft).



4. Install the intake manifold support bracket.
5. Install the intake manifold support bracket retaining bolts.

Tighten

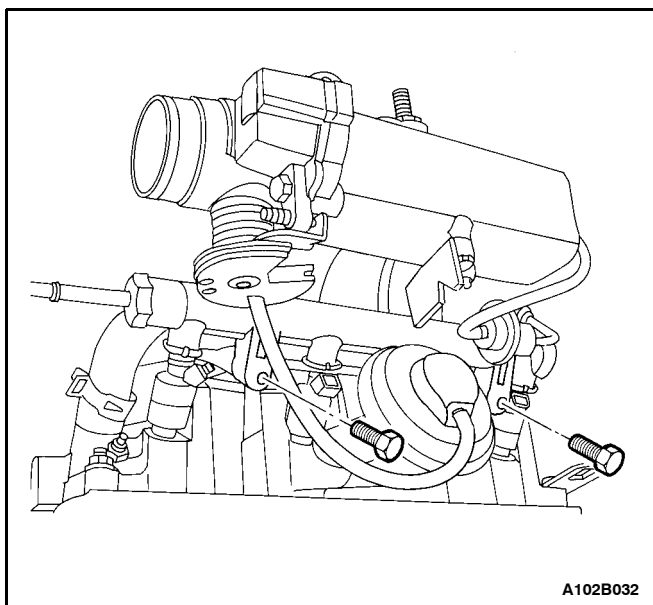
Tighten the intake manifold support bracket retaining bolts to 22 N \cdot m (16 lb-ft).

6. Install the alternator adjusting bracket and the bolts.

Tighten

Tighten the alternator adjusting bracket retaining bolts to 20 N \cdot m (15 lb-ft).

7. Install the alternator drive belt.

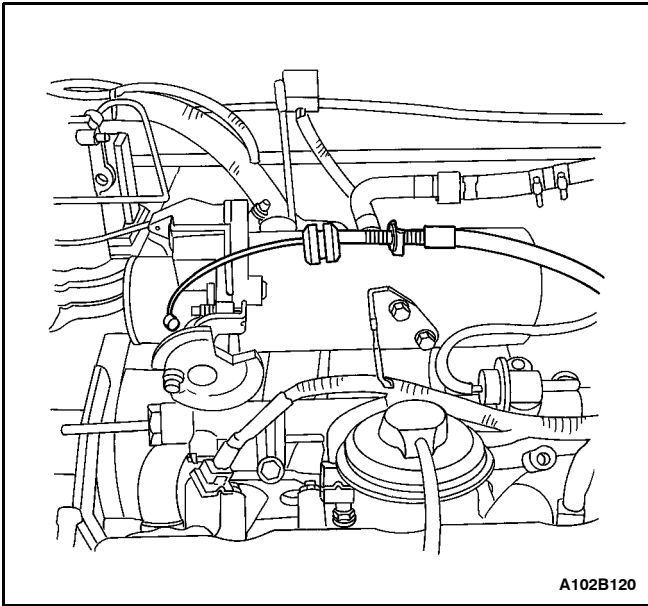


8. Install the fuel rail and the fuel injectors as an assembly. Refer to Section 1F, Engine Controls.
9. Install the fuel rail retaining bolts.

Tighten

Tighten the fuel rail retaining bolts to 25 N \cdot m (18 lb-ft).

1B - 56 SOHC ENGINE MECHANICAL

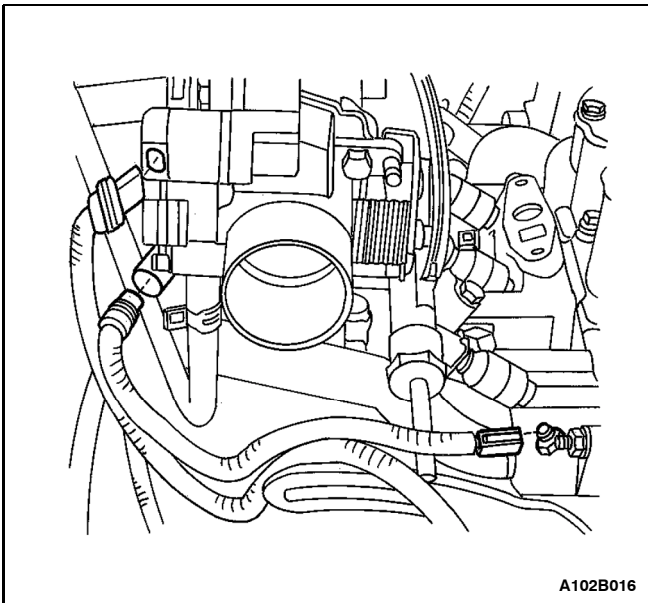


10. Connect the fuel return line to the fuel pressure regulator.
11. Connect the fuel feed line to the fuel rail.
12. Install the throttle cable bracket and the two throttle cable bracket bolts.

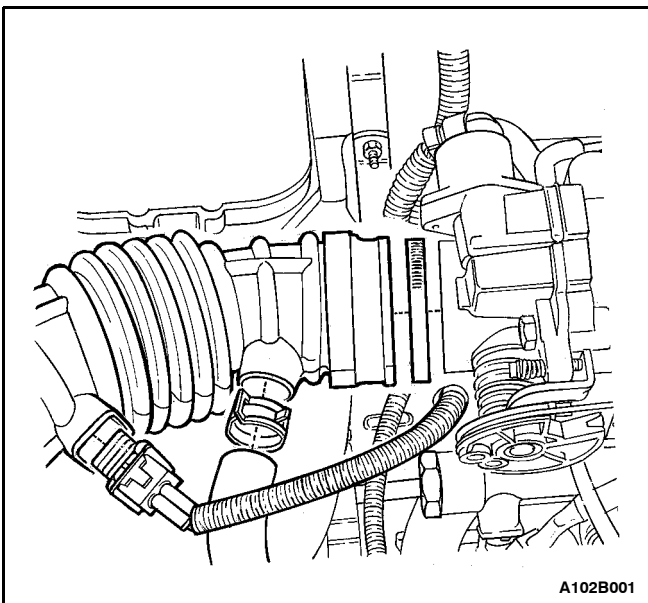
Tighten

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

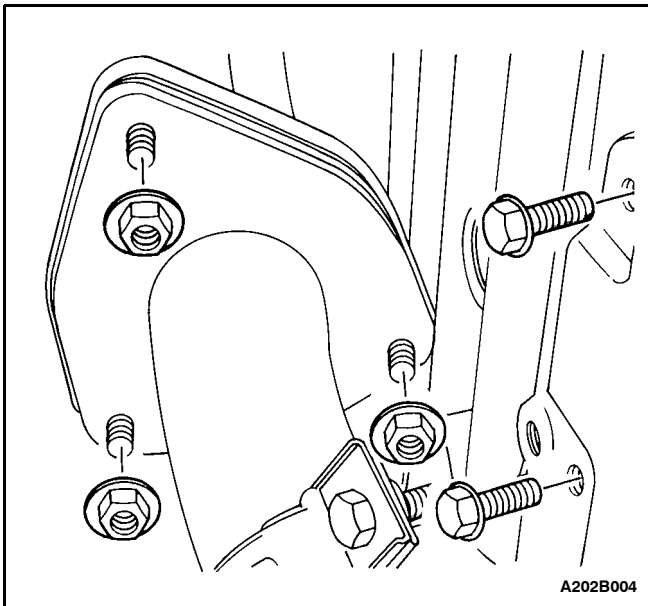
13. Connect the throttle cable to the intake manifold and the throttle body.



14. Connect the fuel injector connectors to the fuel injectors.
15. Connect all of the vacuum lines that were previously disconnected.
16. Connect the heater inlet hose to the coolant distributor beneath the intake manifold.
17. Connect the surge tank coolant hose to the throttle body.
18. Connect the engine coolant temperature sensor connector.
19. Connect the idle air control valve connector.
20. Connect the throttle position sensor connector.



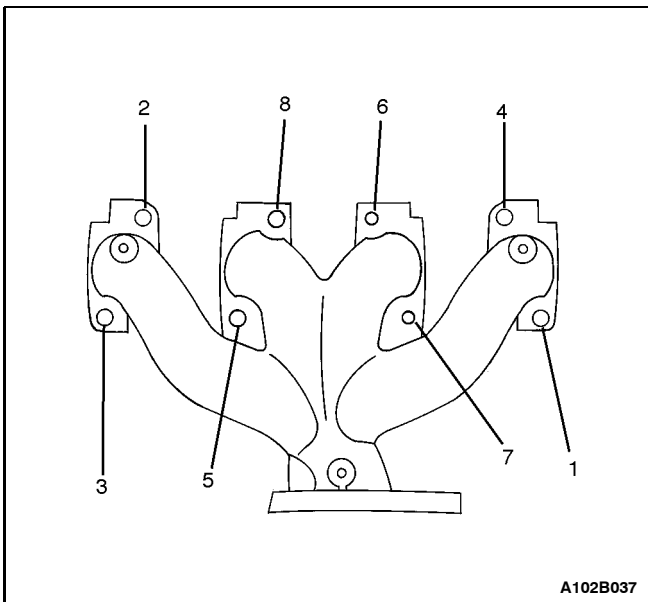
21. Connect the air intake tube to the throttle body.
22. Connect the manifold air temperature sensor connector.
23. Connect the ECM ground terminal to the intake manifold.
24. Connect the negative battery cable.
25. Install the fuel pump fuse.
26. Refill the engine cooling system. Refer to Section 1D, Engine Cooling.



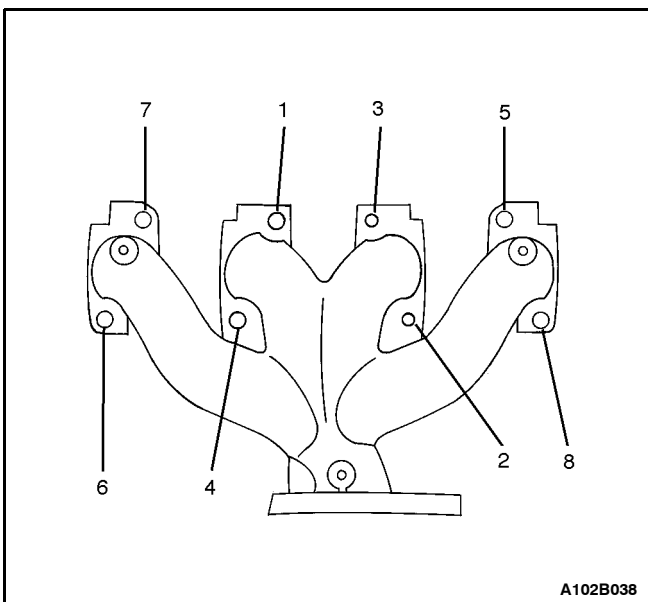
EXHAUST MANIFOLD

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the ignition wires from the spark plugs.
3. Disconnect the oxygen sensor.
4. Remove the exhaust manifold heat shield bolts.
5. Remove the exhaust manifold heat shield.
6. Remove the nuts from the exhaust flex pipe flange and the bracket bolts.



7. Remove the eight exhaust manifold 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.



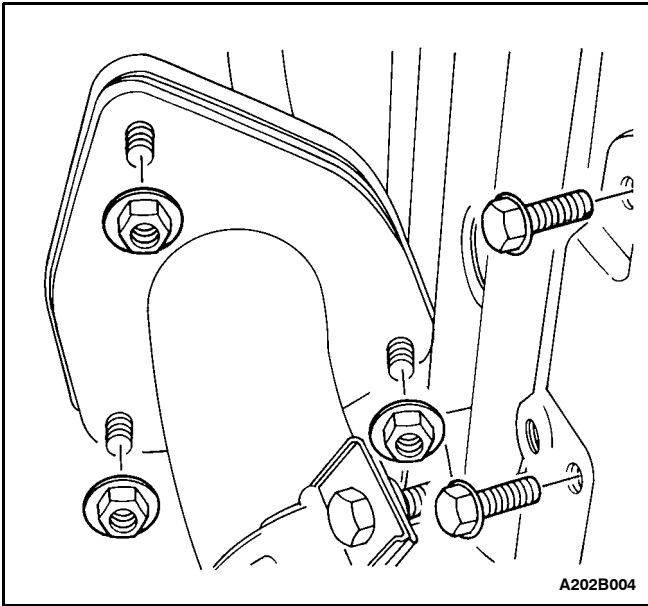
Installation Procedure

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

Tighten

Tighten the exhaust manifold nuts 25 NSm (18 lb-ft).

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4. Install the exhaust flex pipe-to-exhaust manifold retaining nuts and the bracket bolts.

Tighten

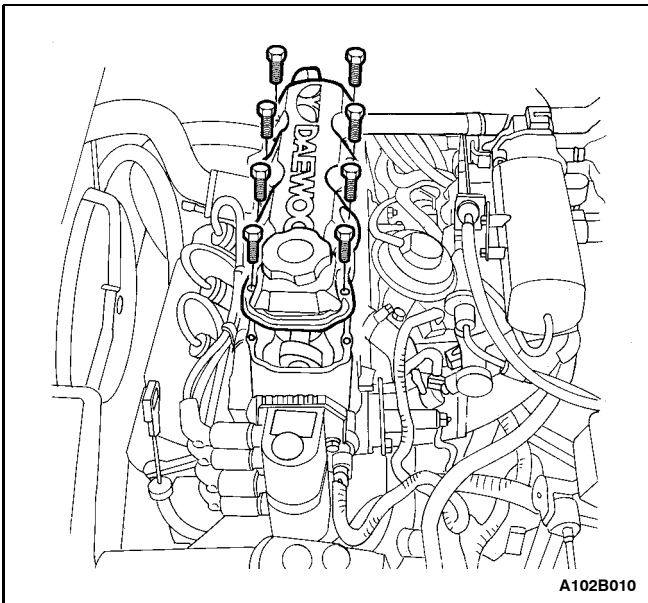
Tighten the three exhaust flex pipe-to-exhaust manifold retaining nuts and the bracket bolts to 40 NSm (30 lb-ft).

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

Tighten

Tighten the exhaust manifold heat shield bolts to 15 NSm (11 lb-ft).

7. Connect the oxygen sensor.
8. Connect the ignition wires to the spark plugs.
9. Connect the negative battery cable.



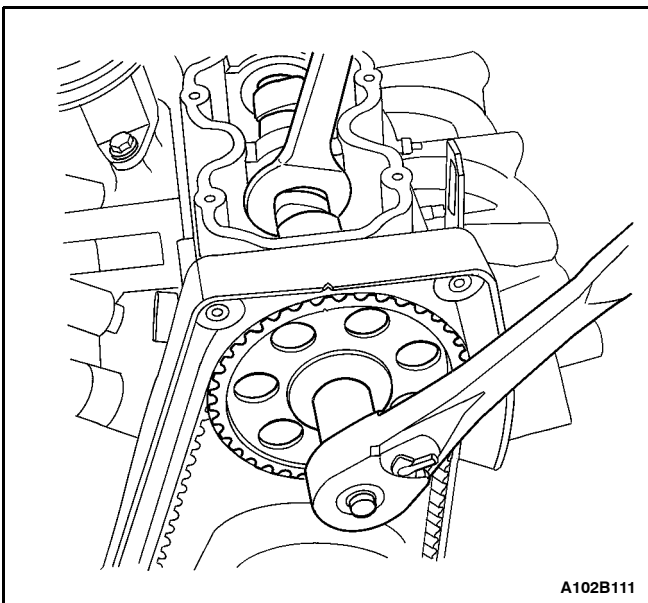
CAMSHAFT GEAR

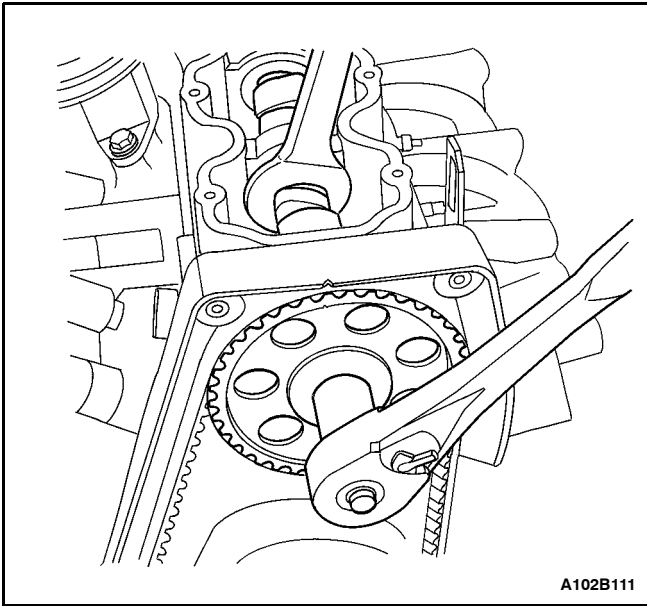
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to "Timing Belt" in this section.
3. Remove the valve cover bolts.
4. Remove the valve cover.

Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshaft. Such damage can impair vehicle operation.

5. While holding the camshaft firmly in place, remove the camshaft gear bolt.
6. Remove the camshaft gear.





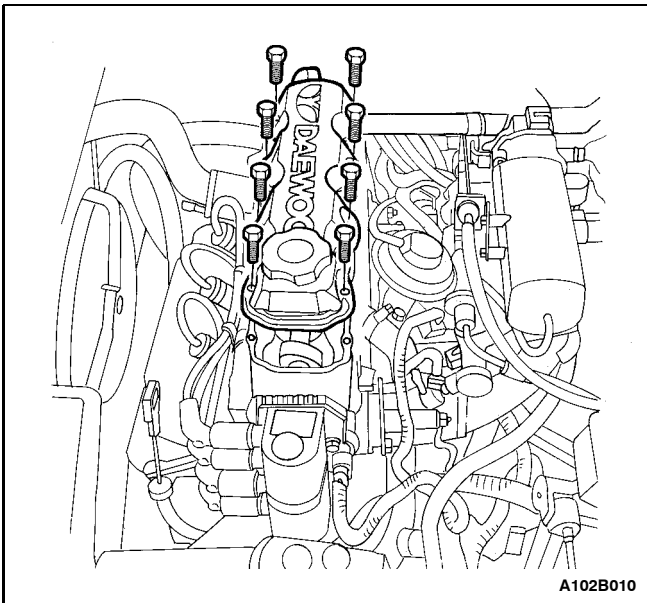
Installation Procedure

Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshaft. Such damage can impair vehicle operation.

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

Tighten

Tighten the camshaft gear bolt to 45 N \cdot m (33 lb-ft).

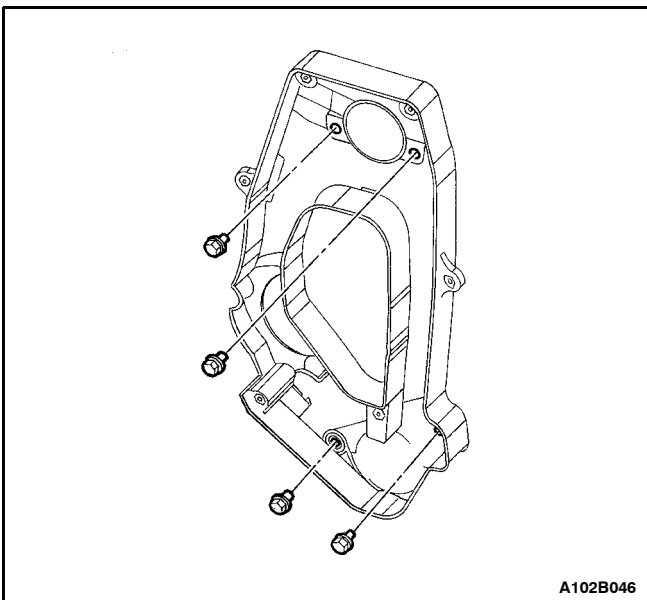


3. Install the valve cover.
4. Install the valve cover bolts.

Tighten

Tighten the valve cover bolts to 10 N \cdot m (89 lb-in).

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



REAR TIMING BELT COVER

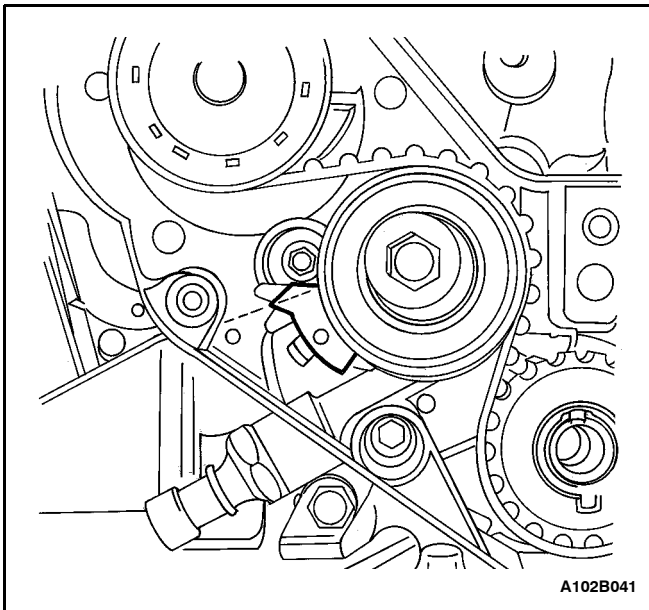
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to "Timing Belt" in this section.

Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshaft. Such damage can impair vehicle operation.

3. Remove the camshaft gear. Refer to "Camshaft Gear" in this section.
4. Remove the timing belt automatic tensioner bolt.
5. Remove the timing belt automatic tensioner.
6. Remove the rear timing belt cover bolts.
7. Remove the rear timing belt cover.

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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 10 N·m (89 lb-in).

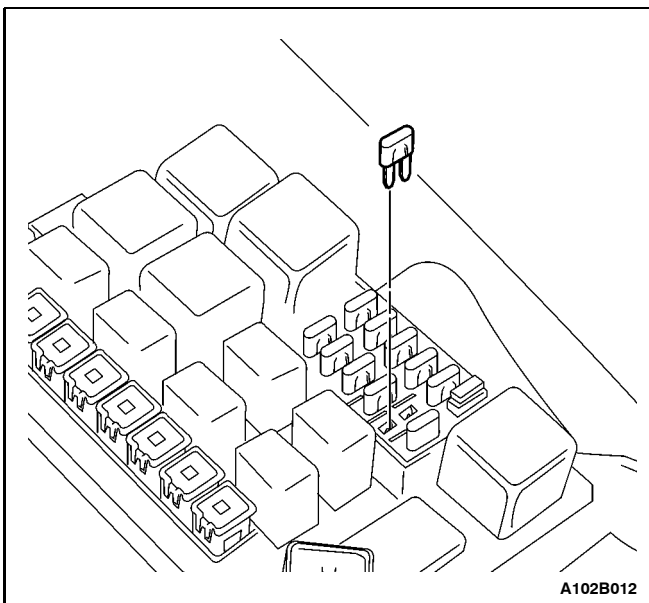
3. Install the timing belt automatic tensioner.
4. Install the timing belt automatic tensioner bolt.

Tighten

Tighten the timing belt automatic tensioner bolt to 20 N·m (15 lb-ft).

Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshaft. Such damage can impair vehicle operation.

5. Install the camshaft gear. Refer to "Camshaft Gear" in this section.
6. Install the timing belt. Refer to "Timing Belt" in this section.
7. Connect the negative battery cable.



ENGINE

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

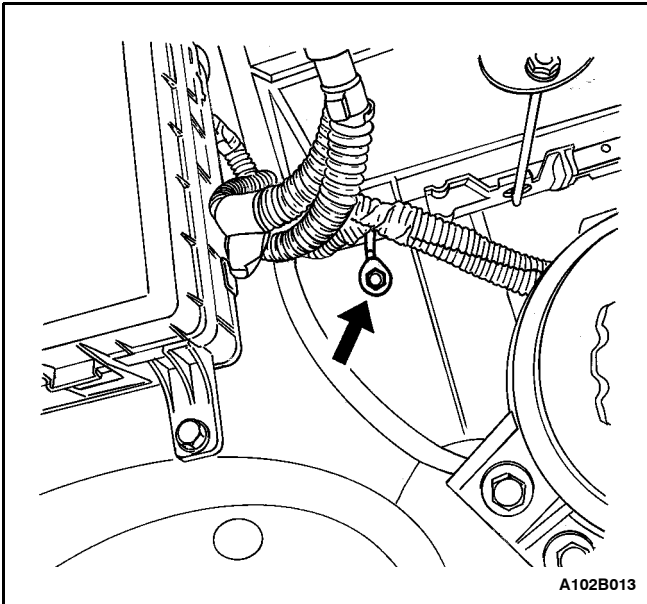
Tools Required

KM-470-B Angular Torque Gauge

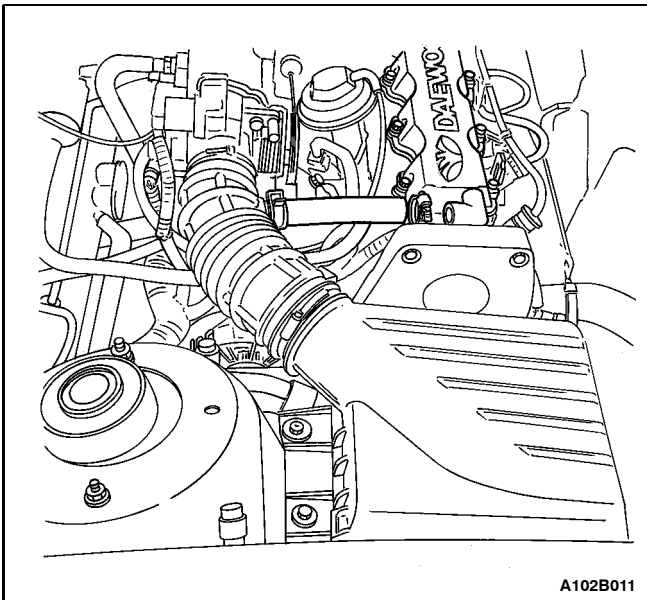
Removal Procedure

Important: On vehicles equipped with a manual transaxle, the manual transaxle must be removed before engine removal. Refer to Section 5B, Five-Speed Manual Transaxle.

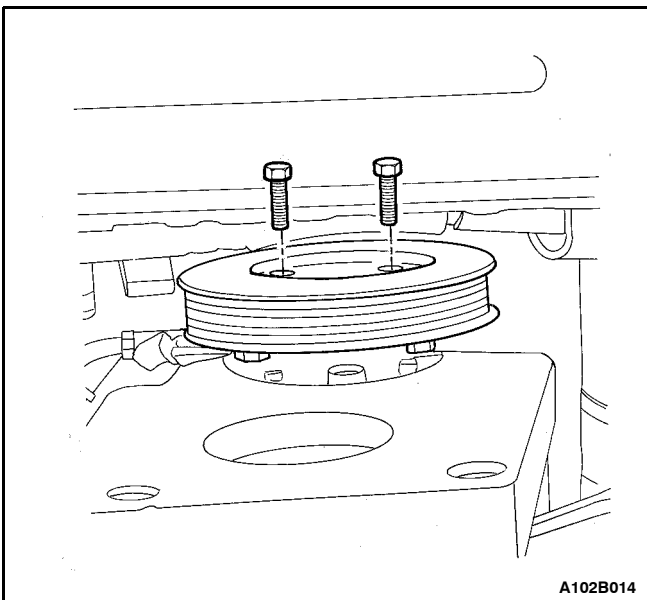
1. Remove the fuel pump fuse.
2. Start the engine. Crank the engine after it stalls for 10 seconds to rid the fuel system of fuel pressure.
3. Remove the hood. Refer to Section 9R, Body Front End.
4. Drain the engine oil.



5. Disconnect the negative battery cable.
6. Disconnect and separate the battery positive cable.
7. Disconnect the negative battery cable from the vehicle frame.

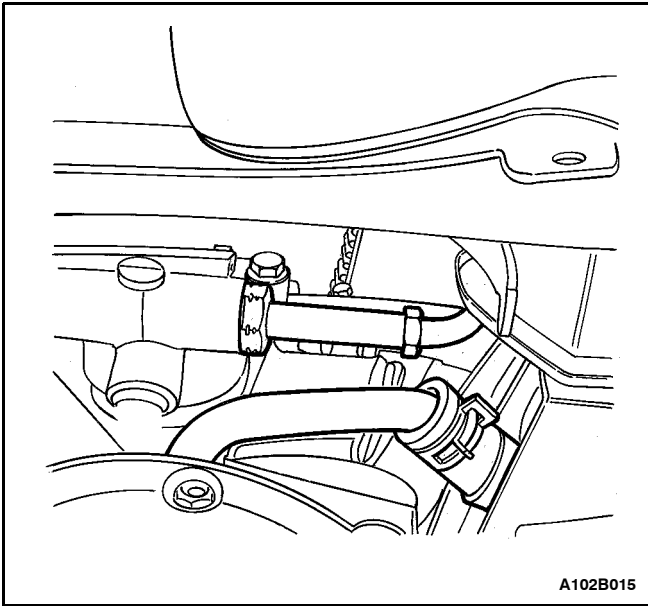


8. Discharge the air conditioning (A/C) system, if equipped. Refer to Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System.
9. Disconnect the manifold air temperature sensor connector.
10. Remove the air intake tube from the throttle body and the air filter housing.
11. Disconnect the breather tube from the valve cover.

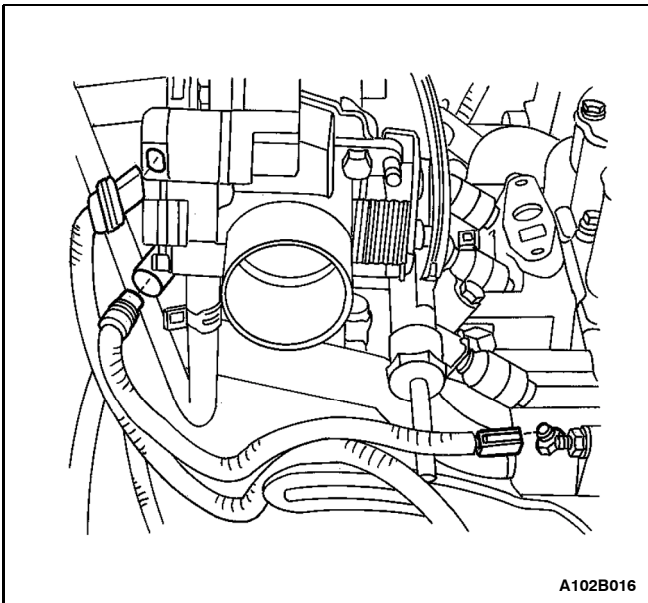


12. Remove the right front wheel. Refer to Section 2E, Tires and Wheels.
13. Remove the right front wheel well splash shield.
14. Remove the A/C compressor drive belt, if equipped.
15. Remove the alternator drive belt.
16. Remove the power steering pump pulley bolts.
17. Remove the power steering pump pulley.

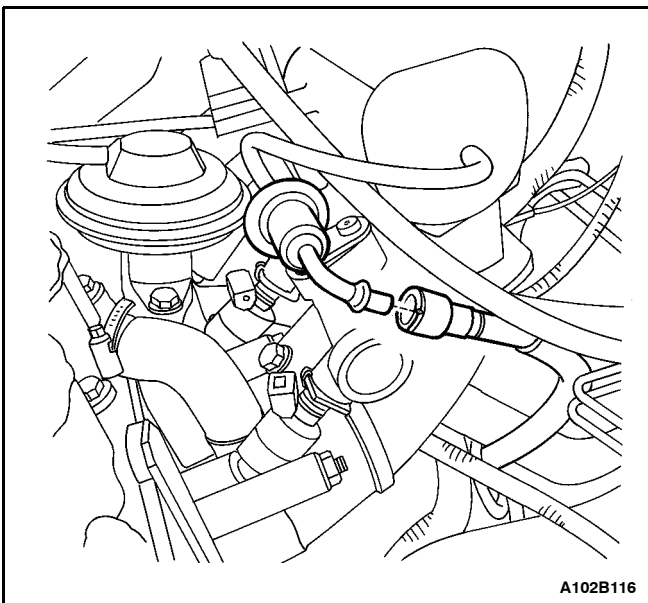
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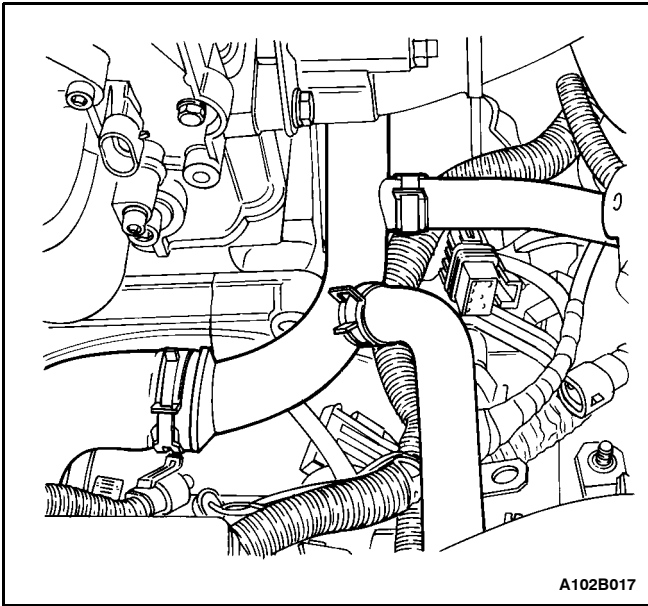
18. Drain the engine coolant. Refer to Section 1D, Engine Cooling.
19. Remove the cooling system radiator and the engine cooling fans. Refer to Section 1D, Engine Cooling.
20. Disconnect the upper radiator hose from the thermostat housing.
21. Disconnect the coolant surge tank hose from the radiator.
22. Disconnect the power steering return hose from the power steering pump, if equipped.
23. Drain the power steering system, if equipped.
24. Disconnect the power steering pressure hose from the power steering pump, if equipped.



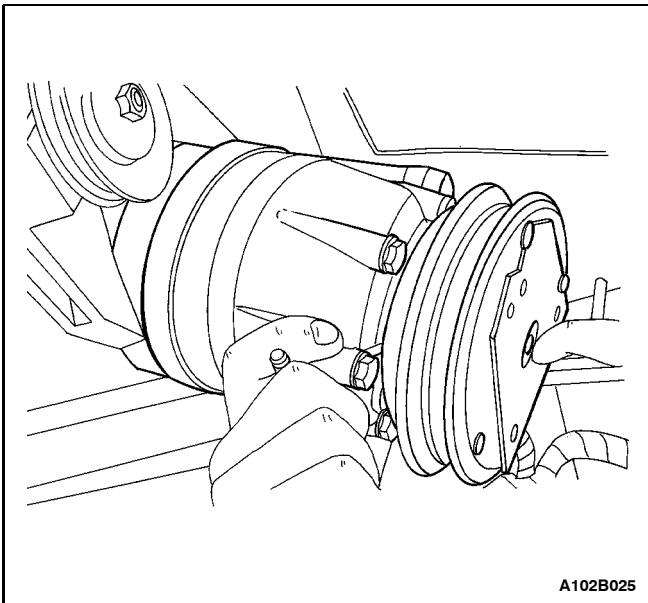
25. Disconnect the electrical connector at the direct ignition system (DIS) ignition coil, and the engine control module (ECM) ground terminal at the intake manifold and at the starter motor.
26. Disconnect the oxygen sensor connector.
27. Disconnect the electrical connectors at the fuel injectors.
28. Disconnect the idle air control valve connector.
29. Disconnect the throttle position sensor connector.
30. Disconnect the engine coolant temperature sensor connector.
31. Disconnect the coolant temperature sensor connector and the knock sensor, if equipped.



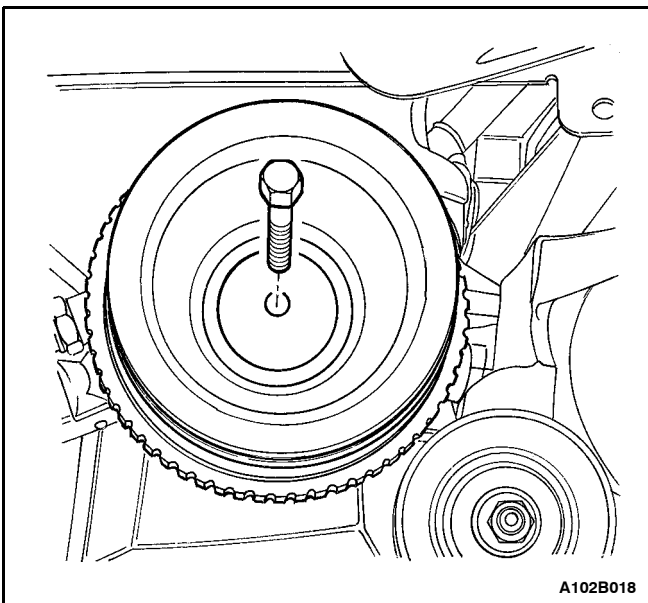
32. Disconnect the alternator voltage regulator connector.
33. Disconnect all of the necessary vacuum lines, including the brake booster vacuum hose.
34. Disconnect the fuel return line at the fuel pressure regulator.
35. Disconnect the fuel feed line at the fuel rail.
36. Disconnect the throttle cable from the throttle body and the intake manifold bracket.



- 37. Disconnect the surge tank coolant hose at the throttle body.
- 38. Disconnect the heater inlet hose from the coolant distributor.
- 39. Disconnect the heater outlet hose at the coolant pipe.
- 40. Disconnect the surge tank coolant hose from the coolant pipe.
- 41. Disconnect the lower radiator hose at the coolant pipe.

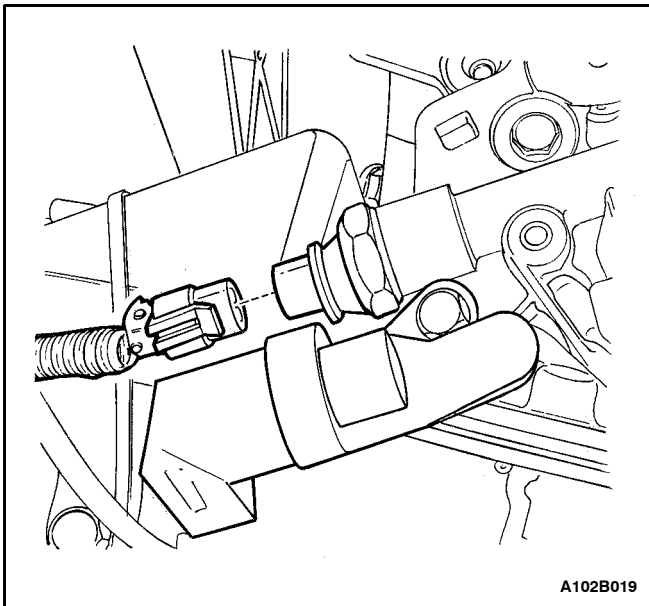


- 42. Disconnect the starter solenoid "S" terminal wire.
- 43. Remove the A/C compressor hose assembly retaining bolt.
- 44. Disconnect the A/C compressor hose assembly from the compressor.
- 45. Disconnect the A/C compressor coil connector.
- 46. Remove the A/C compressor mounting bolts.
- 47. Remove the A/C compressor.
- 48. Remove the A/C compressor mounting bracket bolts.
- 49. Remove the A/C compressor mounting bracket from the engine block.

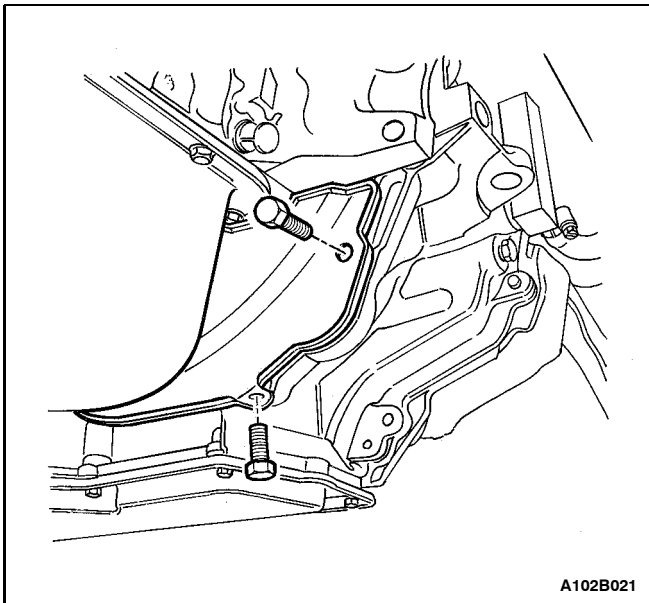


- 50. Remove the exhaust flex pipe retaining nuts from the exhaust manifold.
- 51. Remove the exhaust flex pipe retaining nuts from the catalytic converter or connecting pipe.
- 52. Remove the exhaust flex pipe.
- 53. Remove the engine crankshaft pulley bolt.
- 54. Remove the engine crankshaft pulley.

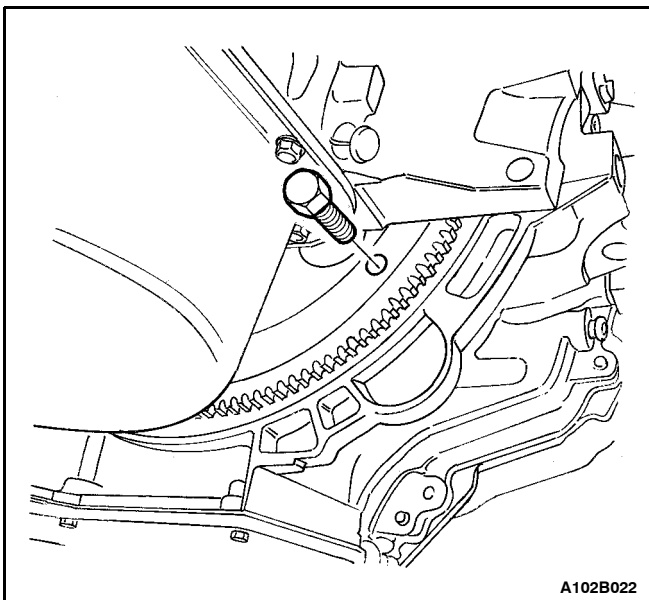
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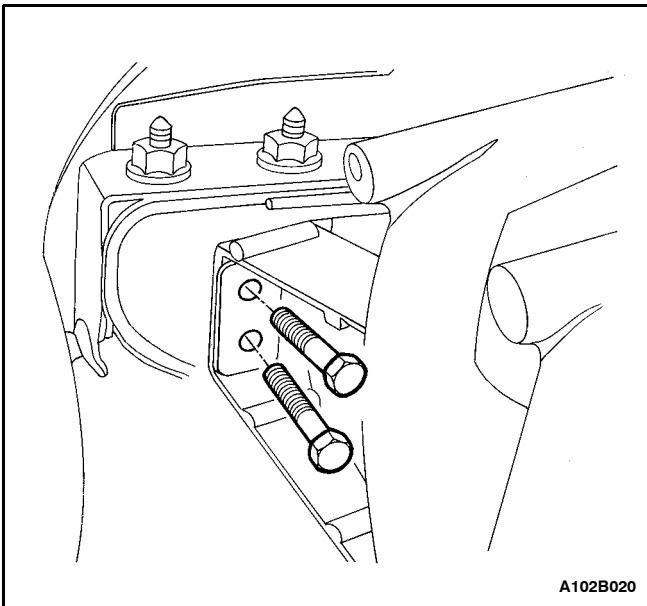
- 55. Disconnect the vacuum lines at the charcoal canister purge and exhaust gas recirculation (EGR) solenoid.
- 56. Disconnect the electrical connector at the charcoal canister purge solenoid and the knock sensor.
- 57. Disconnect the electrical connector at the oil pressure switch.
- 58. Disconnect the crankshaft position sensor connector.
- 59. Remove the crankshaft position sensor retaining bolt.
- 60. Remove the crankshaft position sensor.
- 61. Remove the right transaxle brace bolts from the transmission.



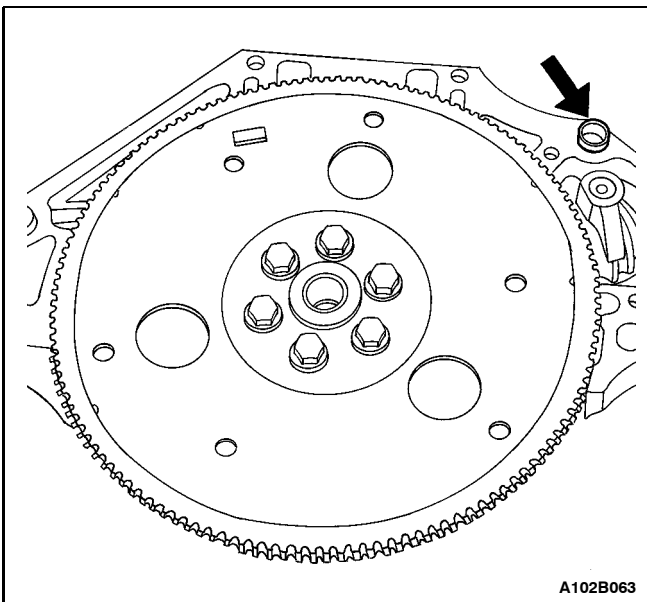
- 62. Remove the flywheel or the flexible plate inspection cover bolts.
- 63. Remove the flywheel or the flexible plate inspection cover.



- 64. Remove the transaxle torque converter bolts on vehicles with an automatic transaxle.



65. Remove the transaxle bell housing bolts.
66. Support the transaxle with a floor jack.
67. Install the engine lifting device.
68. Disconnect the right engine mount bracket from the rubber engine mount by removing the two retaining bolts.
69. Remove the right engine mount bracket from the engine block.
70. Separate the engine block from the transaxle.
71. Remove the engine.
72. Transfer any necessary parts.

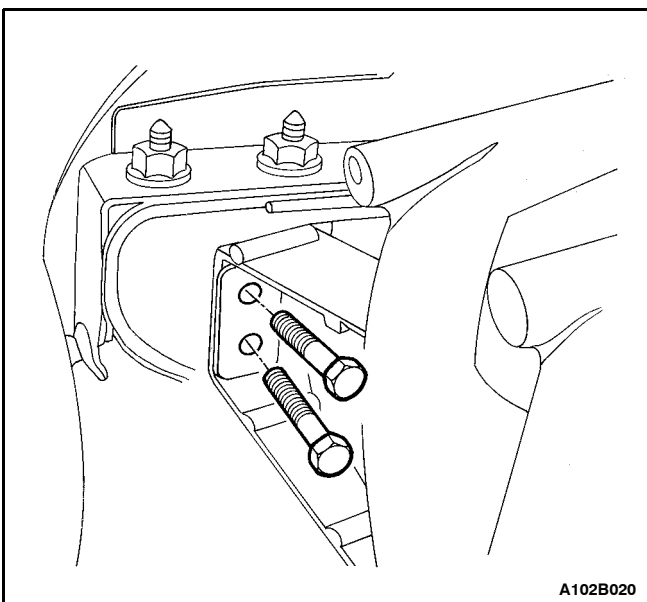


Installation Procedure

1. Install the engine into engine compartment.
2. Align the transaxle 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 right engine mount bracket to the engine block.
5. Install the right engine mount bracket retaining bolts to the engine block.

Tighten

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

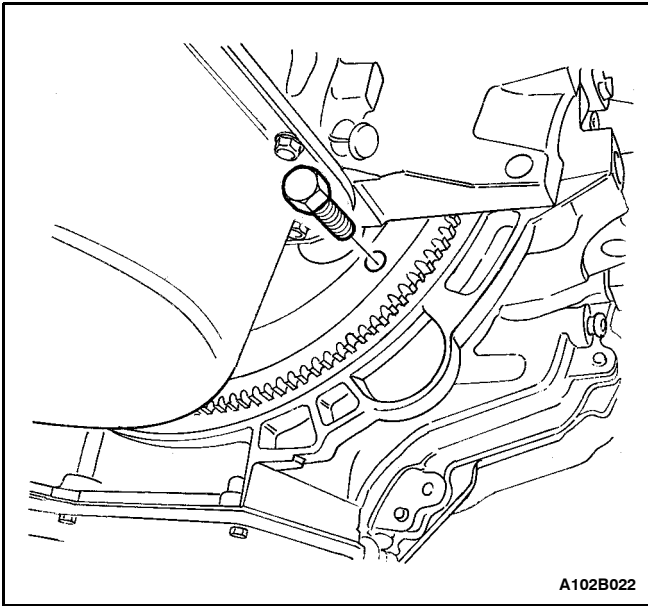
6. Install the engine mount-to-bracket retaining bolts.

Tighten

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

7. Remove the floor jack used for support of the transaxle.
8. Remove the engine lifting device.

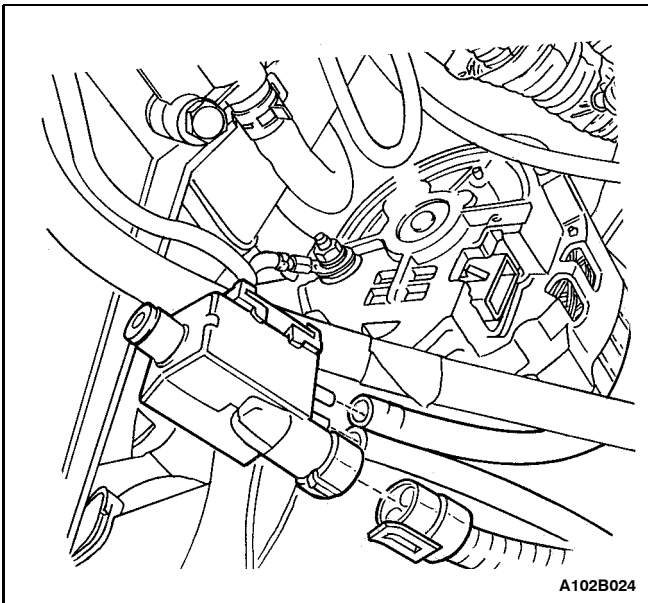
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9. Install the transaxle torque converter bolts, if the vehicle has an automatic transaxle.

Tighten

Tighten the transaxle torque converter bolts to 45 N·m (33 lb-ft).



10. Install the flywheel or the flexible plate inspection cover.

11. Install the flywheel or the flexible plate inspection cover bolts.

Tighten

Tighten the flywheel inspection cover bolts to 12 N·m (106 lb-in) or the flexible plate inspection cover bolts to 10 N·m (89 lb-in).

12. Install the right transaxle brace bolts to the transaxle.

Tighten

Tighten the right transaxle brace bolts to 60 N·m (45 lb-ft).

13. Connect the vacuum lines at the charcoal canister purge and EGR solenoid.

14. Connect the electrical connectors at the charcoal canister purge and EGR solenoids.

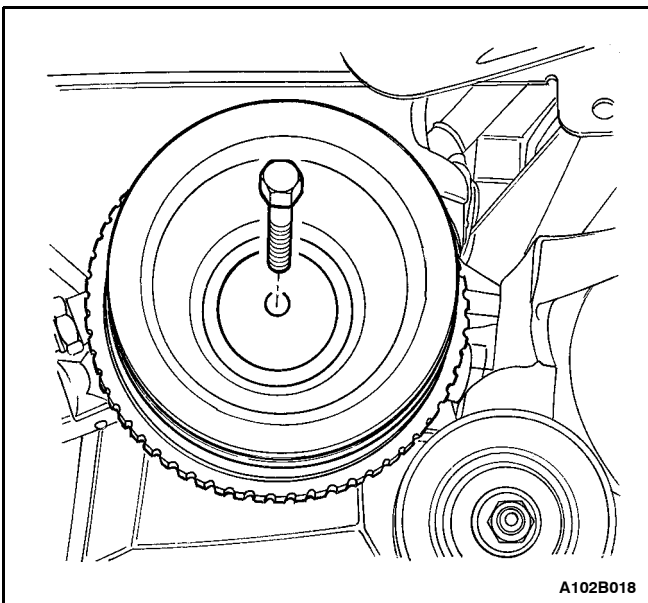
15. Connect the oil pressure switch connector.

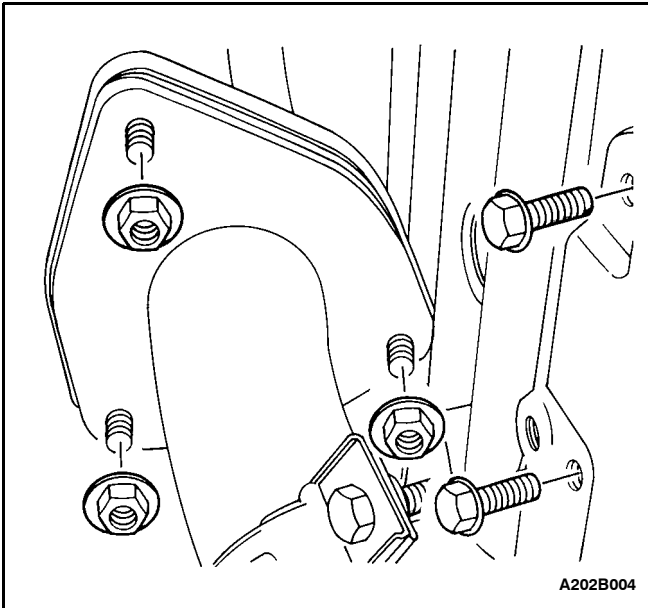
16. Install the crankshaft pulley.

17. Install the crankshaft pulley bolt.

Tighten

Tighten the crankshaft pulley bolt to 95 N·m (70 lb-ft) using a torque wrench. Using the angular torque gauge KM-470-B, tighten the crankshaft pulley bolt another 30 degrees plus 15 degrees.





18. Install the crankshaft position sensor and the crankshaft position sensor retaining bolt.

Tighten

Tighten the crankshaft position sensor retaining bolt to 10 NSm (89 lb-in).

19. Connect the crankshaft position sensor connector.
20. Install the exhaust flex pipe.
21. Install the exhaust flex pipe-to-catalytic converter retaining nuts.

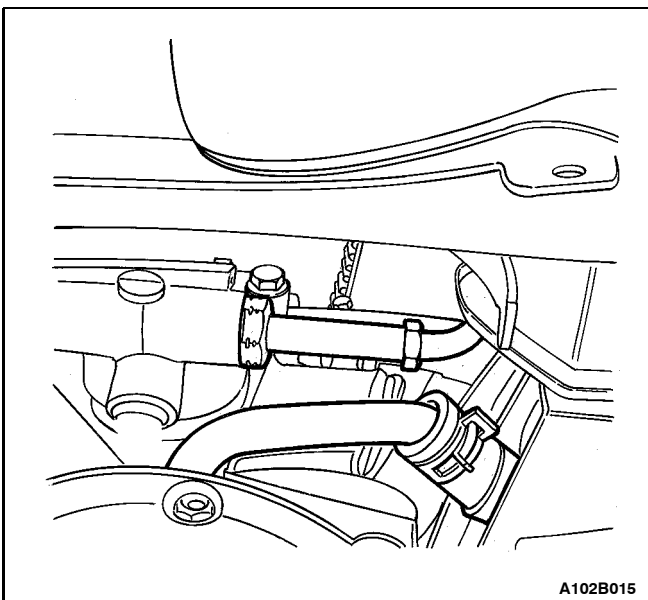
Tighten

Tighten the exhaust flex pipe-to-catalytic converter or connecting pipe retaining nuts to 30 NSm (22 lb-ft).

22. Install the exhaust flex pipe-to-exhaust manifold retaining nuts and the bracket bolts.

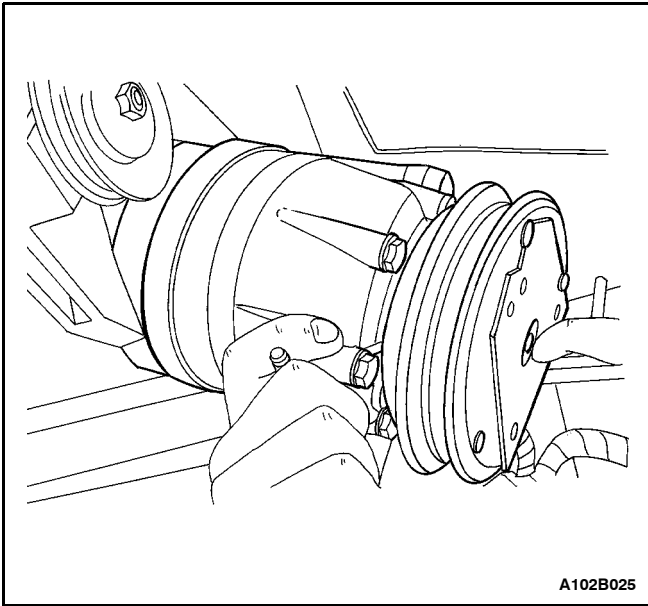
Tighten

Tighten the exhaust flex pipe to exhaust manifold retaining nuts and the bracket bolts to 40 NSm (30 lb-ft).



23. Connect the power steering pressure hose, if equipped.
24. Connect the power steering return hose, if equipped.

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25. Install the A/C compressor mounting bracket, if equipped.

26. Install the A/C compressor mounting bracket bolts, if equipped.

Tighten

Tighten the A/C compressor mounting bracket bolts to 50 N \cdot m (36 lb-ft).

27. Install the A/C compressor, if equipped.

28. Install the A/C compressor mounting bolts, if equipped.

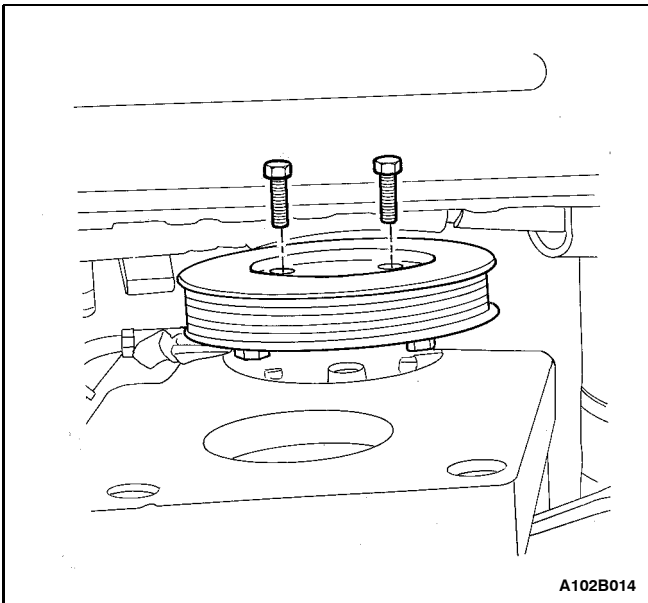
Tighten

Tighten the A/C compressor mounting bolts to 27 N \cdot m (20 lb-ft).

29. Connect the A/C compressor coil connector.

30. Install the alternator drive belt.

31. Install the A/C compressor drive belt, if equipped.



32. Connect the A/C compressor hose assembly and the A/C compressor hose assembly retaining bolt, if equipped.

Tighten

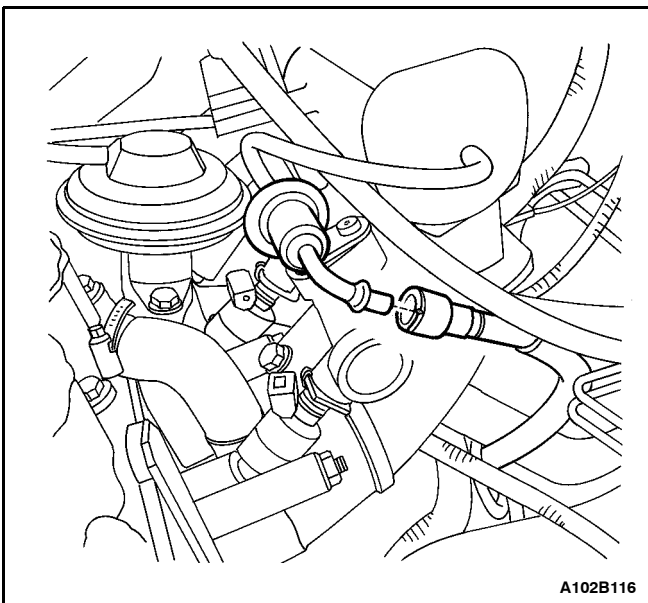
Tighten the A/C compressor hose assembly retaining bolt to 33 N \cdot m (24 lb-ft).

33. Install the power steering pump pulley, if equipped.

34. Install the power steering pump pulley bolts, if equipped.

Tighten

Tighten the power steering pump pulley bolts to 25 N \cdot m (18 lb-ft).



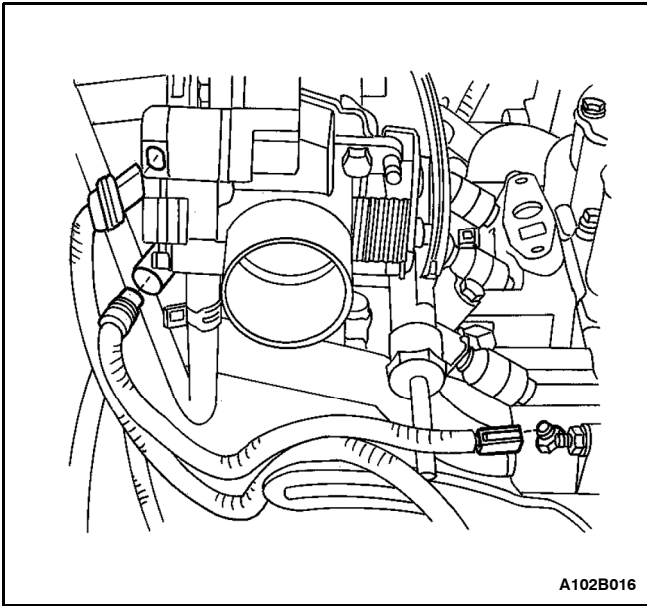
35. Install the right front wheel well splash shield.

36. Install the right front wheel. Refer to Section 2E, Tires and Wheels

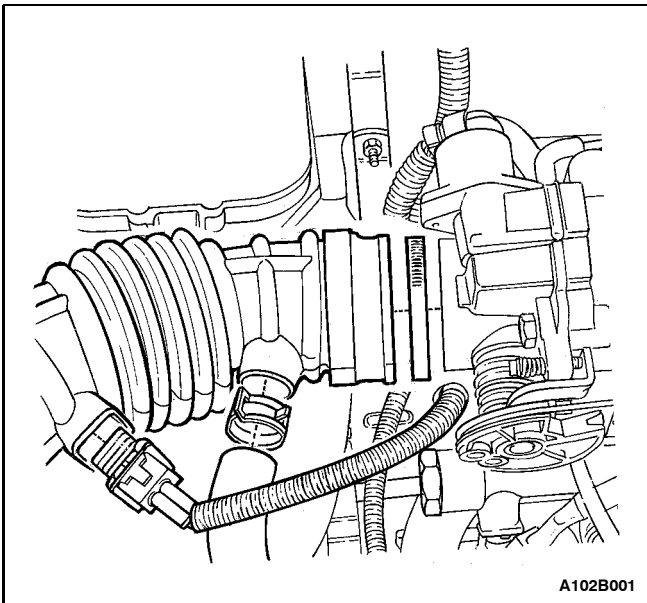
37. Connect the fuel feed line to the fuel rail.

38. Connect the fuel return line to the fuel pressure regulator.

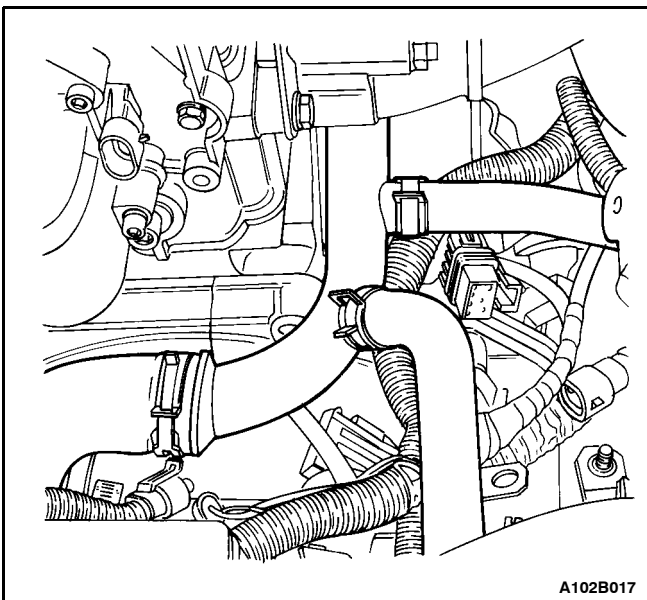
39. Connect all of the necessary vacuum lines, including the brake booster vacuum hose.



40. Connect the oxygen sensor connector.
41. Connect the starter solenoid "S" terminal wire.
42. Connect the alternator voltage regulator connector.
43. Connect the coolant temperature sensor connector.
44. Connect the engine coolant temperature sensor connector and the knock sensor connector, if equipped.
45. Connect the throttle position sensor connector.
46. Connect the idle air control valve connector.

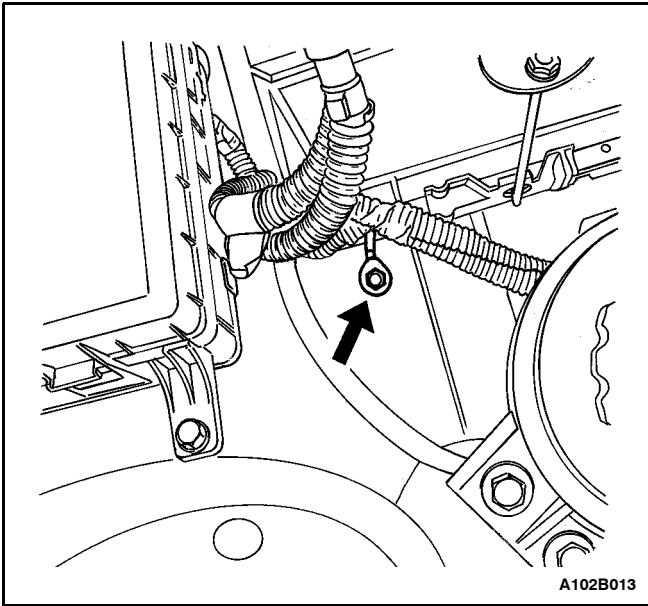


47. Connect the electrical connectors at the fuel injectors.
48. Connect the electrical connector at the DIS ignition coil and the ECM ground terminal at the intake manifold.
49. Install the air intake tube between the throttle body and the air filter housing.
50. Connect the breather tube to the valve cover.
51. Connect the manifold air temperature sensor connector.

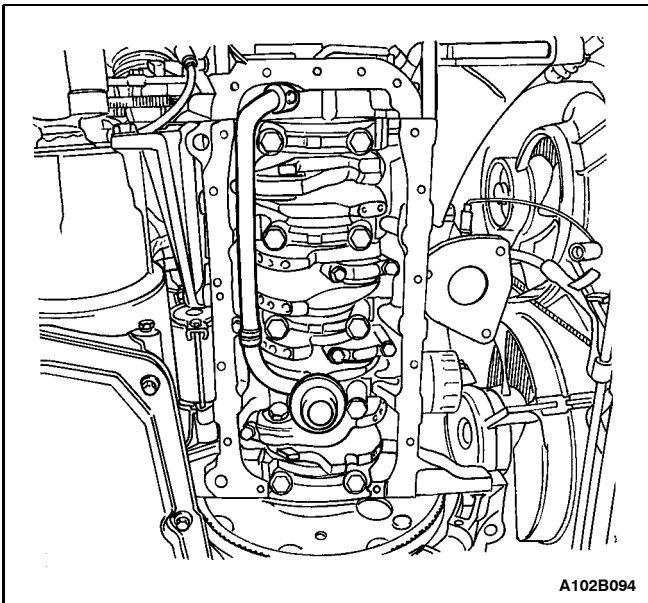


52. Install the cooling system radiator and the engine cooling fans. Refer to Section 1D, Engine Cooling.
53. Connect the lower radiator hose to the coolant pipe.
54. Connect the upper radiator hose to the thermostat housing.
55. Connect the coolant surge tank hose to the radiator.
56. Connect the heater outlet hose to the coolant pipe.
57. Connect the heater inlet hose to the coolant distributor.
58. Connect the coolant surge tank hose to the coolant pipe.
59. Connect the surge tank coolant hose to the throttle body.

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60. Connect the throttle cable to the throttle body and the intake manifold bracket.
61. Install the fuel pump fuse.
62. Connect the negative battery cable to the vehicle frame.
63. Connect the negative battery cable to the battery.
64. Connect and assemble the battery positive cable.
65. Refill the engine crankcase with engine oil.
66. Refill the engine coolant system. Refer to Section 1D, Engine Cooling.
67. Bleed the power steering system as necessary. Refer to Section 6A, Power Steering System.
68. Refill the A/C refrigerant system as necessary. Refer to Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System.
69. Install the hood. Refer to Section 9R, Body Front End.



PISTONS AND RODS

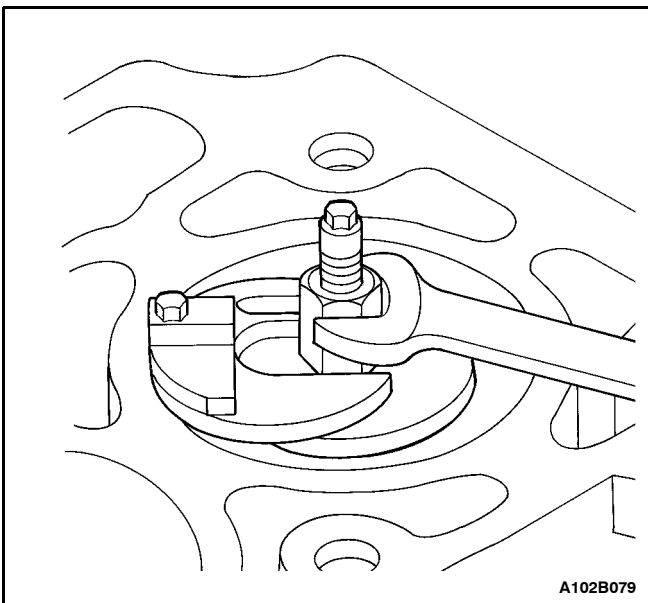
Tools Required

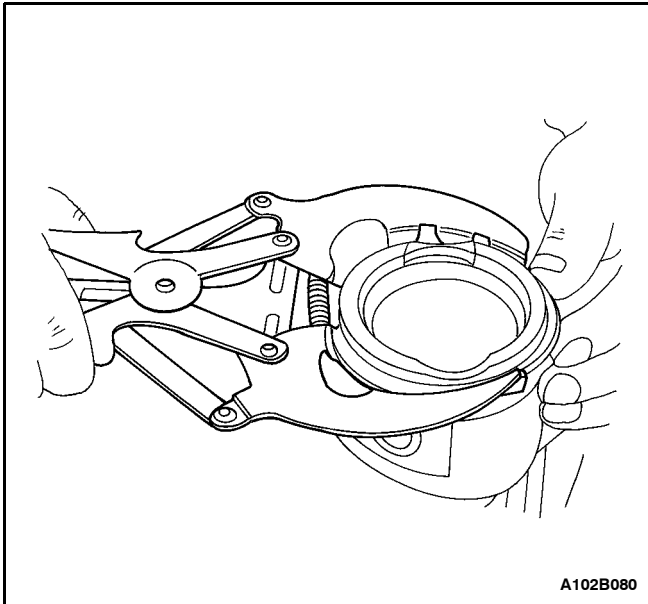
KM-427 Piston Pin Service Set

KM 470-B Angular Torque Gauge

Removal Procedure

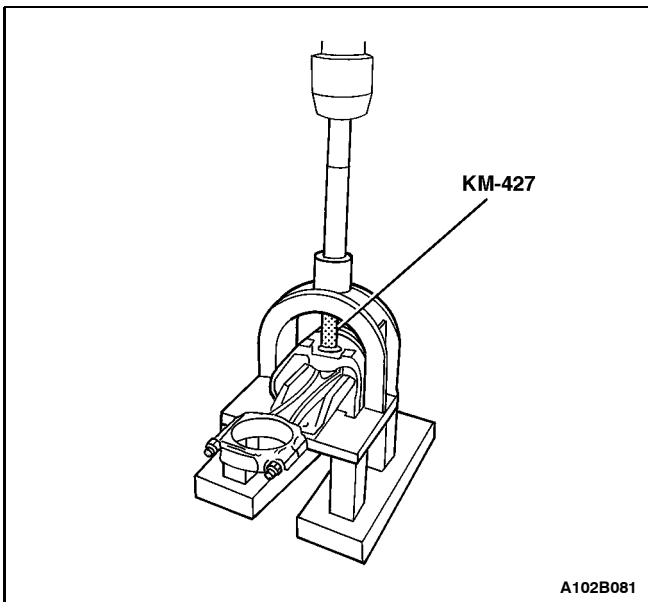
1. Remove the cylinder head with the intake manifold and exhaust manifold attached. Refer to "Cylinder Head and Gasket" in this section.
2. Remove the oil pan. Refer to "Oil Pan" in this section.
3. Remove the oil pump/pickup tube bolts.
4. Remove the oil pump/pickup tube.
5. Move the piston to the bottom of the piston stroke.
6. Mark the connecting rod cap.
7. Remove the connecting rod cap bolts.
8. Remove the connecting rod cap and lower connecting rod bearing.
9. Remove the upper piston connecting rod bearing.
10. Ridge ream the cylinder wall.



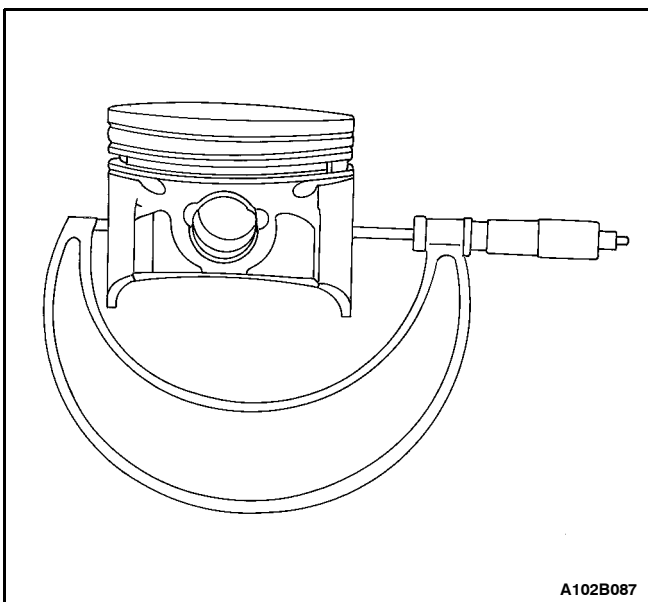


Caution: Use care when handling the piston. Worn piston rings are sharp and may cause injury.

11. Remove the piston.
12. Use a piston ring expander tool to expand the piston rings.
13. Remove the piston rings.



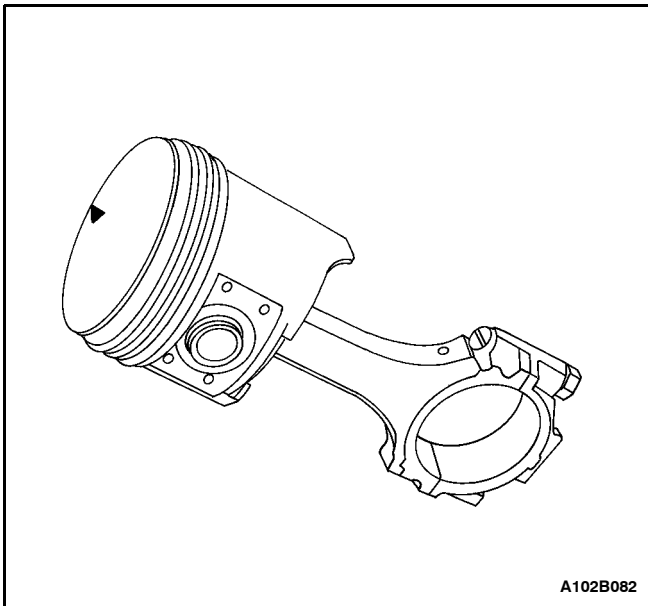
14. Remove the piston pin from the piston and connecting rod assembly using the piston pin service set KM-427.
15. Separate the piston from the connecting rod.



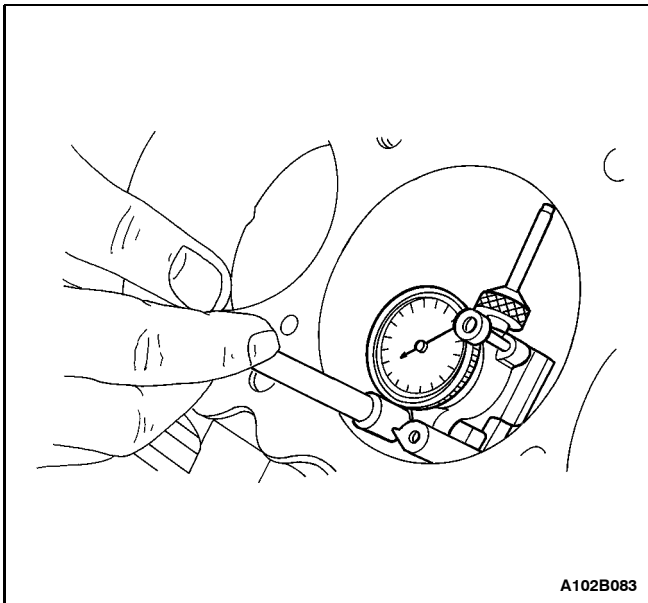
Inspection Procedure

1. Inspect the connecting rod for bending or twisting. If the connecting rod is bent or twisted, replace the connecting rod.
2. Inspect the connecting rod bearings.
3. Inspect the connecting rod lower end for wear.
4. Inspect the connecting rod upper end for scoring.
5. Inspect the piston for scoring, cracks and wear.
6. Inspect the piston for taper using a micrometer.

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

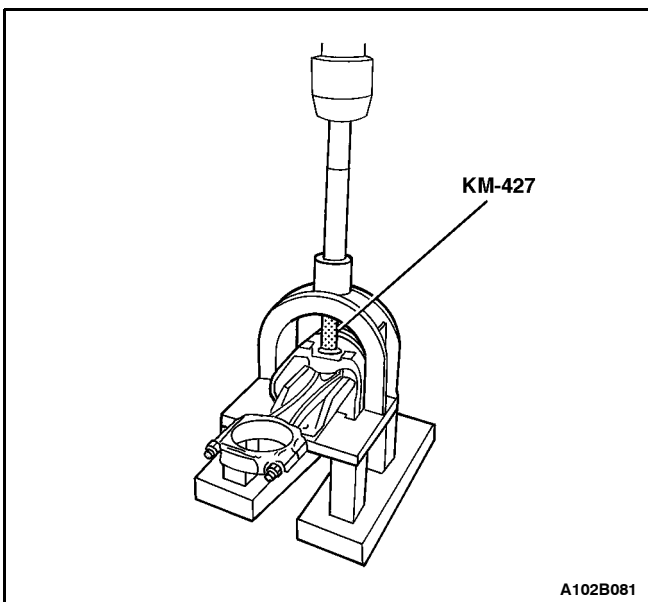


8. Inspect the engine block deck surface for flatness using a straight edge and a feeler gauge. Refer to "Engine Specifications" in this section.

9. Inspect the bearing bore for concentricity and alignment using a bore gauge. Refer to "Engine Specifications" in this section. If beyond specifications, replace the engine block.

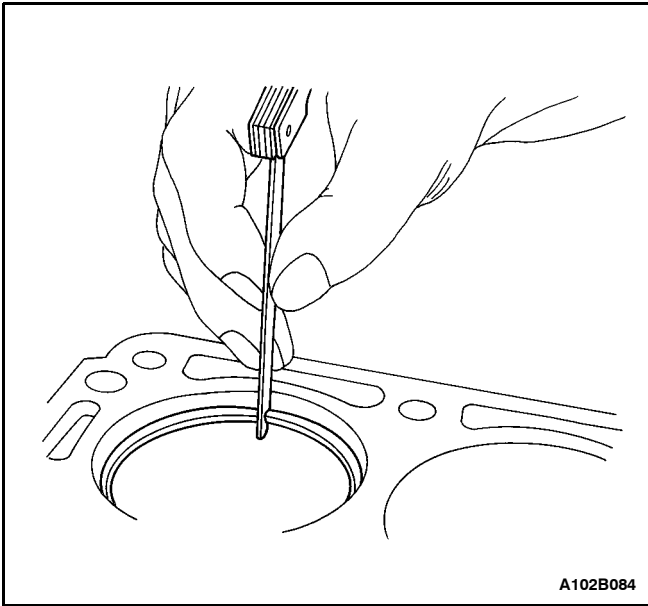
10. Inspect the engine block cylinder bore for wear, run-out, ridging and taper using a bore gauge. Refer to "Engine Specifications" in this section.

11. Inspect the engine block cylinder bore for glazing. Lightly hone the cylinder bore as necessary.

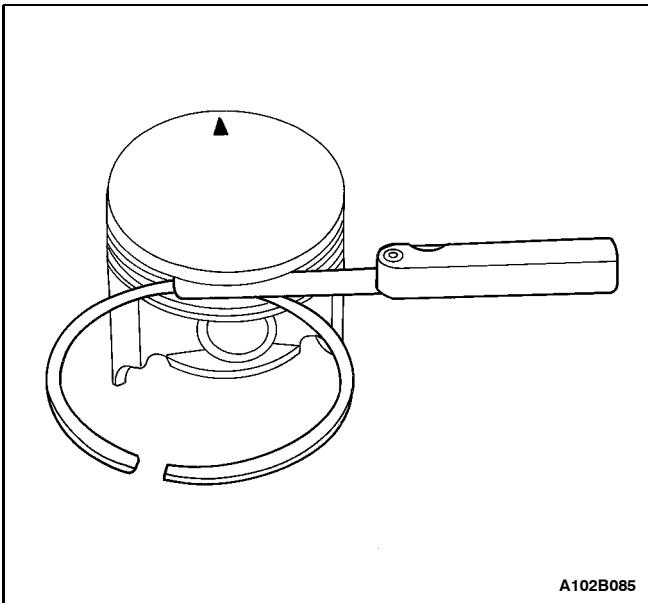


Installation Procedure

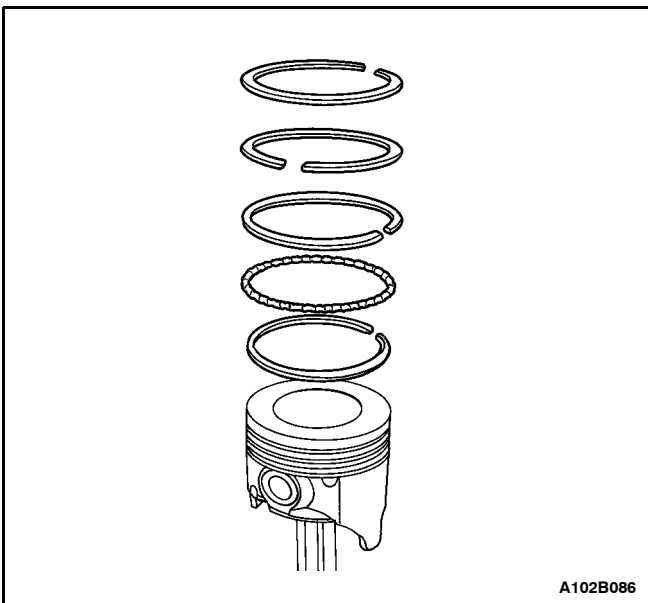
1. Align the notch on the piston and connecting rod so that the proper sides will be facing the front of the engine.
2. Install the piston pin guide through the piston and the connecting rod.
3. Coat the piston pin with clean oil.
4. Install the piston pin into the opposite side of the piston.
5. Install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



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

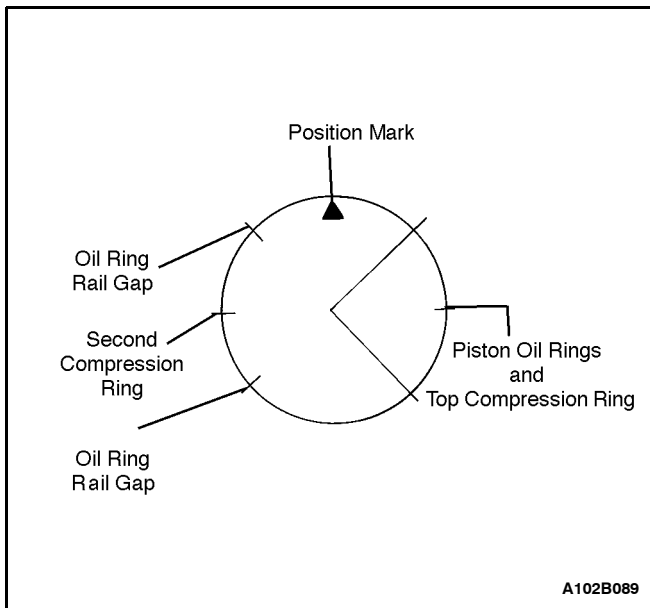


9. Measure the piston ring side clearance using a feeler gauge. Refer to "Engine Specifications" in this section.
10. If the piston ring is too thick, try another piston ring.
11. If no piston ring can be found that fits to specifications, the piston ring may be ground to size with emery paper placed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



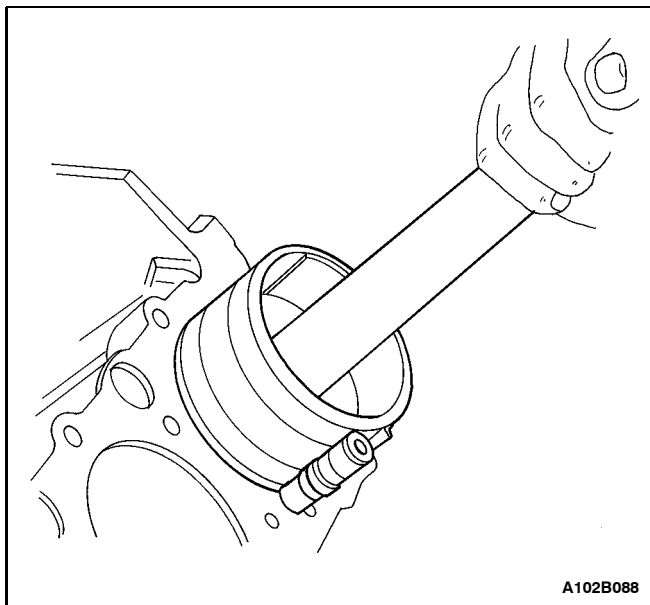
12. Install a piston oil ring, the expander, then the second piston oil ring to the bottom ring groove of the piston.
13. Install the second compression ring to the middle ring groove of the piston.
14. Install the top compression ring to the top ring groove of the piston.

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15. Use a piston ring expander to install the piston rings. Do not expand the piston rings beyond the expansion necessary for installation.

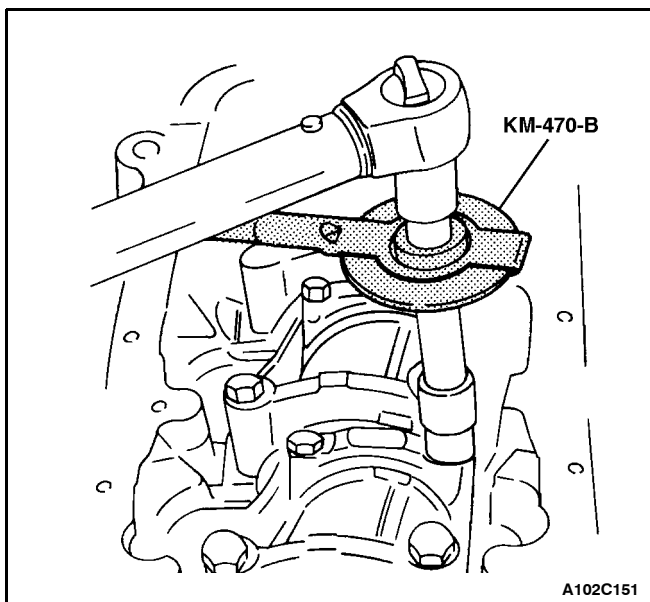
16. Stagger the piston oil rings, the oil ring rail gaps, the second compression ring, and the top compression ring in relation to the notch on the top of the piston.



17. Lubricate the cylinder wall and the piston rings with clean engine oil.

18. Install the piston using a ring compressor and a wood handle. Guide the lower connecting rod end to prevent damaging the crankshaft journal.

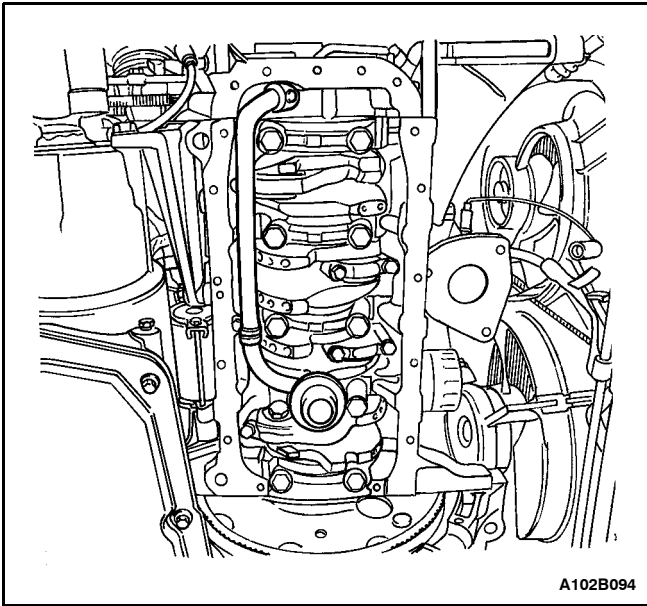
19. Install the connecting rod cap and the bearings. Refer to "Crankshaft Bearings and Connecting Rod Bearings - Gauging Plastic" in this section.



20. Install the connecting rod bearing cap bolts.

Tighten

Tighten the connecting rod bearing cap bolts to 25 N·m (18 lb-ft). Using the angular torque gauge KM-470-B, tighten one turn of 30 degrees plus one turn of 15 degrees.

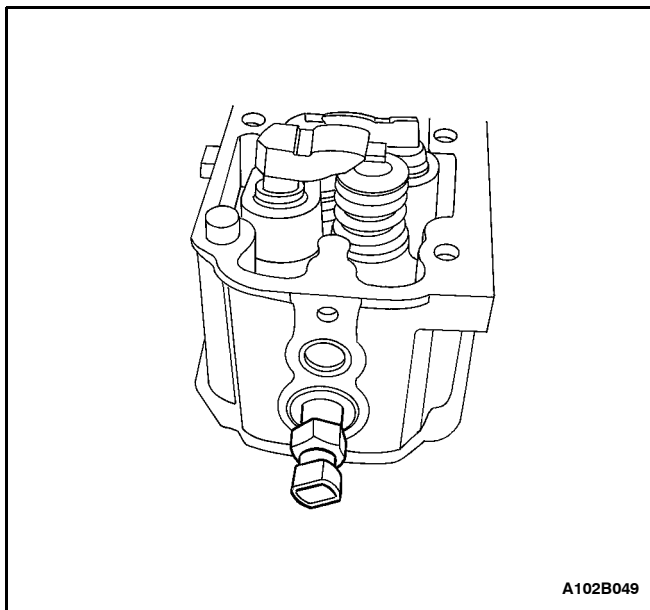


21. Install the oil pump/pickup tube.
22. Install the oil pump/pickup tube bolts.

Tighten

Tighten the oil pump/pickup tube bolts to 10 NSm (89 lb-in).

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



UNIT REPAIR

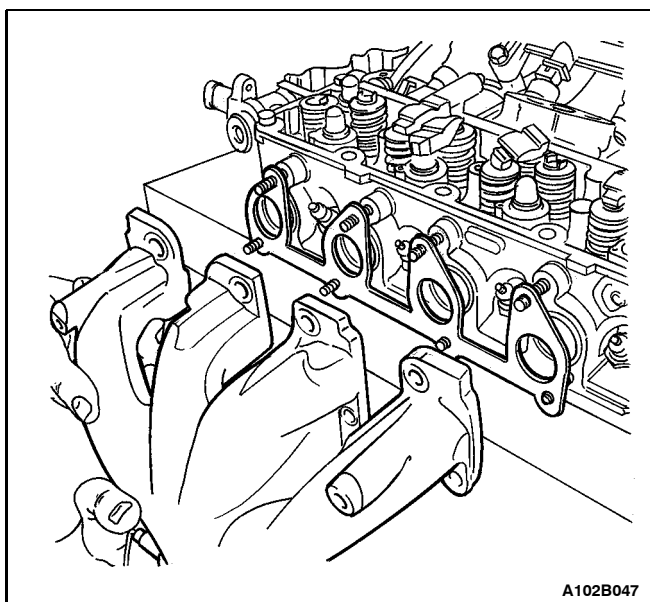
CYLINDER HEAD AND VALVE TRAIN COMPONENTS

Tools Required

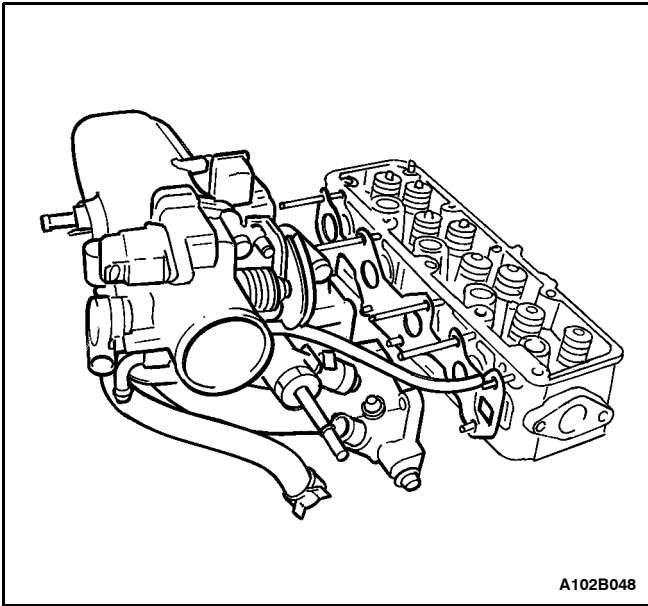
MKM-571-B Gauge
KM-253 Valve Guide Reamer
KM-254 Valve Guide Reamer
KM-255 Valve Guide Reamer
KM-340-0 Cutter Set
 KM-340-7 Guide Drift
 KM-340-13 Cutter
 KM-340-26 Cutter
KM-348 Valve Spring Compressor
KM-419 Distance Gauge

Disassembly Procedure

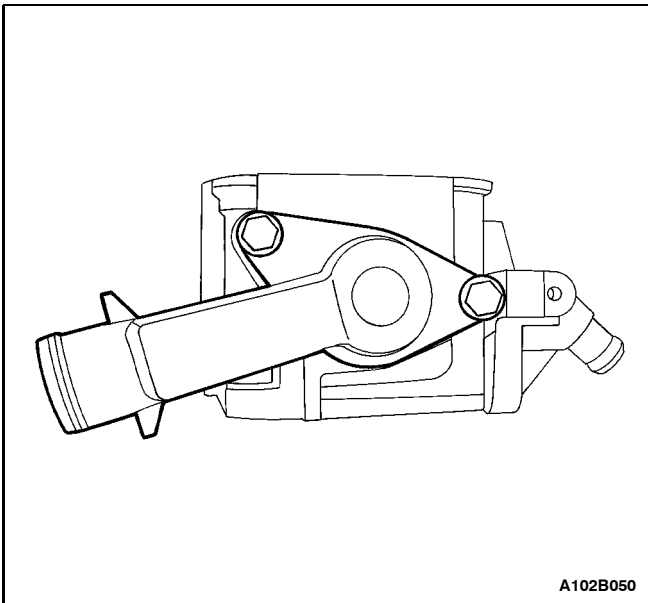
1. Remove the cylinder head with the intake manifold and the exhaust manifold attached. Refer to "Cylinder Head and Gasket" in this section.
2. Remove the coolant temperature sensor.



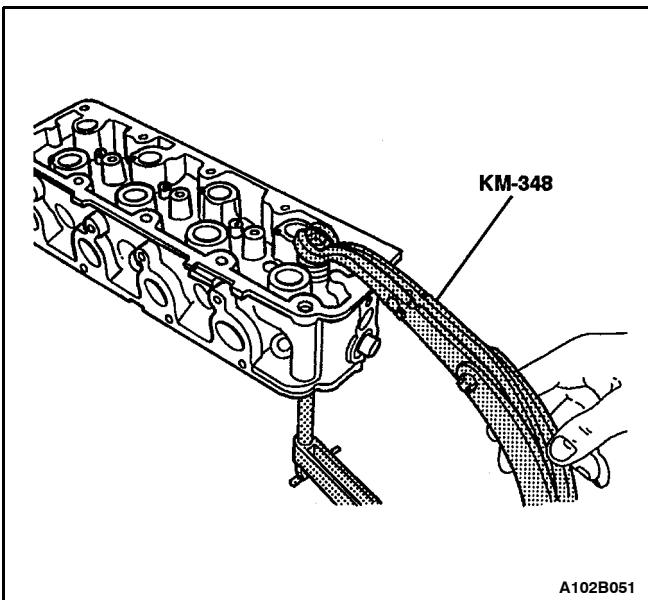
3. Remove the exhaust manifold heat shield bolts.
4. Remove the exhaust manifold heat shield.
5. Remove the exhaust manifold nuts.
6. Remove the exhaust manifold.
7. Remove the exhaust manifold gasket.
8. Remove the exhaust manifold studs.
9. Remove the spark plugs.



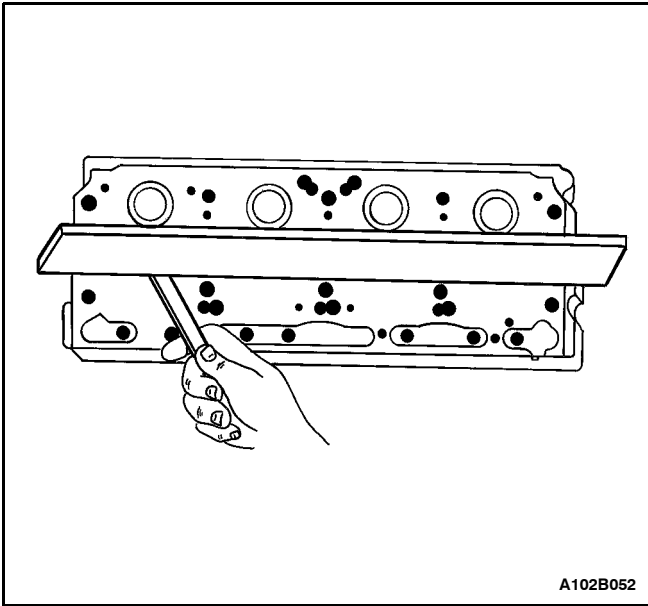
10. Remove the intake manifold retaining nuts.
11. Remove the intake manifold.
12. Remove the intake manifold gasket.
13. Remove the intake manifold studs.



14. Remove the thermostat housing mounting bolts.
15. Remove the thermostat housing.
16. Remove the thermostat and thermostat gasket.

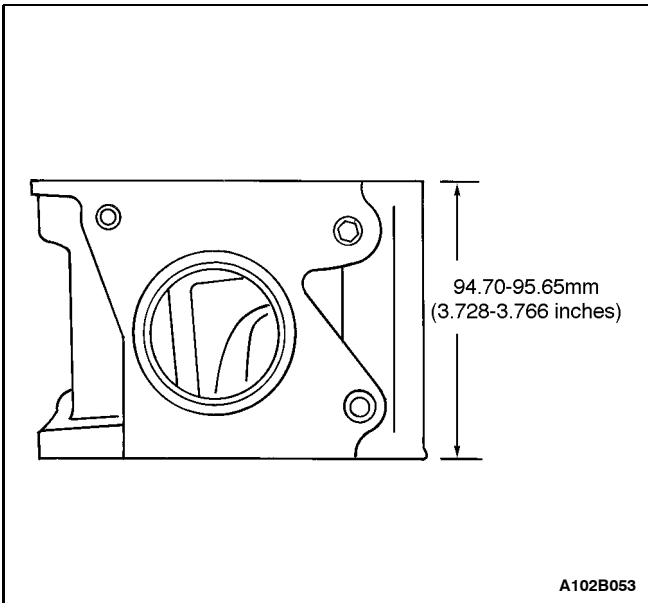


17. Using the valve spring compressor KM-348, compress the valve springs.
18. Remove the valve keepers.
19. Remove the valve spring cap.
20. Remove the valve springs.
21. Remove the valves.
22. Remove the valve stem oil seals.
23. Remove camshaft carrier alignment pins.

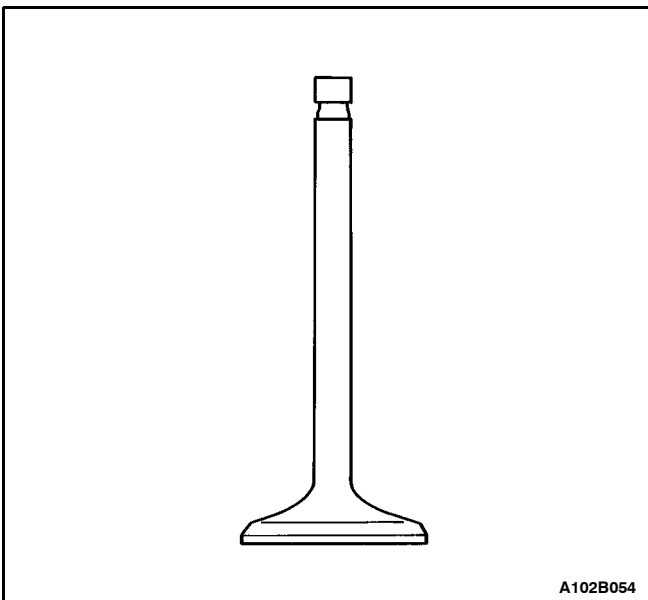


Cylinder Head Inspection

1. Clean the sealing surfaces.
2. Inspect the cylinder head gasket and the mating surfaces for leaks, corrosion, and blowby.
3. Inspect the cylinder head for cracks.
4. Inspect the length and the width of the cylinder head using a feeler gauge and a straight edge.
5. Check the sealing surfaces for deformation and warp-age. The cylinder head sealing surfaces must be flat within .025 mm (.001 inch) maximum.



6. Measure the height of the cylinder head from sealing surface to sealing surface. The cylinder head height should be 94.70 to 95.65 mm (3.728 to 3.766 inches). If the cylinder head height is less than 94.70 mm (3.728 inches), replace the cylinder head.
7. Inspect all threaded holes for damage.
8. Inspect the valve seats for excessive wear and burned spots.

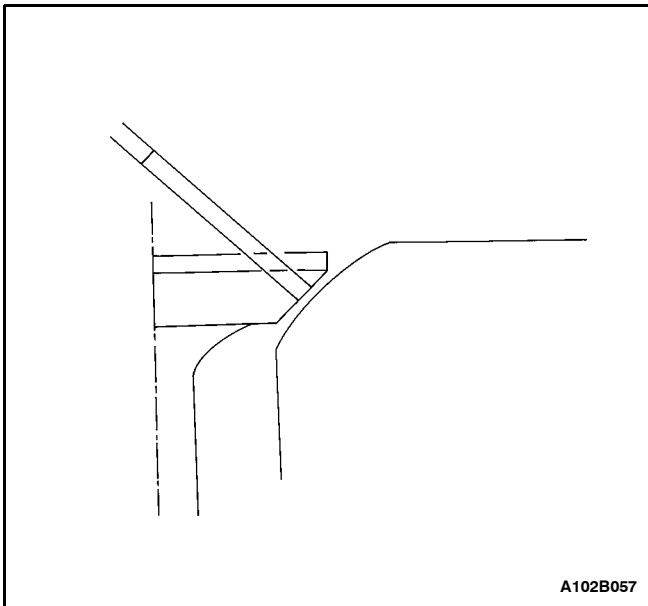


Valve Inspection

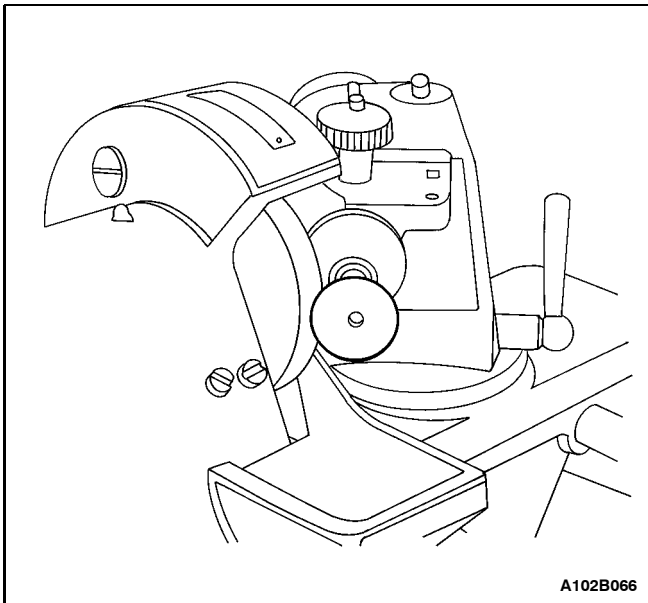
1. Inspect valve stem tip wear.
2. Inspect the valve keeper grooves and oil seal grooves for chips and wear.
3. Inspect the valves for burns or cracks.
4. Inspect the valve stem for burrs and scratches.
5. Inspect the valve stem. The valve stem must be straight.
6. Inspect the valve face for grooving. If the groove is so deep the refacing would result in a sharp edge, replace the valve.



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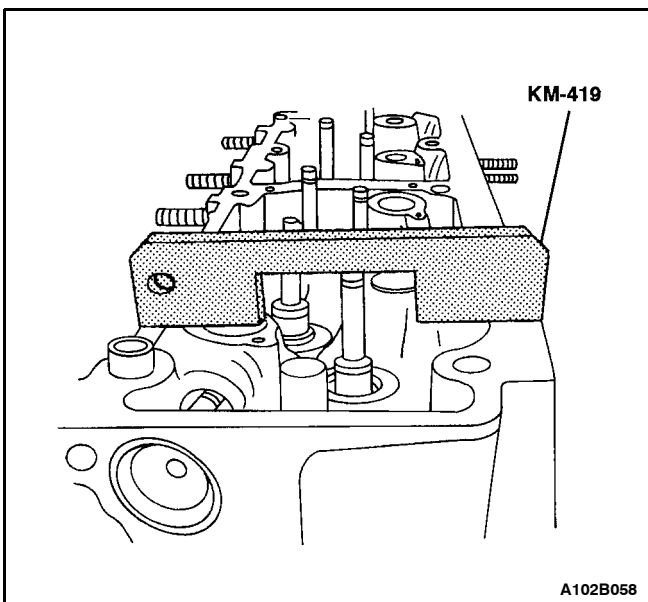


3. Check the contact pattern on the valve head and in the cylinder head.
4. Clean the valves, the valve guides, and the cylinder head.

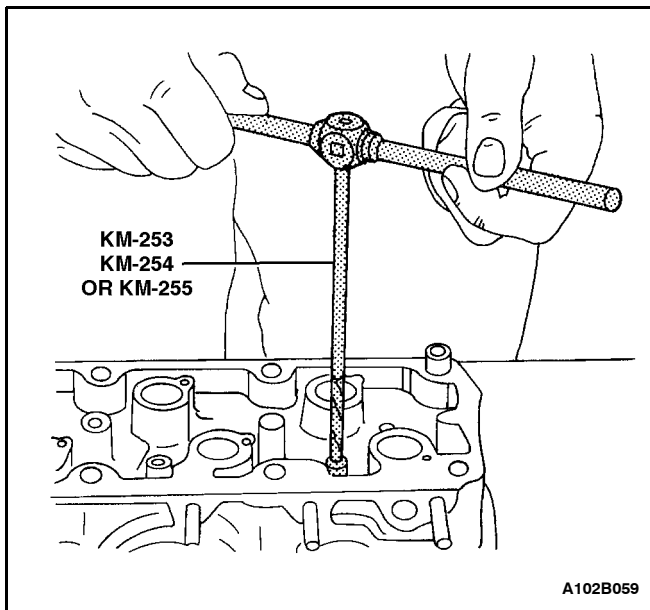


Valve Grind

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. The angle at the valve face angle is 46 degrees.



4. Check the valve stem projection using the distance gauge KM-419.



Valve Guide Ream

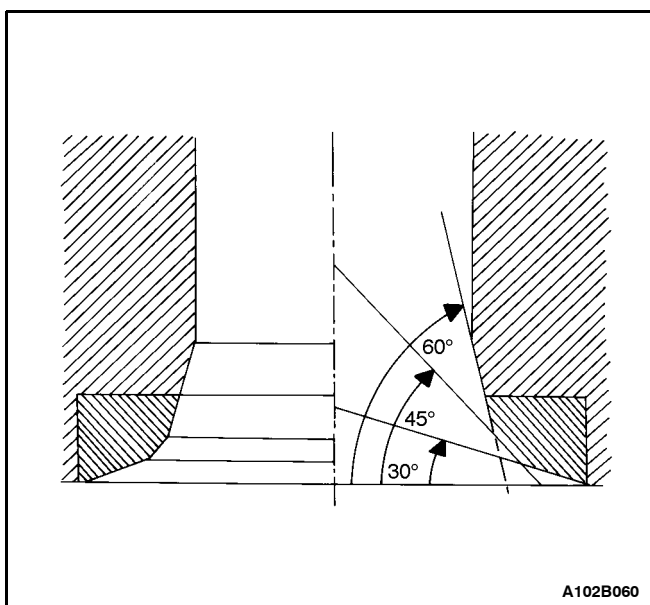
1. Measure the diameter of the valve guide using the gauge MKM-571-B and a commercially available inside micrometer.

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

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

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

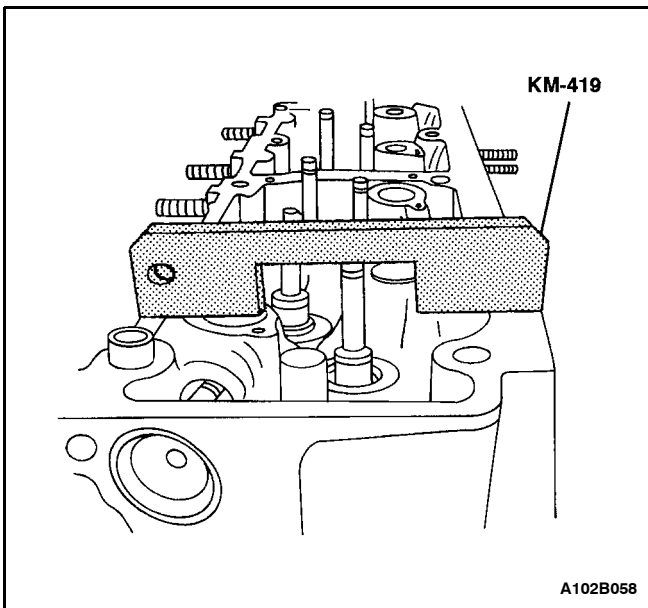
3. Ream the valve guide from the upper side of the cylinder head to the next oversize. After reaming, cross out the code and emboss the valve guide with the new code.



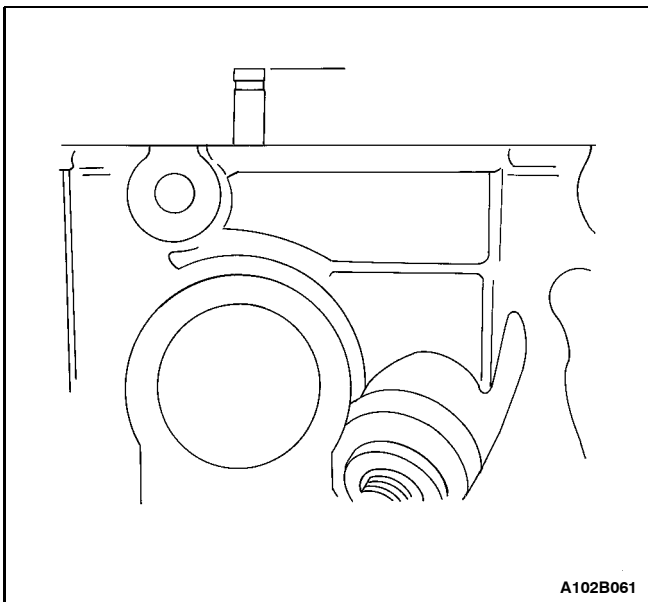
Valve Seat — Cut

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:
 - D Valve seat: a 45-degree side using the cutter KM-340-13.
 - D Upper correction angle: a 30-degree side using the cutter KM-340-13.
 - D Lower correction angle: a 60-degree side using the cutter KM-340-26.

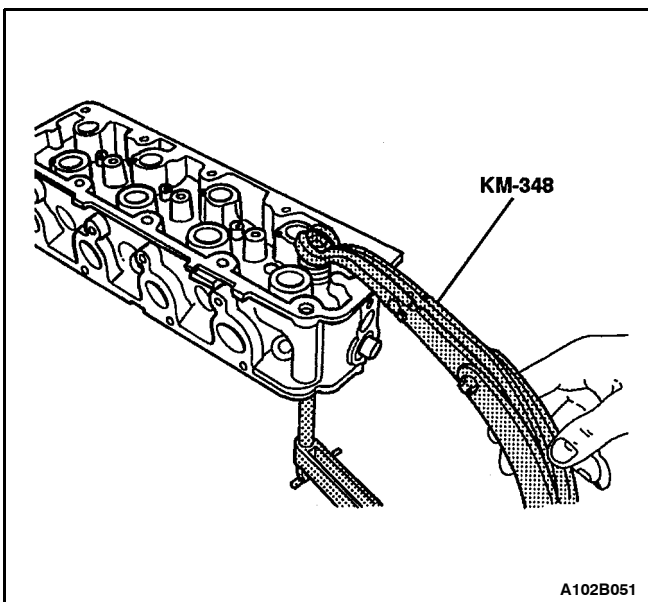
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3. Clean the chippings from the cylinder head.
4. Inspect the dimension for the proper valve seat width.
 - D Intake: 1.3 to 1.5 mm (0.051 to 0.059 inch)
 - D Exhaust: 1.6 to 1.8 mm (0.063 to 0.071 inch)
5. Inspect the valve stem projection using the distance gauge KM-419.

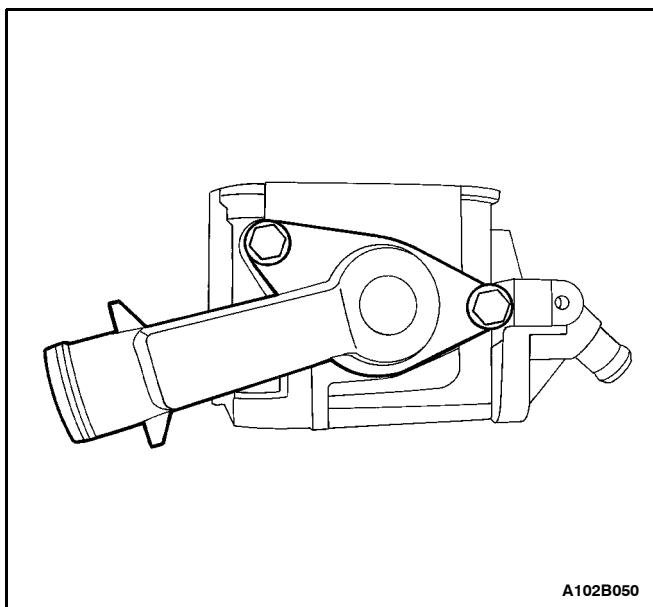


6. If the dimension is exceeded, install new valves and then check the valve stem projection again. Refer to "Valve Grind" and "Valve Grind-In" in this section.
7. If the valve stem projection is still too large despite replacing the valves, replace the cylinder head.



Assembly Procedure

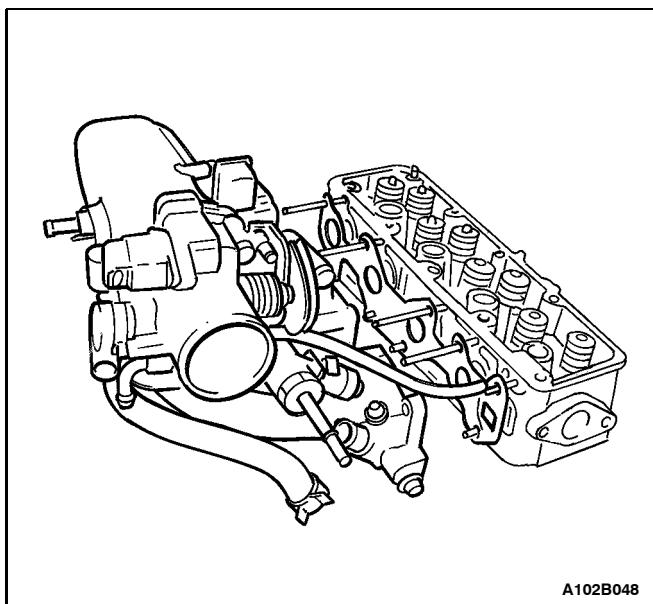
1. Install the camshaft carrier alignment pins.
2. Install the valve stem oil seals.
3. Coat the valves with engine oil.
4. Install the valves.
5. Install the valve springs.
6. Using the valve spring compressor KM-348, compress the valve springs.
7. Install the valve keeper.
8. Install the valve spring cap.



9. Install the thermostat and the gasket.
10. Install the thermostat housing.
11. Install the thermostat housing mounting bolts.

Tighten

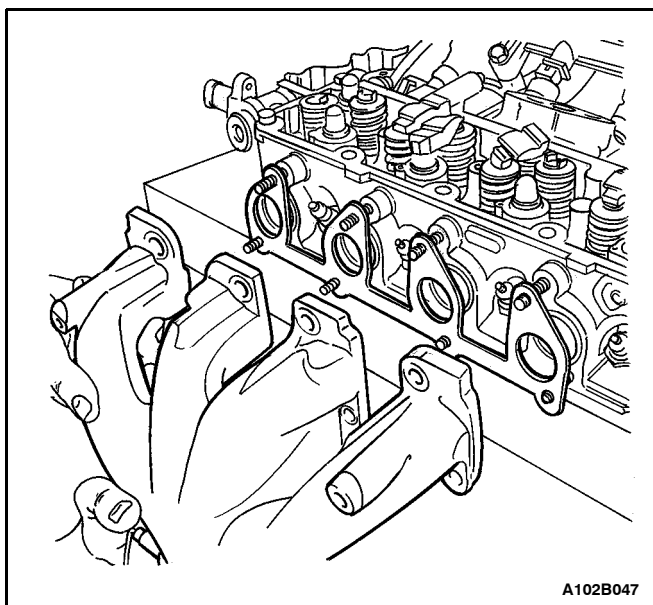
Tighten the thermostat housing mounting bolts to 20 N \cdot m (15 lb-ft).



12. Install the intake manifold studs.
13. Install the intake manifold gasket.
14. Install the intake manifold.
15. Install the intake manifold retaining nuts.

Tighten

Tighten the intake manifold retaining nuts to 25 N \cdot m (18 lb-ft).



16. Install the spark plugs.

Tighten

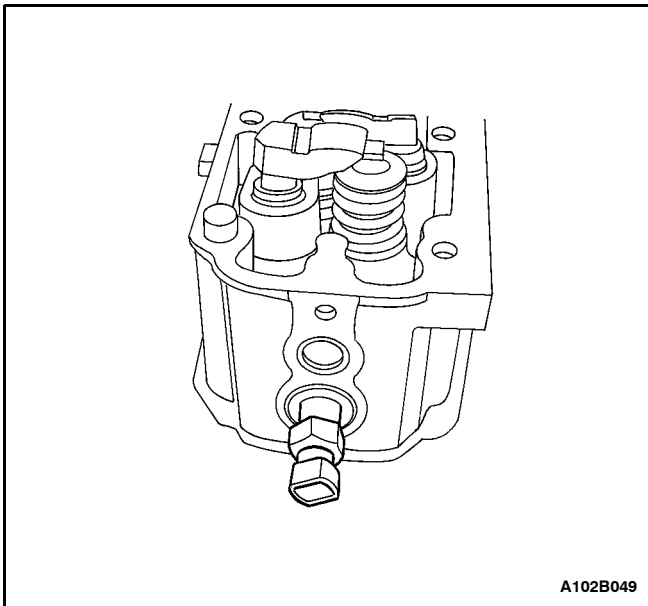
Tighten the spark plugs to 25 N \cdot m (18 lb-ft).

17. Install the exhaust manifold studs.
18. Install the exhaust manifold gasket.
19. Install the exhaust manifold.
20. Install the exhaust manifold nuts.

Tighten

Tighten the exhaust manifold nuts to 25 N \cdot m (18 lb-ft).

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21. Install the exhaust manifold heat shield.

22. Install the exhaust manifold heat shield bolts.

Tighten

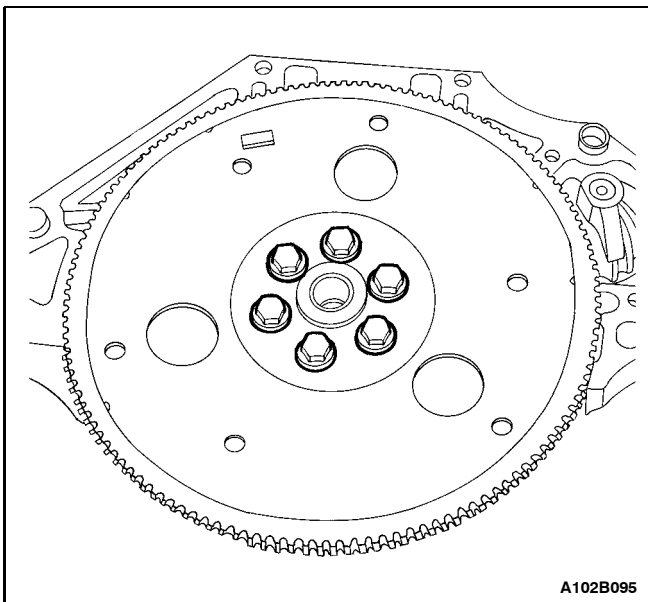
Tighten the exhaust manifold heat shield bolts to 15 N_{Sm} (11 lb-ft).

23. Install the coolant temperature sensor.

Tighten

Tighten the coolant temperature sensor to 20 N_{Sm} (15 lb-ft).

24. 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

MKM-412 Engine Overhaul Stand

J-42492 Timing Belt Adjuster

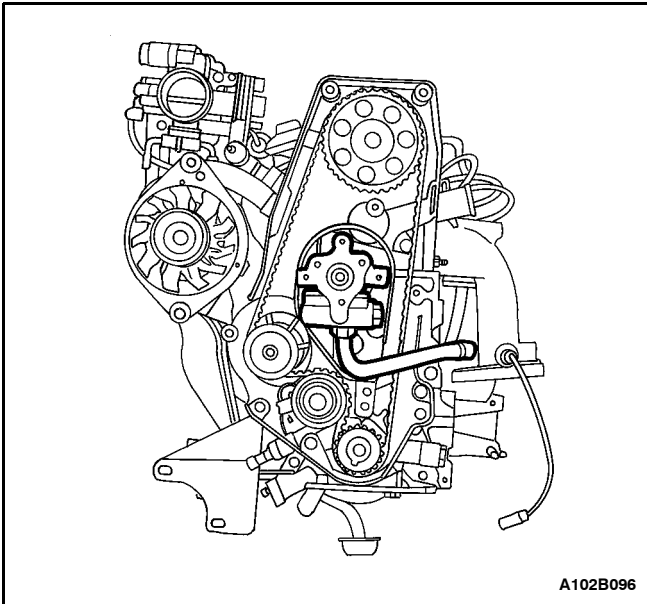
KM-470-B Angular Torque Gauge

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

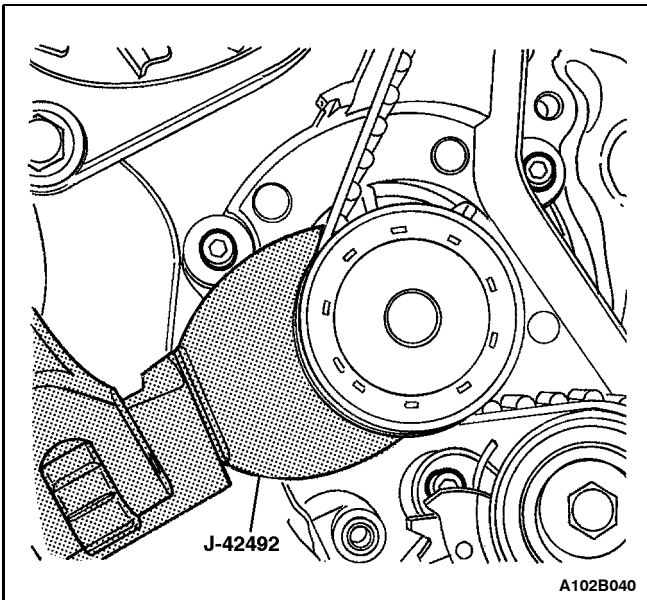
Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshaft. Such damage can impair vehicle operation.

Disassembly Procedure

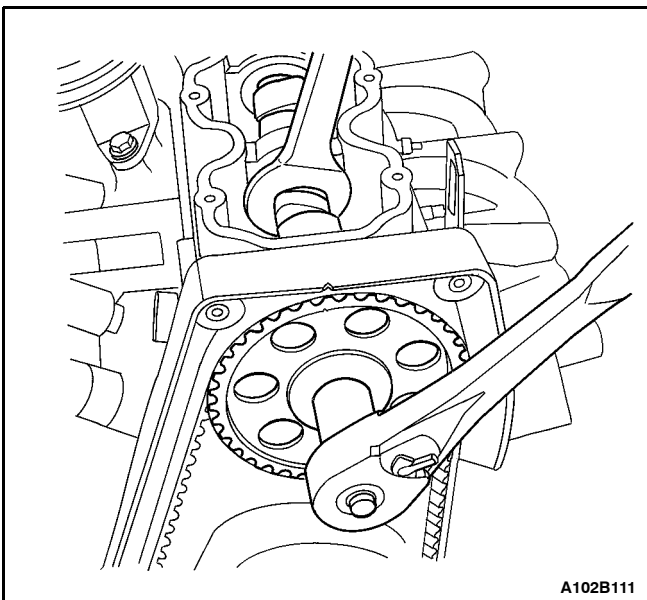
1. Remove the engine. Refer to "Engine" in this section.
2. Remove the flywheel bolts.
3. Remove the flywheel.
4. Remove the crankshaft rear oil seal.
5. Mount the engine assembly on the engine overhaul stand MKM-412.



6. Remove the upper timing belt cover bolts.
7. Remove the upper timing belt cover.
8. Remove the power steering pump mounting bolts.
9. Remove the power steering pump.
10. Remove the lower timing belt cover bolts.
11. Remove the lower timing belt cover.

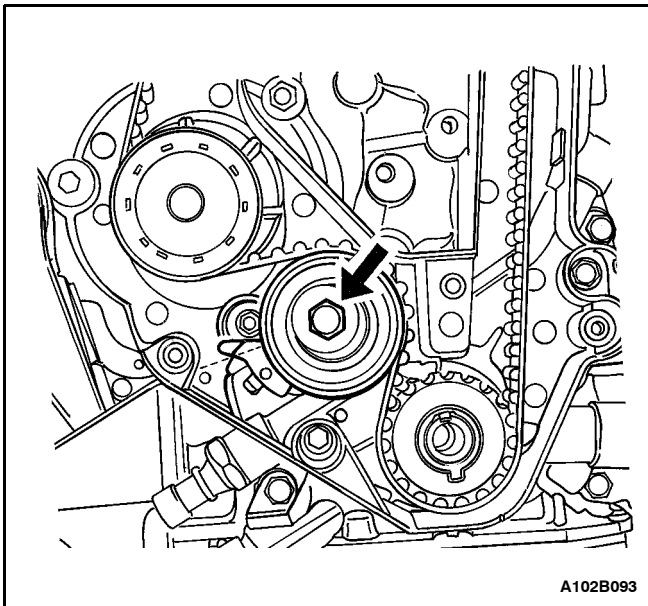


12. Slightly loosen the three coolant pump retaining bolts.
13. Rotate the coolant pump using timing belt adjuster J-42492 to remove the tension from the timing belt.
14. Remove the timing belt.

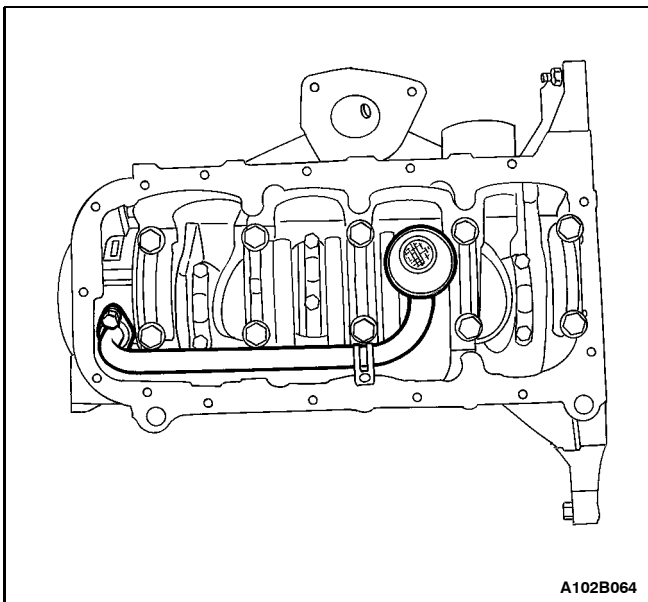


15. Remove the valve cover bolts.
 16. Remove the valve cover and the valve cover gasket.
- Notice:** Take extreme care to prevent any scratches, nicks, or damage to the camshaft. Such damage can impair vehicle operation.
17. While holding the camshaft firmly in place, remove the camshaft gear bolt.
 18. Remove the camshaft gear.

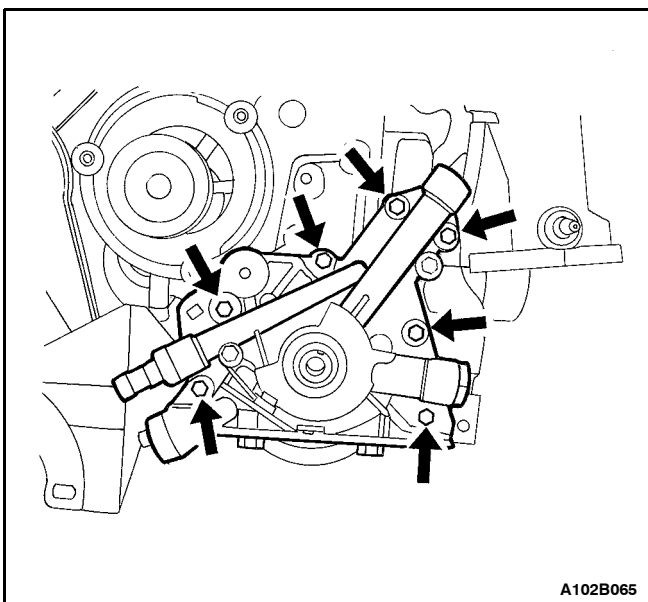
1B - 86 SOHC ENGINE MECHANICAL



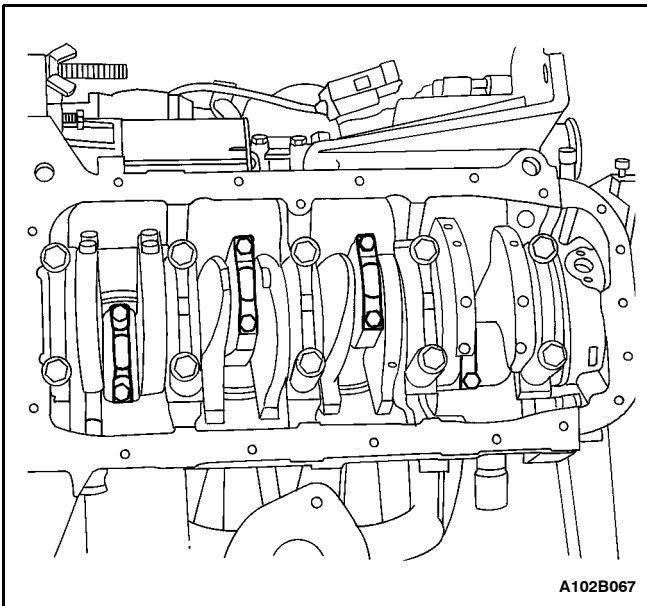
19. Remove the timing belt automatic tensioner bolt.
20. Remove the timing belt automatic tensioner.
21. Remove the rear timing belt cover bolts.
22. Remove the rear timing belt cover.
23. Remove the crankshaft timing belt gear.



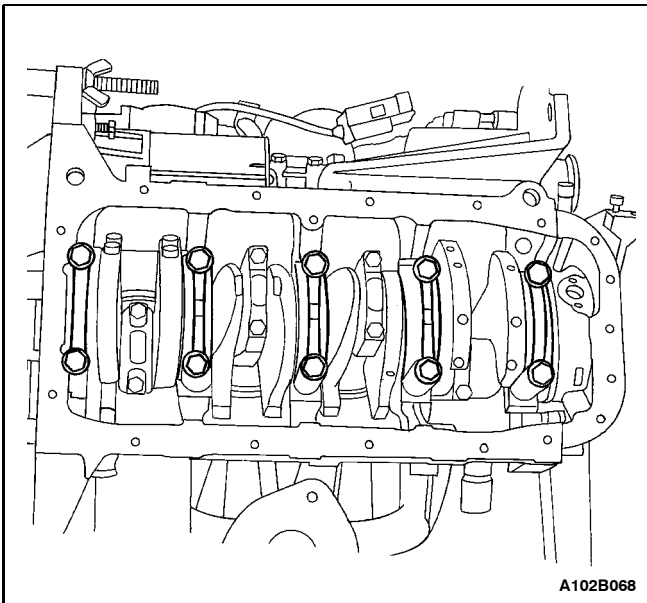
24. Rotate the engine on the engine overhaul stand MKM-412.
25. Remove the oil pan retaining bolts.
26. Remove the oil pan.
27. Remove the oil pickup tube bolts.
28. Remove the oil pump pickup tube.



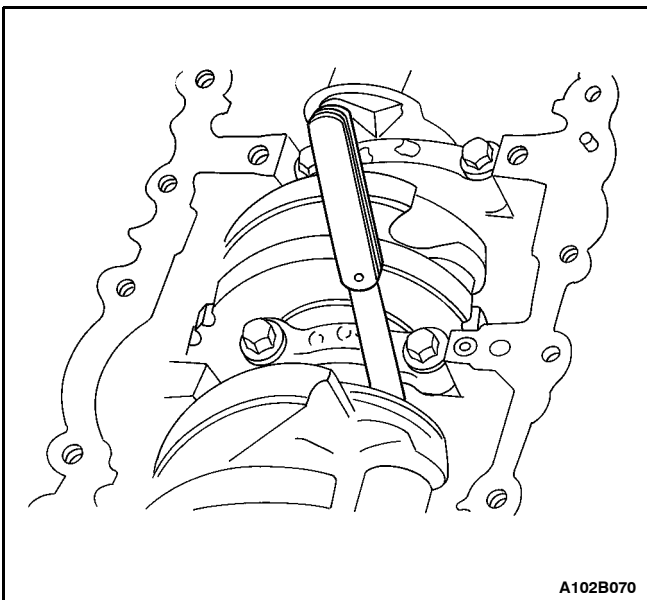
29. Remove the oil pump retaining bolts.
30. Remove the oil pump.



31. Mark the order of the rod bearing caps.
32. Remove the connecting rod cap bolts for all of the pistons.
33. Remove the connecting rod bearing caps and the lower connecting rod bearings.
34. Remove the upper connecting rod bearings.



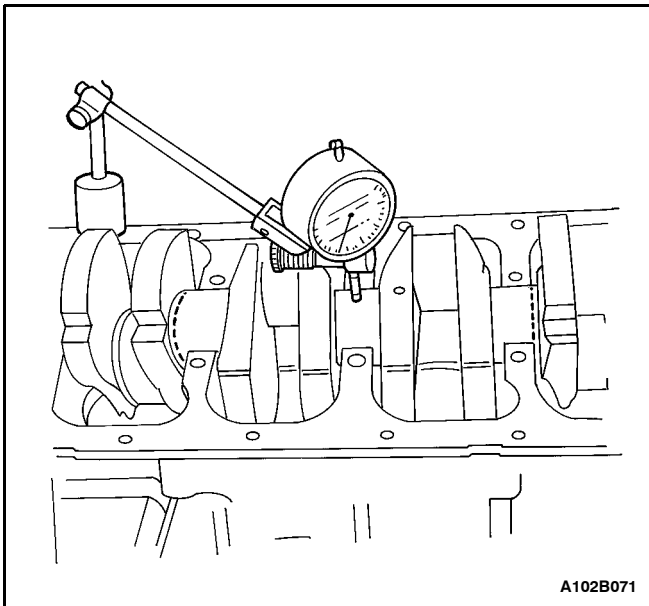
35. Mark the order of the crankshaft bearing caps.
36. Remove the crankshaft bearing cap bolts.
37. Remove the crankshaft bearing caps.
38. Remove the crankshaft bearings from the crankshaft bearing caps.
39. Remove the crankshaft.
40. Remove the crankshaft bearings from the engine block.
41. Clean the parts, as necessary.



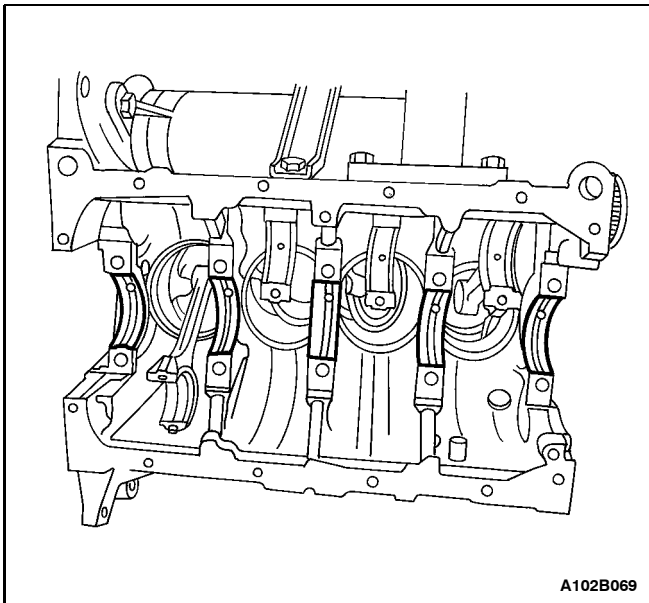
Assembly Procedure

1. With crankshaft and bearings in place, plastic gauge all bearing clearances. Refer to "Crankshaft Bearings and Connecting Rod Bearings - Gauging Plastic" in this section.
2. Inspect the crankshaft end play with the crankshaft bearings installed.
3. Check for permissible crankshaft end play. Refer to "Engine Specifications" in this section.

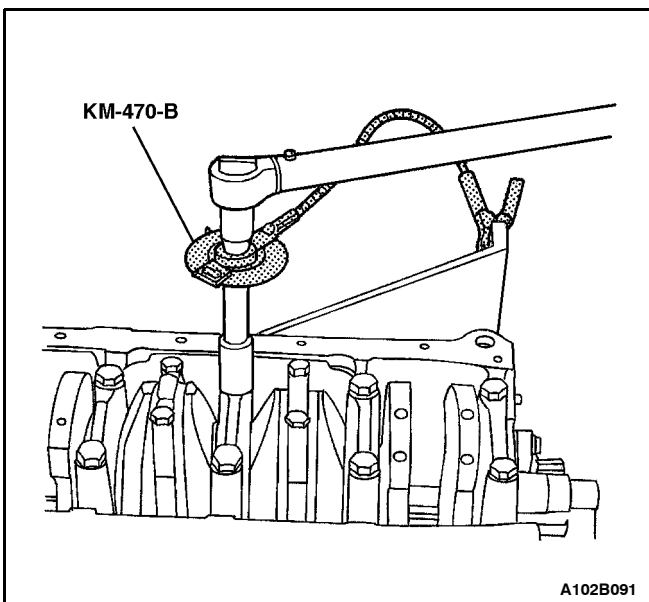
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4. With the crankshaft mounted on the front and the rear crankshaft bearings, check the middle crankshaft journal for permissible out-of-round (runout). Refer to "Engine Specifications" in this section.



5. Coat the crankshaft bearings with engine oil.
6. Apply a bead of adhesive sealing compound to the grooves of the rear crankshaft bearing cap.
7. Install the crankshaft bearings in the engine block.
8. Install the crankshaft.

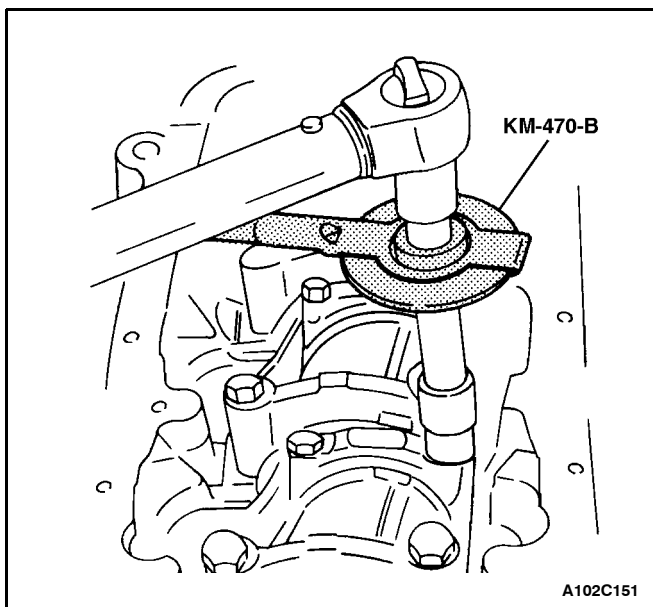


9. Install the crankshaft bearings to the crankshaft bearing caps.
 10. Install the crankshaft bearing caps.
- Notice: Do not reuse the old crankshaft bearing cap bolts. Damage to the engine could result.
11. Install new crankshaft bearing cap bolts.

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 another 45 degrees plus 15 degrees.

12. Install the upper connecting rod bearings to the connecting rods.
13. Install the lower connecting rod bearings to the connecting rod bearing caps



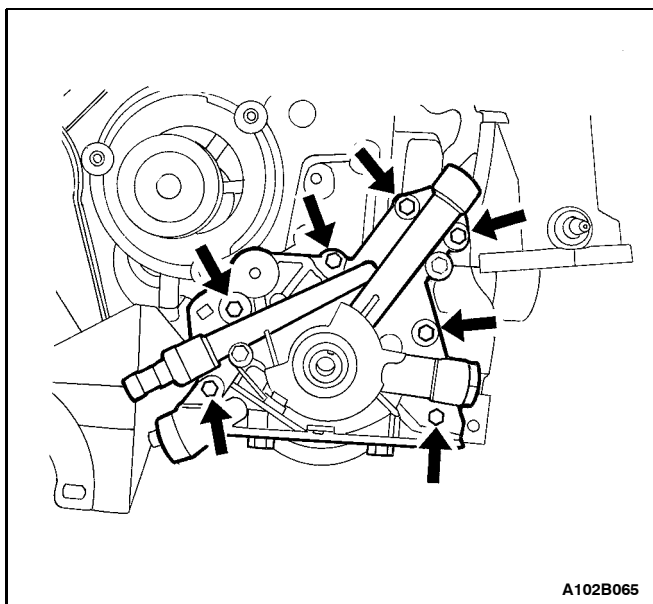
14. Install the connecting rod bearing caps to the connecting rods.

Notice: Do not reuse the old connecting rod bearing cap bolts. Damage to the engine could result.

15. Install new connecting rod bearing cap bolts.

Tighten

Tighten the connecting rod bearing cap bolts to 25 NSm (18 lb-ft). Using the angular torque gauge KM-470-B, tighten the connecting rod bearing cap bolts another 30 degrees plus 15 degrees.

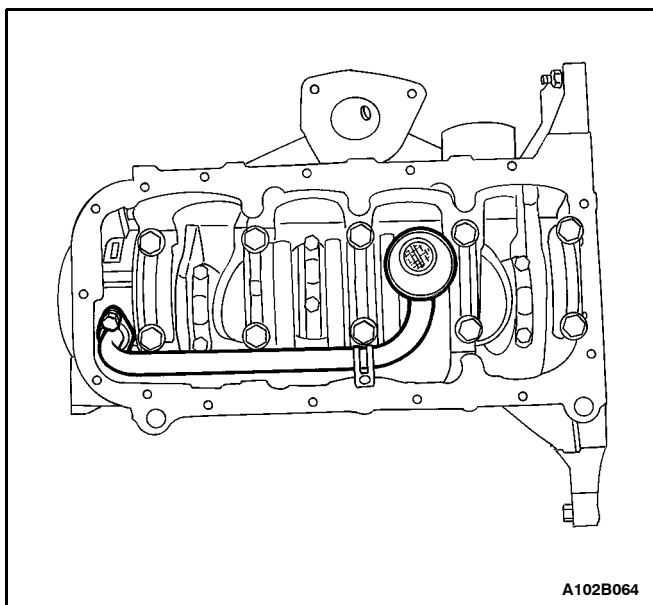


16. Install the oil pump.

17. Install the oil pump retaining bolts.

Tighten

Tighten the oil pump retaining bolts to 10 NSm (89 lb-in).



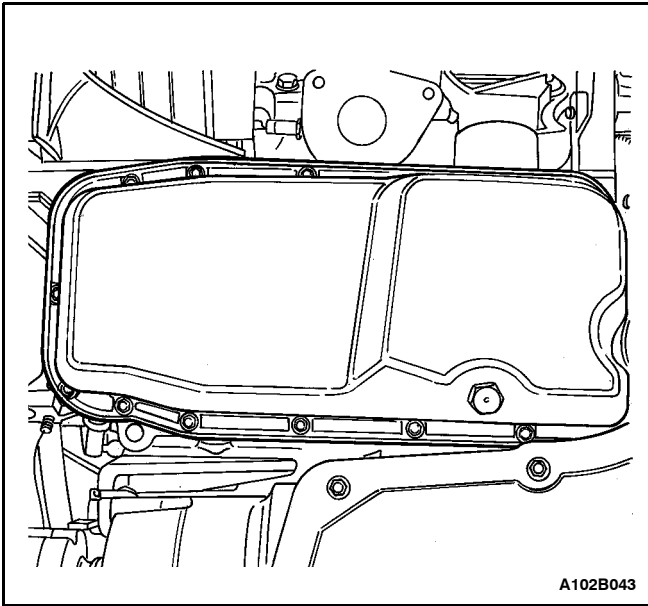
18. Install the oil pump/pickup tube.

19. Install the oil pump/pickup tube bolts.

Tighten

Tighten the oil pump/pickup tube bolts to 10 NSm (89 lb-in).

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20. Install the oil pan gasket to the oil pan.

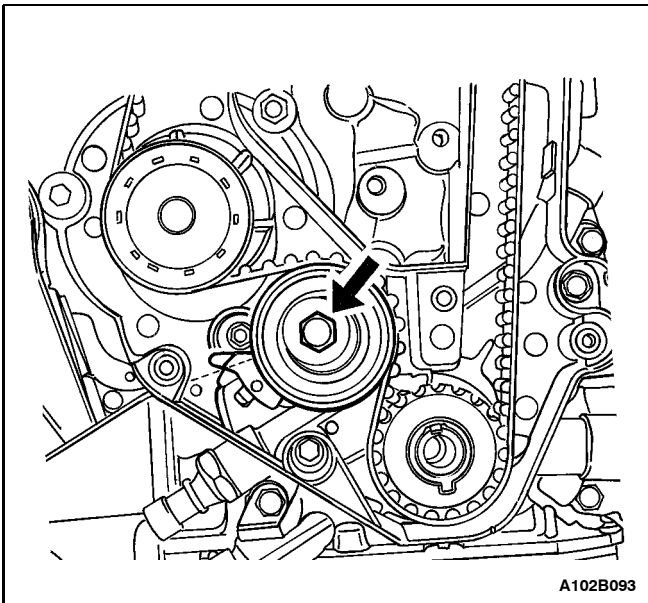
21. Install the oil pan.

Important: Install the oil pan within 5 minutes after applying the liquid gasket to the oil pan.

22. Install the oil pan retaining bolts.

Tighten

Tighten the oil pan retaining bolts to 10 NSm (89 lb-in).



23. Install the crankshaft timing belt gear.

24. Install the rear timing belt cover.

25. Install the rear timing belt cover bolts.

Tighten

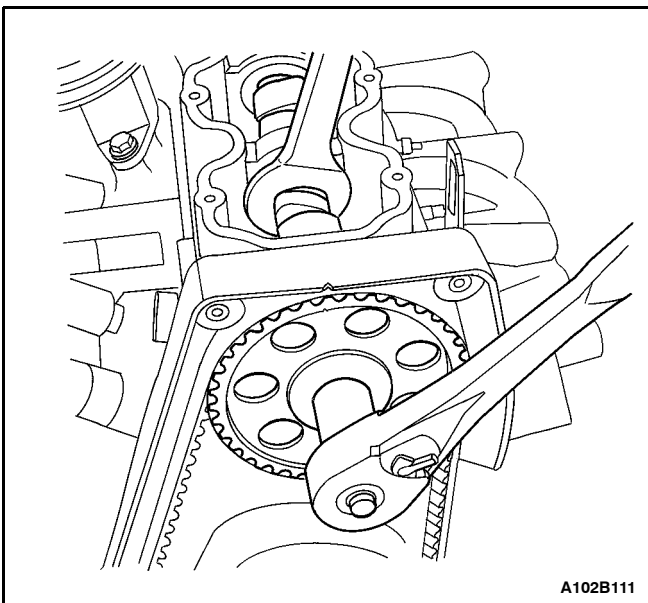
Tighten the rear timing belt cover bolts to 10 NSm (89 lb-in).

26. Install the timing belt automatic tensioner.

27. Install the timing belt automatic tensioner bolt.

Tighten

Tighten the timing belt automatic tensioner bolt to 20 NSm (15 lb-ft).



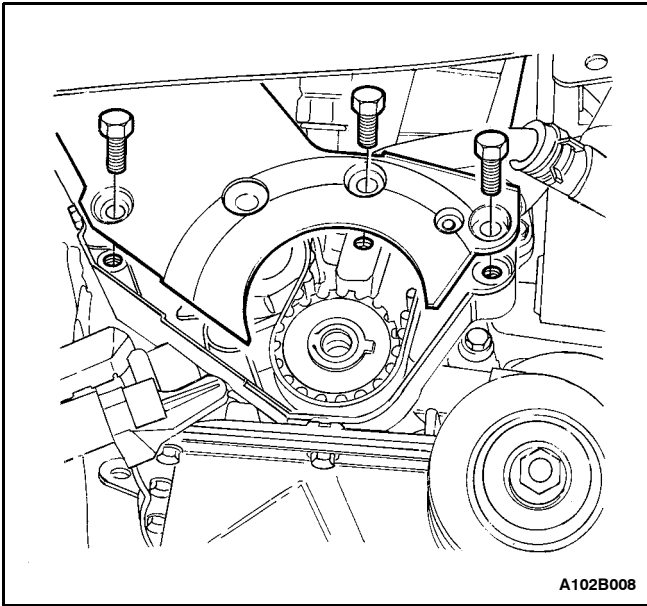
Notice: Take extreme care to prevent any scratches, nicks, or damage to the camshaft. Such damage can impair vehicle operation.

28. Install the camshaft gear.

29. Install the camshaft gear bolt while holding the camshaft firmly in place.

Tighten

Tighten the camshaft gear bolt to 45 NSm (33 lb-ft).



30. Install the timing belt.
31. Adjust the timing belt tension. Refer to "Timing Belt Check and Adjust" in this section.
32. Install the valve cover gasket and the valve cover.
33. Install the valve cover bolts.

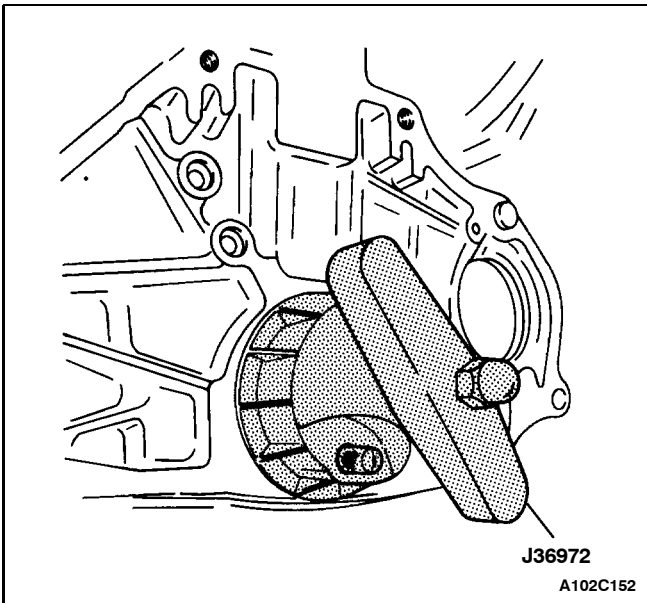
Tighten

Tighten the valve cover bolts to 10 NSm (89 lb-in).

34. Install the lower timing belt cover.
35. Install the lower timing belt cover bolts.

Tighten

Tighten the lower timing belt cover bolts to 10 NSm (89 lb-in).



36. Install the power steering pump.
37. Install the power steering pump mounting bolts.

Tighten

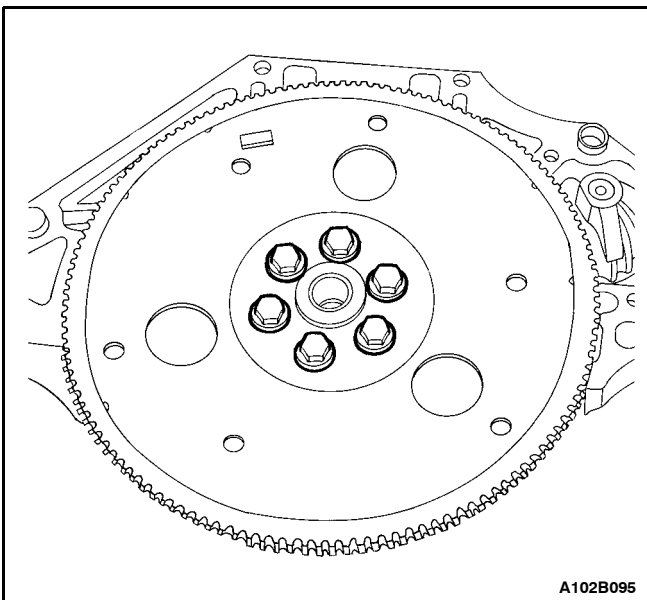
Tighten the power steering pump mounting bolts to 25 NSm (18 lb-ft).

38. Install the upper timing belt cover.
39. Install the upper timing belt cover bolts.

Tighten

Tighten the upper timing belt cover bolts to 10 NSm (89 lb-in).

40. Install the engine lifting device.
41. Dismount the engine from the engine overhaul stand MKM-412.
42. Install the crankshaft rear oil seal using installer J-36972 or KM-635.

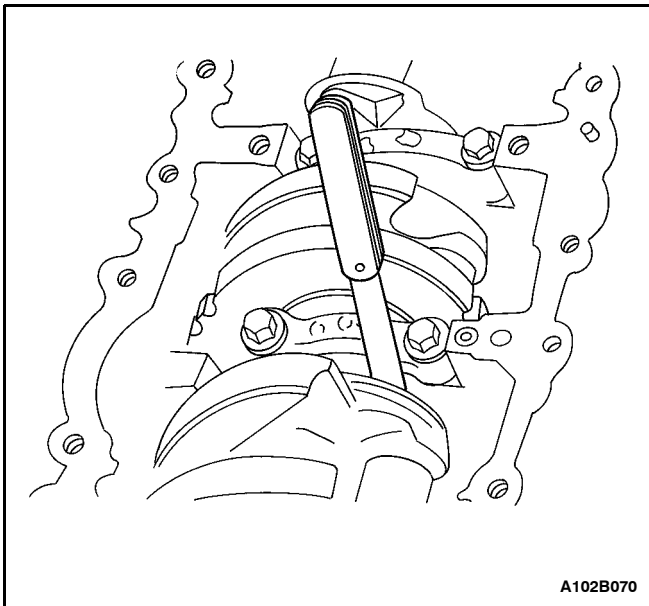


43. Install the flywheel.
44. Install the flywheel bolts.

Tighten

Tighten the flywheel bolts to 35 NSm (25 lb-ft) using a torque wrench. Use the angular torque gauge KM-470-B to tighten the flywheel bolts another 30 degrees plus 15 degrees.

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



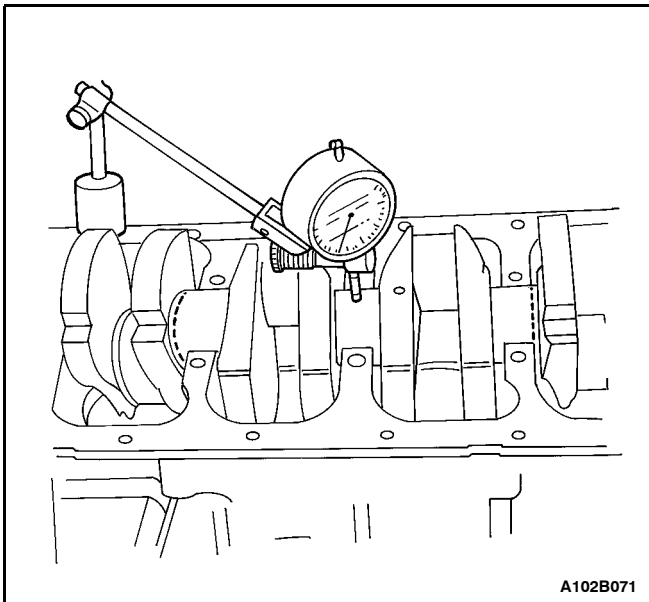
CRANKSHAFT BEARINGS AND CONNECTING ROD BEARINGS — GAUGING PLASTIC

Tools Required

KM-470-B Angular Torque Gauge

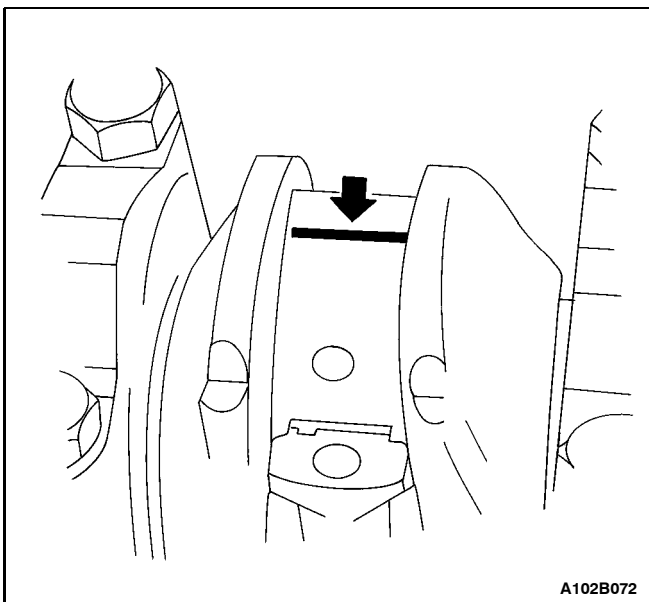
Inspection Procedure - Crankshaft

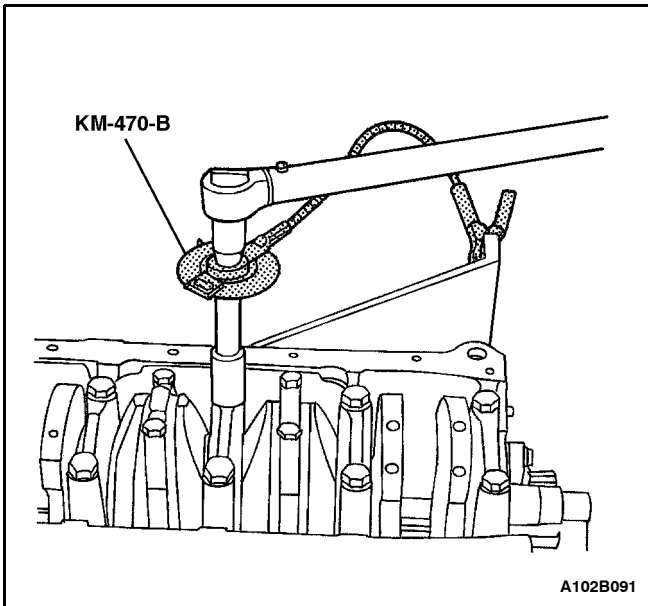
1. Coat the crankshaft bearings with engine oil.
2. Install the upper crankshaft bearings into the engine block crankshaft journals.
3. Install the lower crankshaft bearings into the crankshaft bearing caps.
4. Install the crankshaft.
5. Inspect the crankshaft end play with the crankshaft bearings installed.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



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

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



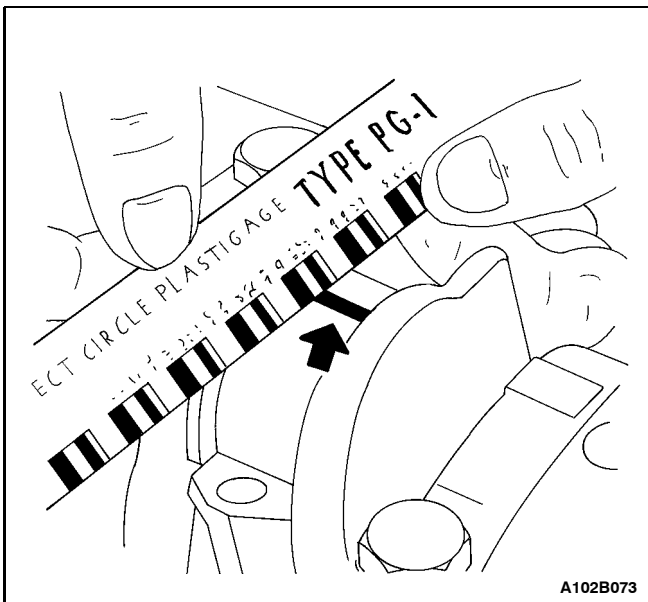


10. Install the crankshaft bearing caps.

11. Install the crankshaft bearing cap bolts.

Tighten

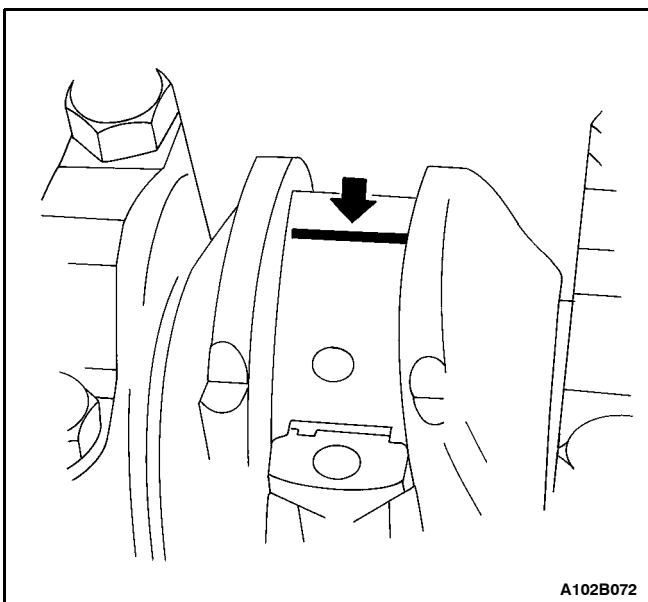
Tighten the crankshaft bearing cap bolts to 50 N·m (37 lb-ft). Using the angular torque gauge KM-470-B, tighten the crankshaft bearing cap bolts another 45 degrees plus 15 degrees.



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 tolerance ranges. Refer to "Engine Specifications" in this section.



Inspection Procedure - Connecting Rods

1. Coat the connecting rod bearings with engine oil.

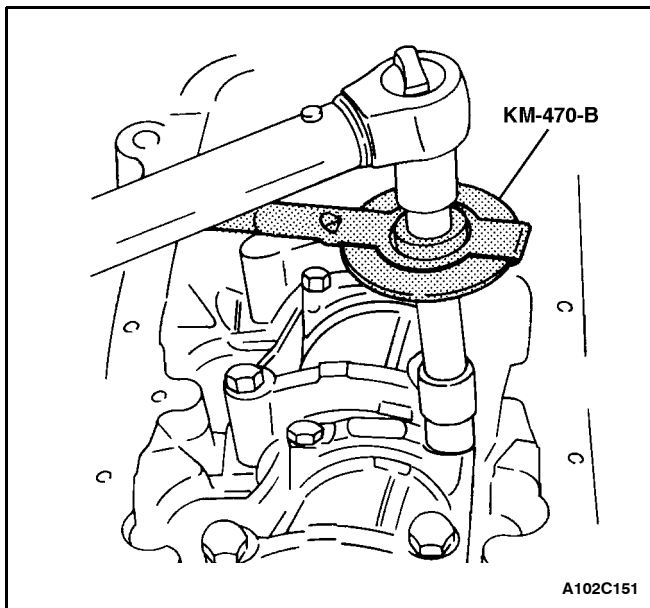
Important: Grease the connecting rod journals and lubricate the connecting rod bearings slightly so that the plastic gauging thread does not tear when the connecting rod bearing caps are removed.

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.

4. Inspect all of the connecting rod bearing clearances using a commercially available plastic gauging (ductile plastic threads).

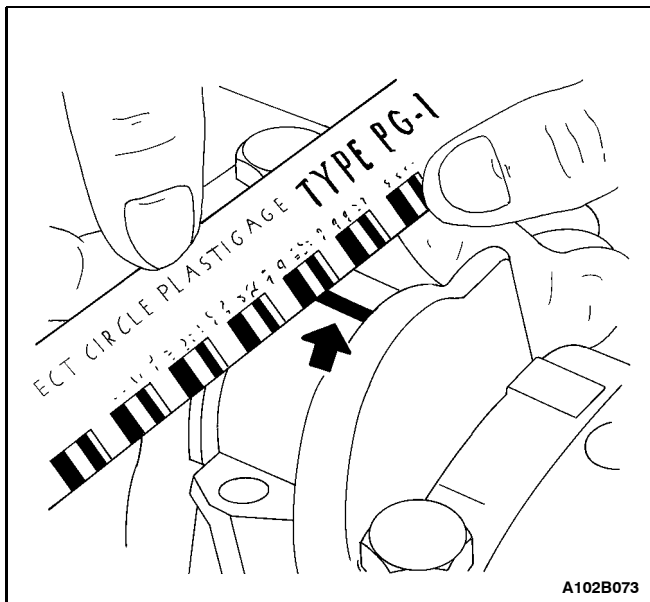
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5. Cut the plastic gauging threads to the length of the bearing width. Lay them axially between the connecting rod journals and the connecting rod bearings.
6. Install the connecting rod bearing caps.
7. Install the connecting rod bearing cap bolts.

Tighten

Tighten the connecting rod bearing cap bolts to 25 Nsm (18 lb-ft). Using the angular torque gauge KM-470-B, tighten the crankshaft cap bolts another 30 degrees plus 15 degrees.



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 tolerance ranges. Refer to "Engine Specifications" in this section.

GENERAL DESCRIPTION AND SYSTEM OPERATION

CYLINDER HEAD AND GASKET

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

CRANKSHAFT

The crankshaft is supported by the five main bearings. The number three bearing is the end thrust bearing. The main bearings are lubricated from the oil holes which intersect the main oil gallery on the left side of the engine block.

TIMING BELT

The timing belt coordinates the crankshaft and the camshaft 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 is a tension pulley that maintains the correct timing belt tension. The timing belt is made of a tough reinforced rubber similar to that used on the serpentine drive belt. The timing belt requires no lubrication.

OIL PUMP

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

At high engine speeds, the oil pump supplies a much higher amount of oil than required for lubrication of the engine. The oil pressure regulator prevents too much oil from entering the engine lubrication passages. During normal oil supply, a coil spring and a valve keep the bypass closed, directing all of the oil pumped to the engine. When the amount of oil being pumped increases, the pressure becomes high enough to overcome the force of the spring. This opens the valve of the oil pressure regulator, allowing the excess oil to flow through the valve and drain back to the oil pan.

OIL PAN

The oil pan is mounted to the bottom of the cylinder block. The oil pan houses the crankcase and is made of pressed sheet metal.

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

EXHAUST MANIFOLD

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

INTAKE MANIFOLD

The intake manifold is made of aluminum. The intake manifold is heated by the engine coolant. An air/fuel mixture is transferred through the intake manifold to the engine cylinders for combustion.

CAMSHAFT

The cast-iron camshaft is supported by the five bearing surfaces in an aluminum camshaft carrier located on the top of the cylinder head. The camshaft gear is power driven by the crankshaft, using the timing belt.

EXHAUST GAS RECIRCULATION VALVE

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

The EGR valve feeds small amounts of exhaust gas into the intake manifold to decrease the combustion temperature. The amount of exhaust gas recirculated is controlled 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 conditions:

- D Warm engine operation.
- D Above idle speed.